



Flora and Vegetation Environmental Management Plan

Mt Keith Satellite Project

December 2019

Version 0.2

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Note to Reader:

The obligations to meet the requirements of Ministerial Statement conditions are addressed in the Schedules of this Flora and Vegetation Environmental Management Plan. All other information is considered supporting information, and is not subject to Department of Water and Environmental Regulation (DWER) compliance auditing, nor does it require DWER endorsement to be amended.

Document Amendment Record

Version	Page Number	Version description	Key changes	Date of Change
A	ALL	Draft submitted for review to EPA to meet the requirements of EPA Scoping document item 9	New document.	April 2018
B	ALL	Draft submitted for review to EPA to meet the requirements of EPA Scoping document item 9	Revised document.	July 2018
0	ALL	Final Issued for Use	Revised document.	September 2018
0.1	7, 23, 33 and 39	Final Re-issued for Use	Remove highlighted text and replace with details within Ministerial Statement 1087 (issued 27 December 2018).	January 2019
0.2	4-6, 12 and 20	DRAFT submitted for review to EPA to support application for amendment to MS1087.	Changes highlighted.	December 2019

Summary

Summary of the Proposal	
Proposal title	Mt Keith Satellite Project
Proponent name	BHP Billiton Nickel West Pty Ltd
Purpose of the EMP	To satisfy EPA Scoping document item 9, and to outline the key flora and vegetation values associated with the MKS Project, the potential impacts and the proposed management provisions to mitigate these impacts.
Key Environmental Factors and Objectives	Land - Flora and Vegetation - To protect flora and vegetation so that biological diversity and ecological integrity are maintained .
Key provisions in the EMP	<p>Site based adaptive management actions (including pre-disturbance approvals, weed management, progressive rehabilitation).</p> <p>Monitoring of significant flora (indicator species) and vegetation communities within Violet Range PEC and Wanjarri Nature Reserve.</p> <p>Monitoring of areas of land disturbance and rehabilitation.</p> <p>Monitoring and control of weeds.</p> <p>Annual reporting (including results of monitoring).</p>

1. Context, Scope and Rationale

This Flora and Vegetation Environmental Management Plan (FVEMP) has been compiled by BHP Billiton Nickel West Pty Ltd (NiW) to meet Environmental Protection Authority (EPA) requirements. Those requirements are to develop and submit an 'Environment Management Plan (EMP)' and relevant 'Schedules' in accordance with the *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2018) (the 'Instructions').

The provisions of the Instructions permit a Proponent to:

- cover one or more key environmental factors for a particular proposal, and
- cover one or more operations or Ministerial Statements (EPA, 2018, p. i).

In accordance with the Instructions (EPA, 2018), the following sub-sections outline the Proposal that this FVEMP addresses (Section 1.1), the relevant key environmental factors (Table 1), the condition requirements applicable to the Proposal (Section 1.3) and the rationale and approach underlying this FVEMP (Section 1.4).

1.1. Proposal

Mt Keith Satellite (MKS) Project (the Proposal) is approved under MS1087. The Proposal has a Disturbance Footprint of 878 hectares (ha) that lies within a Development Envelope of 1,259 ha (Figure 1). The Proposal involves the development of two satellite mine pits (Six Mile Well and Goliath), a waste rock landform (WRL), associated support infrastructure and a 20 kilometre (km) transport corridor north to the existing Mt Keith Mine (Figure). An application to amend MS1087 to increase the area to be cleared to 1069 Ha, and the development envelope to 1265 Ha is under assessment.

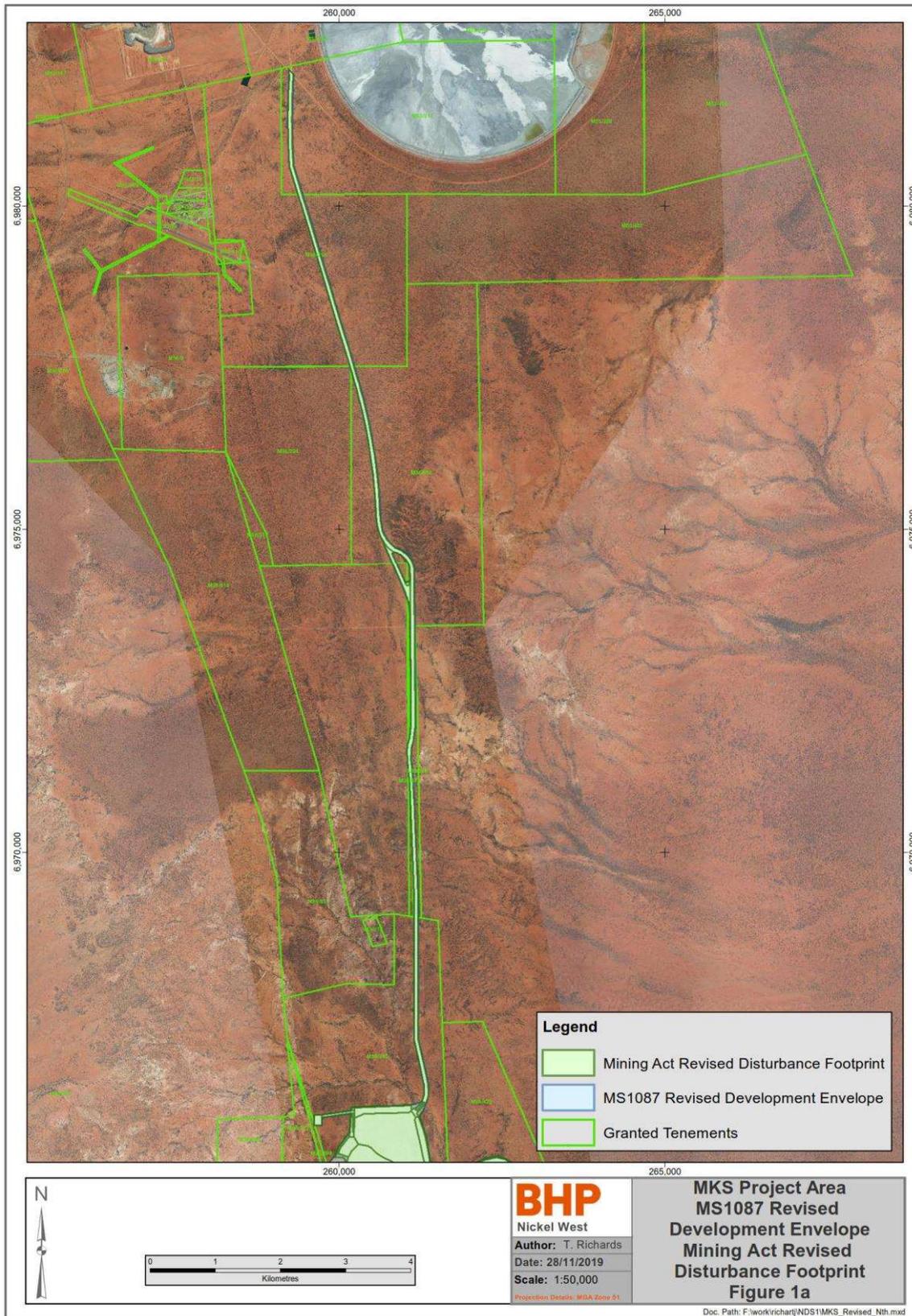


Figure 1a: MKS Revised Development Envelope and Disturbance Footprint (North)

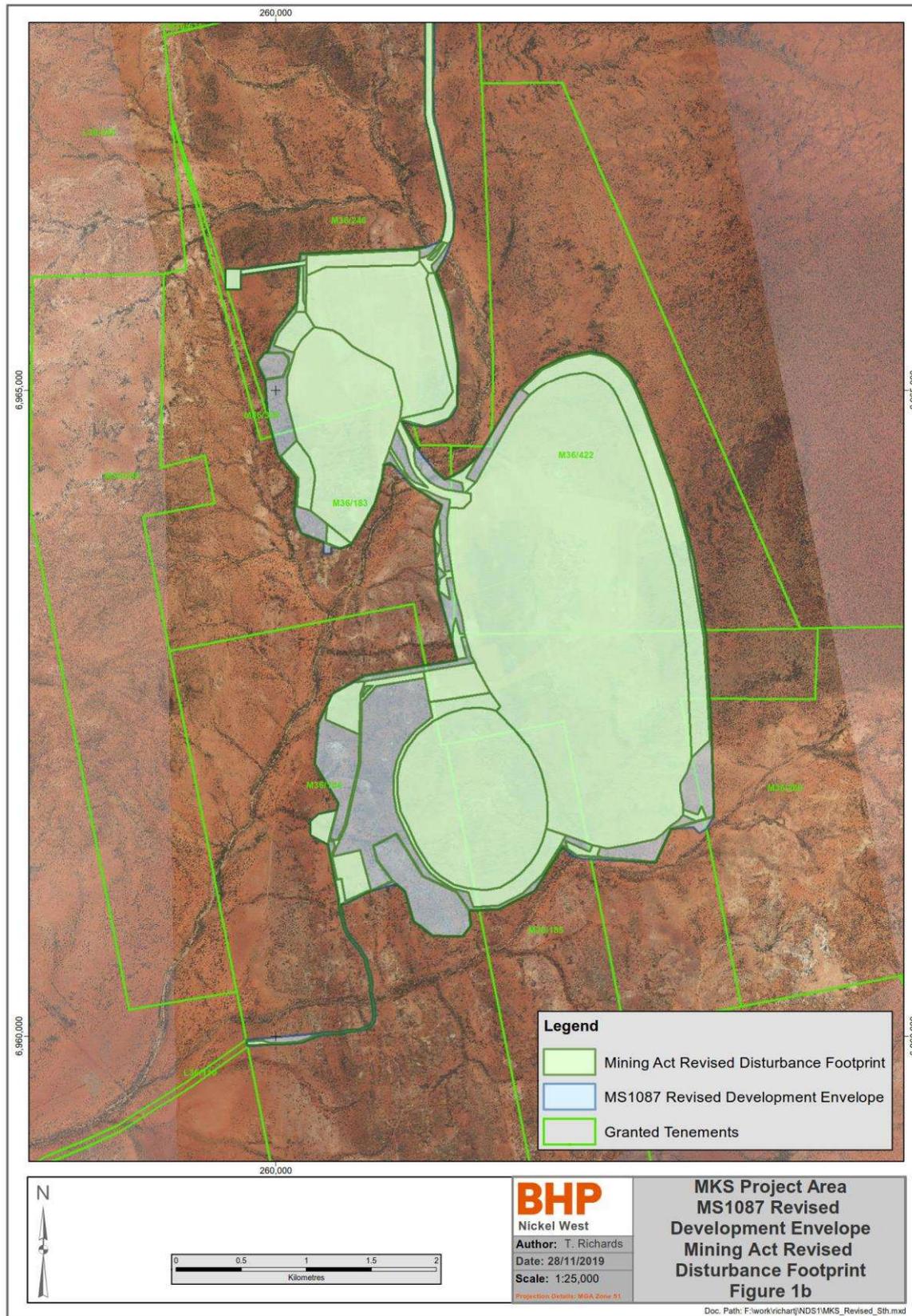


Figure 1b: MKS Revised Development Envelope and Disturbance Footprint (South)

1.2. Key environmental factors

The key environmental factor relevant to this EMP is Flora and Vegetation for which Table 1 describes the activities, values and actual or potential impacts on flora and vegetation.

Table 1: Key environmental factor, values and impacts

Key environmental factor	Activities	Values	Impacts
Flora and vegetation	<p>Clearing of native vegetation</p> <p>Mining activities</p>	<ul style="list-style-type: none"> Priority flora, with indicator species of concern: <ul style="list-style-type: none"> - <i>Eremophila</i> sp. long pedicels (P2) - <i>Hibbertia</i> sp. Sherwood Breakaways (P2) - <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3) - <i>Verticordia jamiesonii</i> (P3) Violet Range Priority Ecological Community (PEC) Wanjarri Nature Reserve (WNR) 	<p>Direct Impacts</p> <ul style="list-style-type: none"> Clearing of up to 1069 Ha of native vegetation within a Development Envelope of 1,265 Ha. <p>Indirect Impacts</p> <ul style="list-style-type: none"> Potential increased spread or introduction of weeds. Habitat fragmentation Altered fire regime Dust Alteration to surface water flow.

1.3. Condition requirements

The Proposal has been assessed by the EPA (Assessment No. 2122). Ministerial Statement 1087 and associated Proposal Implementation conditions were issued by the Minister for Environment on 27 December 2018.

This EMP addresses the requirements of the EPA Scoping document item 9 and details:

- Monitoring of significant flora and vegetation communities;
- Monitoring and control of weeds; and
- Adaptive management actions to be implemented in response to environmental criteria (triggers and thresholds) being reached.

Rehabilitation requirements will be addressed within the Mt Keith Satellite Project Mine Closure Plan.

1.4. Rationale and approach

This section provides a concise description of the rationale and approach for this FVEMP and discusses the environmental objectives for the identified biodiversity regional assets to which implementation conditions (and Schedules) apply.

The following sections summarise:

- survey findings;
- key assumptions and uncertainties;
- the management approach; and
- the rationale for choice of provisions,

as is required by the Instructions (EPA, 2018, p. ii).

1.4.1. Overall objective, purpose and scope of this FVEMP

As previously mentioned, this FVEMP has been compiled by NiW to meet EPA requirements to develop and submit an EMP and relevant Schedules to demonstrate how NiW meets the intent of various biodiversity-related implementation conditions.

The biodiversity-related assets, within the Development Envelope, which have been identified as requiring a 'Schedule' to be developed are:

- Indicator Priority flora species (including *Eremophila* sp. long pedicels (P2), *Hibbertia* sp. Sherwood Breakaways (P2), *Hybanthus floribundus* subsp. *chloroxanthus* (P3), *Verticordia jamiesonii* (P3)) (Schedule 1).
- Violet Range Priority Ecological Community (PEC) (Schedule 2).
- Wanjarri Nature Reserve (WNR) (Schedule 3).

For these above-listed biodiversity-related assets, management actions, targets and proposed monitoring parameters have been developed in this FVEMP and specifically included in the relevant Schedules for the endorsement of the CEO. The Schedules are intended to be stand-alone documents.

1.4.2. Surveys and study findings

Ordinarily, baseline surveys are conducted at a tenement scale. This ensures a regional understanding of flora and vegetation and fauna communities which enables informed management in a regional context and an assessment at a Proposal level of impact and area of influence beyond its direct footprint. Baseline surveys are reviewed on a five-yearly basis to ensure they remain current and applicable for management. In these reviews, survey timing, methodology and extent are considered against contemporary standards. The results of the survey are considered against taxonomic and conservation significance changes over the past five years and the potential for future operational activity in the area.

Targeted surveys may be undertaken to update baseline information or to resolve particular survey or study gaps. Targeted surveys may also be undertaken prior to approved land clearing if there is an identified risk of Declared Rare Flora or Priority 1 species occurring in a proposed impact area.

The Study Area for the Proposal has been subject to extensive field surveying since 1990, including desktop, reconnaissance and detailed surveys, and targeted work for *Acacia* species (Appendix A). The most recent survey, undertaken by Western Botanical in 2017 (Western Botanical, 2017), covered approximately 5,422 ha within the Study Area, and encompassed the Disturbance Footprint (878 ha) and the Development Envelope (1,259 ha). The survey by Western Botanical (2017) was prepared to meet the requirements for

environmental impact assessment (EIA) in accordance with EPA (2016) Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment. Survey effort included a desktop assessment, three EIA field surveys in November 2016 and December 2016, and three field surveys during July 2017, August 2017 and September 2017 to target *Hibbertia* and *Acacia* taxa. A further desktop review, supported by a one day field visit to verify previous work and to target conservation significant flora previously recorded within the survey area was conducted by Western Botanical in September 2019. This review ensured plant numbers and population extents were current.

1.4.3. Key assumptions and uncertainties

The findings of the flora and vegetation surveys completed to date have formed the basis for the rationale and management approach adopted for the FVEMP. It is assumed that the surveys undertaken have accurately identified and mapped vegetation associations, and identified Priority flora and populations within the Proposal area and surrounds. It is also assumed that the previous assessment of impacts on flora and vegetation associated with the Proposal are correct, and are typically considered to be minor on a local and regional scale

In order to establish measurable environmental criteria (targets, triggers, thresholds) and appropriate adaptive management measures, baseline surveys and ground-truthing of potential monitoring locations is required. The findings of the baseline surveys will provide a greater understanding of the natural variability and range of vegetation condition and plant condition and reproductive capacity that can be expected during monitoring.

The Schedules developed for this FVEMP identify proposed environmental criteria and corresponding adaptive management actions based on the limitations of current knowledge. Upon completion of pre-disturbance baseline surveys to establish appropriate monitoring locations, the environmental criteria and management provisions within the Schedules of this FVEMP will be reviewed and revised as required.

1.4.4. Management Approach – General

NiW mining operations are managed under Asset Wide and site specific plans and procedures, inductions and training. The Proposal will operate under Mt Keith environmental plans and procedures where relevant, with Project specific procedures developed as required (such as procedures required to ensure the implementation of this FVEMP).

NiW has an Asset wide Environment and Heritage Impact Approval (EHIA) permit process to manage the implementation of its environmental, Aboriginal heritage, land tenure and legal obligations prior to and during land disturbance activities. All ground disturbance activities will be required to meet the requirements of the EHIA process, as well as relevant legislative and regulatory requirements. Additionally, the EHIA process provides a mechanism whereby technical and professional advice can be provided to the business regarding environmental aspects, land access and Aboriginal heritage planning and management issues. The EHIA system consists of an electronic workflow process linked to a geographical information system. The objectives of the EHIA process are to:

- identify the significant environmental¹, Aboriginal heritage and legal aspects of proposed activities;
- ensure that, through appropriate environmental Aboriginal heritage and land access planning and management, BHP activities comply with all legal and other obligations;
- avoid, minimise and mitigate the number and nature of environmental*, Aboriginal heritage and land tenure impacts and ensure adequate environmental performance of BHP operations; and
- provide a mechanism for continuous improvement.

¹ In relation to this FVEMP, environmental aspects particularly consider conservation significant flora species and communities.

Mine closure objectives, criteria and activities (including rehabilitation requirements) will be addressed within Mt Keith Satellite Project Mine Closure Plan.

1.4.5. Value specific rationale and approach

The Instructions (EPA, 2018) require a “concise” description of the rationale and approach for the EMP against the environmental objective for each value. Appendix B outlines the survey and study findings, key assumptions and uncertainties, management approach and rationale for choice of provisions regarding each value.

2. EMP provisions

Please refer to the Schedule sections.

3. Adaptive Management and review of the EMP

Adaptive management shall be achieved through ongoing training, supervision and monitoring of operational performance. Area inspections, audits and task observations may be used to assess performance and identify procedural or technical variance in operational practices that can then be remediated.

Through an annual review and reporting process the following will occur:

- Define operational issues and proposed changes to the plan.
- Implement management and mitigation measures.
- Monitor and evaluate performance against amended environmental provisions.
- Adjust management and mitigation measures and monitoring where required to meet the outcome or objective.

BHP applies an adaptive management framework for implementing management measures identified in this FVEMP. Adaptive management is a structured, iterative process to decision making. An integral component is the application of the mitigation hierarchy (avoid, minimise and rehabilitate environmental impacts, prior to applying offsets as a last resort).

The framework embeds a cycle of monitoring, reporting and implementing change where required. It allows an evaluation of the management controls so that they are progressively improved and refined, or alternative solutions adopted, to ensure the outcome-based objectives are achieved. The key steps of the adaptive management approach are outlined in Figure 2.

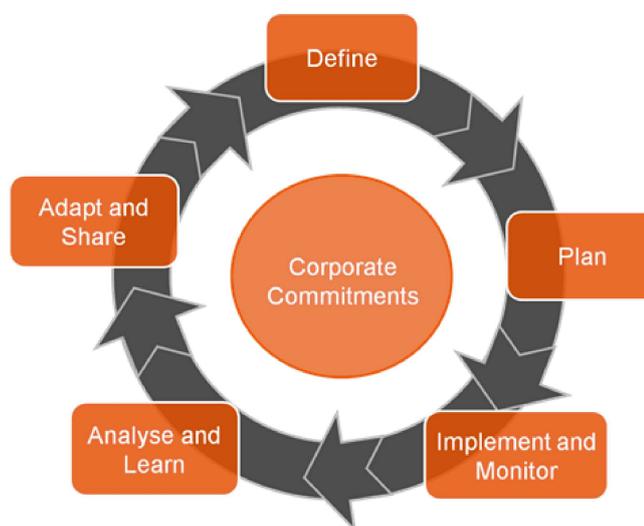


Figure 2: BHP's adaptive management approach

3.1. Review and update of this FVEMP

This FVEMP will be reviewed and updated to ensure it addresses the relevant conditions and is being implemented effectively. Changes may arise from, but not limited to, a change of scope, request by proponent or regulator for a change to Ministerial Conditions or this FVEMP, stakeholder consultation comments or from opportunities for improvement.

New and/or revised Schedules will be provided for review and endorsement by the CEO as per the requirements of the respective Ministerial Statement implementation conditions.

4. Stakeholder consultation

NiW undertakes regular and ongoing stakeholder engagement as part of its core business activities. NiW aims to facilitate regular, open and honest dialogue to understand expectations, concerns and interests of stakeholders and incorporate them into business planning to help build strong, mutually beneficial relationships. The main objectives of the consultation programme are to:

- provide information and the opportunity to comment to relevant government agencies, local authorities and to other groups or individuals who may potentially be interested in a Proposal; and
- where relevant, discuss and allow stakeholder comments on this FVEMP.

NiW will continue to engage with Traditional Owners through targeted consultation and via administration of Native Title heritage agreements where applicable.

This plan is submitted as a preliminary draft for consultation. Stakeholder consultation shall be monitored and reported through revision of this EMP for its finalisation and implementation.

Ongoing consultation has been undertaken with EPA. A summary of this consultation is included in Table 2.

Table 2: Stakeholder Consultation

Date	Proponent	Stakeholder	Discussion	Outcomes
March, 2018	BHP Billiton Nickel West	EPA	Comments on Mt Keith Satellite Project Environmental Review Document	Requested significant revision of Flora and Vegetation Management Plan
April, 2018	BHP Billiton Nickel West	EPA	Focus required on revisions to Flora and Vegetation EMP	EMP to focus on: <ul style="list-style-type: none"> • EPA Factors • Cumulative and residual impacts
July, 2018	BHP Billiton Nickel West	EPA	Document review comments specific to FVEMP (Item 2)	FVEMP to be revised to measure indirect impacts to significant flora and vegetation and take action to address any impacts

5. References

- Beard, J. S., Beeston, G.R., Harvey, J.M., Hopkins, A. J. M. and Shepherd, D. P. (2013) *The Vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir*. Second edition. Conservation Science Western Australia 9: 1-152.
- BHP Billiton Nickel West Pty Ltd (2018) *Mt Keith Satellite Project Environmental Review (Assessment No 2122)*, Draft, April 2018
- CALM (1996) *Wanjarri Nature Reserve Management Plan 1996-2006. Management Plan No 35*. Department of Conservation and Land Management for the National Parks and Conservation Authority Perth, Western Australia.
- Environmental Protection Authority (EPA) (2004). *Guidance statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessments in Western Australia*.
- Environmental Protection Agency (2016) *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment*, EPA, Western Australia. December 2016.
- Environmental Protection Agency (2018) *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans*, EPA, Western Australia. April 2018.
- Keighery, B.J. (1994) *Bushland Plant Survey. A Guide to Plant Community Surveys for the Community*. Western Australia: Wildflower Society (Inc).
- Mattheck, C and Breloer, H. (1994). *The Body Language of Trees: A Handbook for Failure Analysis*. The Stationary Office, Great Britain.
- Western Botanical (2017) *Flora and Vegetation Assessment of the Mt Keith Satellite Proposal Study Area* October 2017. Consultant report to BHP Billiton, Nickel West Pty Ltd. Report reference: WB867.
- Western Botanical (2019) *Flora and vegetation Assessment for the revised development envelop s45C Application, Mt Keith Satellite* November 2019. Consultant report to BHP Billiton Nickel West. Report reference: WB914.

Appendices

Appendix A – Summary of Botanical Surveys, 1990 - 2019

Table A-1: Summary of botanical surveys completed throughout the Study Area between 1990 and 2019.

Author	Title	Date	Scope
Western Botanical	Flora and Vegetation Assessment for the Revised Development Envelope, s45c Application, Mt Keith Satellite	November 2019	Assessment of impacts on flora and vegetation resulting from the proposed minor changes to the MKS Development Envelope, wholly within the 2017 study area.
Western Botanical	Flora and Vegetation Assessment of the Mt Keith Satellite Operations Study Area.	October 2017	Review and update of the previous baseline flora and vegetation report (2012) following a revision of the area surveyed including supplementary field works conducted during November-December 2016. Area survey covers 5,422 ha. The initial March 2017 report updated to include the results of further targeted surveys, undertaken in August to October 2017, and revised Proposal footprint.
Western Botanical	Flora and Vegetation Assessment, Yakabindie Nickel Proposal.	September 2016	A review and update of all data relating to flora and vegetation, including review of previous reports relating to the Mount Keith Satellite Operations Study Area inclusive of the Six Mile and Goliath pits and related infrastructure and produce an updated report meeting the requirements of EPA Guidance Statement 51 and Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment.
Western Botanical	Baseline review and statistical analysis of the flora and vegetation of the (previously proposed) NDS1 mine and corridor Study Area.	2012	A review and synthesis of previous works and addition of quadrat-based vegetation assessment and analysis, to meet the criteria of a Level 2 Survey. Includes Six-Mile and Goliath orebody areas, waste rock storage area, and associated transport corridor based on additional field works implemented in 2011.
Mattiske Consulting Pty Ltd	Summary of <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> E.M. Benn. (P3) Populations, Yakabindie.	September 2011	Confirmation of the identification of populations previously recorded in the Proposal area and abundance of the populations of <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3) outside immediate impact areas.
Western Botanical	Assessment of flora and vegetation, Yakabindie Proposal (draft report).	2009	Level 1 assessment commissioned for the purposes of applying for a Native Vegetation Clearing Permit (NVCP) for the (previously proposed) YNP.
Western Botanical	Flora, vegetation and habitats of the Yakabindie tenements 2004-2005.	2006a	Level 1 assessment inclusive of the initial review of flora, vegetation, and conservation values of Yakabindie tenements and surrounding local areas. This represents the most comprehensive and extensive works conducted at the Mt Keith Study Area inclusive of vegetation mapping, habitat descriptions and species profiles.
Western Botanical	Review of flora, vegetation, landscapes and conservation values of the Six-mile and Sir Samuel blocks, Wanjarri Nature Reserve and Yakabindie Station.	2006b	Level 1 assessment of a section of Wanjarri Nature Reserve and a section of Sir Samuel Block, in preparation for a land swap to facilitate mining at Yakabindie Nickel Proposal.

Author	Title	Date	Scope
Landcare Services	Review of <i>Hemigenia exilis</i> (S. Moore).	2001	Combined all data including WMC, Anaconda Nickel and CALM sources to review the status of <i>Hemigenia exilis</i> Declared Rare Flora (DRF) resulting total of 46,005 plants from 66 populations and reduction to P4 status.
Landcare Services	A review of <i>Hemigenia exilis</i> (S. Moore) populations at The Mt Keith Operation and within the north-eastern Goldfields.	1996	Targeted survey and review of <i>Hemigenia exilis</i> local and regional populations, incorporating data supplied by Anaconda Nickel.
Ecologia	Yakabindie Nickel Proposal: <i>Hemigenia exilis</i> survey and management plan.	1996	Targeted survey and management of <i>Hemigenia exilis</i> , previously ranked as Declared Rare Flora, at the Yakabindie Nickel Proposal.
Ecologia	Yakabindie nickel mine Proposal, Six Mile Well – Mt Pasco blocks: environmental assessment.	1995	Unknown.
Ecologia Ecological Consultants	<i>Yakabindie Nickel Mine Proposal Consultative Environmental Review: Flora and Fauna Survey.</i>	March 1990	Documentation of existing biota, delineation of the main ecological units, map the area and integration of previously published and unpublished vegetation information.

Appendix B – Rationale and Context

Schedule	Value	Surveys and Studies	Survey and Study Findings	Key assumptions and uncertainties	Rationale for choice of provisions
Schedule 1	Priority flora	<p>Western Botanical (2019) <i>Flora and Vegetation Assessment for the Revised Development Envelope s45c Application, Mt Keith Satellite</i></p> <p>Western Botanical (2017) <i>Flora and Vegetation Assessment of the Mt Keith Satellite Operations Study Area.</i></p> <p>Western Botanical (2012) <i>Baseline review and statistical analysis of the flora and vegetation of the (previously proposed) NDS1 mine and corridor Study Area.</i></p> <p>Western Botanical (2006) <i>Flora, vegetation and habitats of the Yakabindie tenements 2004-2005.</i></p>	<p>The Study Area is known to support 393 endemic flora taxa from 140 genera and 51 families, ranging from six to 36 taxa per vegetation associations (Table B-1). No listed Threatened Flora are known to occur within, or adjacent to, the Study Area.</p> <p>Thirteen Priority Flora species were initially known within the Study Area. Following the Western Botanical (2017) survey, the species, <i>Eremophila</i> sp. long pedicels G. Cockerton 1975, has since been listed by DBCA as a Priority 2 species. This takes the total known Priority Flora within the Study Area to 14, which includes one Priority 1, two priority 2, eight Priority 3, and three Priority 4 listed species (Table B-2). Of these 14 species, five are not directly impacted by the Proposal.</p> <p>Of the nine remaining Priority species, four taxa have been selected as "indicator species of concern" for use in monitoring: <i>Eremophila</i> sp. long pedicels (P2), <i>Hibbertia</i> sp. Sherwood Breakways (P2) and <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3). A description of these taxa of concern is provided in Table B-3.</p> <p>There is the potential for the viability of Priority flora taxa and vegetation communities, remaining after land clearing, to be reduced by fragmentation, particularly within the Violet Range PEC. This may result in changes in genetic flow, colonisation and recruitment that may impede the functionality of a species population or community, particularly for populations at the limits of their distribution. The flora of breakaway landscapes is naturally sparse with large gaps between individual plants and plant communities. Species tend to flower rapidly after sufficient rainfall, often following thunderstorm or cyclonic rainfall events. A number of taxa found with the breakaway landscape of the Violet Range PEC are insect-pollinated, with gaps between disjunct populations of insect-pollinated species potentially already resulting in barriers to gene flow.</p>	<p>With the exception of <i>Hibbertia</i> sp. Sherwood Breakways (R.-J. Cranfield 6771) and <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i>, all of the priority flora recorded have wider distributions outside of the sub-region or bioregion and in some cases occur outside of the State.</p> <p>Indirect impacts considered in the impact assessment and the development of Schedule 1 are:</p> <ul style="list-style-type: none"> Habitat fragmentation – The potential for habitat fragmentation is most likely to occur where plants exist immediately adjacent to areas of disturbance associated with the Proposal. Alteration of surface water flows – Some of the species are found within drainage lines. These may be impacted by interception by the haul road or impacted or reduction in catchment flow due to the construction of mining landforms. Potential to spread or introduce weeds – The impact of weeds on these species is unknown. <p>The impacts to these species are not considered significant.</p>	<p>The Priority indicator species have been selected due to proximity to either haul road or mine landforms (pits, waste rock dump) and therefore risk of indirect impacts:</p> <ul style="list-style-type: none"> <i>Eremophila</i> sp. long pedicels (G. Cockerton 1975) (P2) is a species that was first discovered at the Mt Keith Nickel Operation (NMK) in 1996 by Geoff Cockerton & Kirsty Stratford. It is locally abundant to dominant in drainage lines downstream of the NMK tailings facility (CDTSF). The northern extent of the proposed haul road intercepts a small population (estimated at 20 plants) on the south-western perimeter of the CDTSF. <i>Hibbertia</i> sp. Sherwood Breakways (P2) is a newly recognised species that is currently known only from the Yakabindie station and Wanjarri Nature Reserve. A population occurring in the western end of the Wanjarri Nature Reserve will be fragmented from populations to the east of the Development Envelope by construction of the haul road. <i>Hybanthus floribundus</i> subsp. is typically found in rocky areas, creek banks and along drainage lines. The sub-population to be disturbed by clearing is largely located within the Six Mile Well pit boundary. A large portion of this sub-population that exists outside the proposed pit within an ephemeral drainage line will remain undisturbed and will be intact. Here, the species occupies a small niche on the margins of narrowly incised Mulga dominated ephemeral drainage line (DRMS Community) which drains southward. It receives run-on from the adjacent granitoid landscape to the west and from the Six Mile orebody area on the eastern side of the drainage line. Development of the MKS proposal will unavoidably reduce the overall catchment area (by 12.25%) and therefore overall volume of surface water run-on into this minor creekline. It is assumed that the <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> plants here derive their moisture from within the fractured rocks on the margins of the drainage line and that this moisture is replenished during surface flow events, particularly when free water is resident in the ephemeral drainage line for extended periods. This would normally be following heavy rainfall events. A population of 63 plants of <i>Verticordia jarniesonii</i> (5.26% of the overall enumerated population) lies within the proposed MKS haul road alignment over a breakaway and will be impacted by the development of the MKS project.

Flora & Vegetation Environmental Management Plan

Schedule	Value	Surveys and Studies	Survey and Study Findings	Key assumptions and uncertainties	Rationale for choice of provisions
Schedule 2	Violet Range PEC and associated Priority Flora	Western Botanical (2019) <i>Flora and Vegetation Assessment for the Revised Development Envelope s45c Application, Mt Keith Satellite</i> Western Botanical (2017) <i>Flora and Vegetation Assessment of the Mt Keith Satellite Operations Study Area</i> Western Botanical (2012) <i>Baseline review and statistical analysis of the flora and vegetation of the (previously proposed) NDS1 mine and corridor Study Area</i> Western Botanical (2006) <i>Flora, vegetation and habitats of the Yakabindie tenements 2004-2005</i>	The Violet Range PEC comprises a number of vegetation associations that occur within limonitic landforms, basalt geology of the Perseverance fault line, carbonate soils derived from weathered basalt and some colluvial slopes associated with these. Western Botanical (2017) have mapped other occurrences of these vegetation associations and landforms and suggest that the boundaries of the PEC could be expanded to include a further 18,288 ha. Historical impacts to the PEC comprise clearing for pastoralism and mining (including the abandoned Bellevue site). There is the potential for the viability of florataxa and vegetation communities, remaining after land clearing, to be reduced by fragmentation, particularly within the Violet Range PEC. This may result in changes in genetic flow, colonisation and recruitment that may impede the functionality of a species population or community. The flora of breakaway landscapes is naturally sparse with large gaps between individual plants and plant communities. Species tend to flower rapidly after sufficient rainfall, often following thunderstorm or cyclonic rainfall events. A number of taxa found with the breakaway landscape of the Violet Range PEC are insect-pollinated, with gaps between disjunct populations of insect-pollinated species potentially already resulting in barriers to gene flow. Six weed species documented from the Study Area are found in small, isolated populations with low numbers of individuals present (Table B-4). Three of these species have the potential to be highly invasive and, excluding intentional introduction through pastoral activities, the nearest significant sources are the Goldfields Highway and NMK. In addition, a number of other weed species are documented at NMK - the two sites will be linked by a haul road, with frequent vehicle movements between the two areas, providing risk of weed ingress.	Detailed flora surveys have been undertaken across the Development Envelope and surrounding areas over multiple years and seasons and the species lists considered to be highly representative of the communities present within the study area (Western Botanical, 2017). Clearing will directly impact less than 4% of the PEC; however it is possible that the PEC extends further than the extent currently mapped based on the survey effort to date. Indirect impacts considered in the impact assessment and the development of Schedule 1 are: - Habitat fragmentation - The potential for habitat fragmentation is most likely to occur where plants exist immediately adjacent to areas of disturbance associated with the Proposal. - Potential to spread or introduce weeds - Weeds can compete for resources with native flora and disrupt ecological function. When intact populations of native plants are fragmented, or adjacent areas are disturbed, the risk of weed incursion increases. - Altered Fire Regime – the likelihood of fire in the Proposal area is low due to arid climate and low natural fire frequency. The introduction of mining activities, including clearing is unlikely to increase or alter the existing fire regime within both local and regional context. The presence of existing weed species in small isolated patches does not alter the existing fire regime. Effective management of weeds will ensure the fire potential is not exacerbated.	The PEC occurs within areas that are currently subjected to cattle grazing and previous exploration activities. The impacts from these activities are minimal, suggesting that the vegetation communities that comprise the PEC are relatively resilient to these processes. The key risks to the PEC arising from the Proposal are considered to be unauthorised clearing outside the Development Envelope and weed incursion. Four Priority species within the PEC have been selected for ongoing monitoring due to proximity to either haul road or mine landforms (pits, waste rock dump) and therefore risk of indirect impacts. These assessments will also record condition of the associated vegetation. In addition to these, the condition of key vegetation associations typical of the PEC will be monitored. Monitoring and management actions for these species and vegetation associations are provided in Schedule 1.
Schedule 3	Wanjarri Nature Reserve	Western Botanical (2006) <i>Review of flora, vegetation, landscapes and conservation values of the Six-mile and Sir Samuel blocks, Wanjarri Nature Reserve and Yakabindie Station</i> Plus also refer to: CALM (1996) <i>Wanjarri Nature Reserve Management Plan 1996-2006</i> .	Indirect impacts considered in the impact assessment and the development of Schedule 1 are: - Dust impacts - Based on a depositional trigger value of 0.3 g/m ² /day, the predicted impacts to vegetation within the Wanjarri Nature Reserve from activity along the transport corridor with no controls applied is likely to be low (NW, 2018). - Habitat fragmentation - The potential for habitat fragmentation is most likely to occur where plants with limited populations exist immediately adjacent to areas of disturbance associated with the Proposal. - Potential to spread or introduce weeds - Weeds can compete for resources with native flora and disrupt ecological function. When intact populations of native plants are fragmented, or adjacent areas are disturbed, the risk of weed incursion increases. - Altered fire regime - The risk of fire in non-grassy habitats is naturally low due to low	The Wanjarri Nature Reserve is a Class A nature reserve covering approximately 53,000 ha. The key vegetation component is spinifex grasslands with mulga complexes that occur primarily in the western third of the reserve, adjacent to the MKS proposals. It is acknowledged by the State government that due to the small size of the reserve that a regional approach to management is required, and therefore potential indirect impacts arising from weed incursion need to be managed. Water-based dust suppression will be utilised during both construction and operational phases of the Proposal to minimise dust impacts on adjacent vegetation on either side of the transport corridor. Given the low likely impacts to the vegetation within the Nature Reserve, dust suppression is not included in this management plan.	

Schedule	Value	Surveys and Studies	Key assumptions and uncertainties	Rationale for choice of provisions
			<p>fuel loads, however, fires within the Spinifex and perennial grass dominated communities (SAMW, SAMS, SAMA, MUWA) are naturally more frequent following lightning strike. Mining should not increase the incidence of fire occurrences.</p> <p>- The presence of existing weed species in small, isolated patches does not alter or enhance the existing fire regime. However the introduction of grass weeds such as Buffel Grass and Birdwood Grass may alter and increase the fuel load in those areas. Infestations along water courses and disturbed areas introduce a risk of altered fire regime. Effective management of weeds will ensure the fire potential is not exacerbated.</p>	

Table B-1: Vegetation Associations of the Study Area

Veg Code	Vegetation Association Name	Area within MKS Study Area (ha)	% of MKS Proposal Study Area	Area (ha) within MKS Development Envelope	% within MKS Development Envelope
Basalt Geology Landform (Fresh Rock)					
BaMAS Complex	Basalt, mixed Acacia species Shrubland Complex	182.9	3.37	0.33	0.03
BaAdS	Basalt, Acacia dorela long phyllode form Shrubland	19.4	0.36	0.86	0.07
BaAxS	Basalt, Acacia aff. xanthocarpa Shrubland	83.2	1.54	9.80	0.77
BaAbS	Basalt, Acacia burkittii Shrubland	11.9	0.22	0.00	0.00
BaCdS	Basalt, Calytrix desolata low Shrubland	22.7	0.42	0.00	0.00
Weathered Basalt Landforms (Carbonate Soils)					
GHPS	Weathered Basalt, Hakea leucoptera subsp. serripes - Eremophila pantonii Shrubland	233.19	4.32	107.19	8.47
SSS	Stony Senna Shrubland	127.71	2.37	54.49	4.31
EGPW	Weathered Basalt, Eucalyptus gypsophila - Eremophila pantonii Woodland	11.92	0.22	5.32	0.42
Limonic Landforms					
SILS	Stony Ironstone Low Shrubland	27.17	0.50	4.57	0.36
SIMS	Stony Ironstone Mulga Shrubland	412.28	7.60	260.47	20.59
USBS	Upland Small Bluebush Shrubland	92.93	1.71	32.61	2.58
Archaean Granite Landforms					
BrCP Complex	Breakaway Chenopod Plain Complex	12.23	0.23	0.41	0.03
BrCP – TectS	Breakaway Chenopod Plain Complex - Tecticornia Shrubland	0.58	0.01	0.00	0.00
BrCP-FRAN	Breakaway Chenopod Plain Complex - Frankenia Shrubland	8.46	0.16	0.00	0.00
BrGP	Breakaway Grassy Plain	18.70	0.35	0.00	0.00
BrX-FOL	Archaean Granite Breakaway Footslope	15.71	0.29	0.00	0.00
BrX	Archaean Granite Breakaway	7.08	0.130	0.00	0.00
BrX-P	Archaean Granite geology	30.79	0.57	3.25	0.26
GrEx	Granite, Exfoliating granite outcrops	62.4	1.15	0.00	0.00
GrMS	Granitic Mulga Shrubland	990.0	18.26	34.68	2.74
GrMS - BRX Complex	Granite Mulga Shrubland - Granite Breakaway Plateaux Complex	48.3	0.89	0.02	0.00

Veg Code	Vegetation Association Name	Area within MKS Study Area (ha)	% of MKS Proposal Study Area	Area (ha) within MKS Development Envelope	% within MKS Development Envelope
SAES	Stony Acacia Eremophila Shrubland	484.25	8.93	79.91	6.32
SGRS	Sandy Granitic Mulga Shrubland	5.37	0.10	0.00	0.000
Sandplain Landforms					
MUWA	Mulga - Wanderrie Grassland	2.75	0.05	0.00	0.00
SAMU	Sandplain Mulga Spinifex Shrubland	172.04	3.17	16.31	1.29
SAWS	Sandplain, Acacia species Spinifex Shrubland	11.92	0.22	0.00	0.00
SAMA	Sandplain, Mallee, Acacia species Spinifex Shrubland	13.27	0.24	0.00	0.00
WABS	Wanderrie Bank Grassy Shrublands	182.23	3.36	36.19	2.86
WABS – SAMU Complex	Wanderrie Bank Grassy Shrublands / Sandplain Mulga Spinifex Shrubland Complex	153.89	2.84	20.57	1.63
Colluvial and Alluvial Drainage Landforms					
DRES	Drainage Line Eucalypt Woodland	50.46	0.93	3.76	0.30
DRMS	Drainage Line Mulga Shrubland	381.54	7.04	33.56	2.65
GRMU	Groved Mulga Woodland	65.21	1.21	5.55	0.44
HMCS	Mulga Shrubland with scattered low Chenopod Shrubs	24.00	0.44	0.00	0.00
HPMS	Hardpan Mulga Shrubland	323.35	5.96	103.06	8.15
HPMS THOMA	Hardpan Mulga Shrubland with Acacia thoma co-dominant	3.02	0.06	3.02	0.24
MMS	Mulga over Maireana triptera Shrubland	329.99	6.09	252.11	19.93
MPS	Maireana pyramidata Shrubland	6.83	0.13	0.00	0.00
SMS	Stony Mulga Shrubland	763.84	14.16	196.61	15.54

Table B-2 Priority taxa recorded from the Proposal Study Area (orange cells are indicator taxa of concern).

Priority taxa	Priority	Distribution
Aizoaceae		
<i>Gunnipopsis propinqua</i>	P3	Several records in the Development Envelope and Study Area, saline areas downslope of granitoid breakaways, recorded in the Study Area for the first time in 2016.
Anacampserotaceae		
<i>Anacampseros</i> sp. Eremaean (F. Hort, J. Hort & J. Shanks 3248)	P1	Granitoid domains.
Dilleniaceae		
<i>Hibbertia</i> sp. Sherwood Breakaways (R.J. Cranfield 6771)	P2	Development Envelope (transport corridor) and Study Area, associated with granitoid breakaways and laterite capped hills.
Lamiaceae		
<i>Hemigenia exilis</i>	P4	Low numbers, widespread in the Development Envelope and Study Area, associated with creeklines and volcaniclastic sediments.
Malvaceae		
<i>Hibiscus krichauffianus</i>	P3	Three records within the Development Envelope and Study Area, recorded in the Study Area for the first time in 2016, stony landscapes.
<i>Sida picklesiana</i>	P3	Development Envelope and Study Area, granitoid breakaways.
Myrtaceae		
<i>Thryptomene</i> sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3	Development Envelope and Study Area, granitoid breakaways, SIMS and SILS communities.
<i>Verticordia jamiesonii</i>	P3	Development Envelope and Study Area, granitoid breakaways.
Poaceae		
<i>Aristida ?jerichoensis</i> var. <i>subspinulifera</i>	P3	One specimen was recorded from Jones Creek. (Refer to Western Botanical, 2017. Taxa was identified based on sub-optimal material and re-collections for confirmation of the identification is required)
Proteaceae		
<i>Grevillea inconspicua</i>	P4	Low numbers, widespread in the Development Envelope and Study Area, associated with outcropping basalt.
Scrophulariaceae		
<i>Eremophila pungens</i> complex inclusive of <i>Eremophila</i> sp. Leinster (R.J. Cranfield 6767)	P4	Low numbers, widespread in the Development Envelope and Study Area, granitoid breakaways and limonitic landforms.
<i>Eremophila</i> sp. long pedicels (G. Cockerton 1975)	P2	~20 individuals known within the north of the proposed haul road towards NMK, located on the south-western margin of the NMK TSF on hardpan plains and adjacent sandplain.
Violaceae		
<i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i>	P3	Scattered populations in the Development Envelope and Study Area, mostly in drainage areas.
Zygophyllaceae		
<i>Tribulus adelacanthus</i>	P3	One specimen was recorded within the Development Envelope on colluvial slopes.

Table B-3: Description of the four Priority indicator taxa of concern (based on Florabase 2018, and Western Botanical, 2017).

Taxa	Description	Habitat	Populations
<i>Eremophila</i> sp. long pedicels (G. Cockerton 1975) (P2)	Domed shrub, up to 0.7 m by 1-1.5 m diameter. Glabrous dark green, glossy filiform leaves with prominent dorsal groove. Purple (rarely white) flowers held on sinuoidal pedicels to 20 mm long, fruits containing up to 4 seeds in a woody capsule up to 8 mm diameter with long prominent simple hairs on the papery pericarp.	Associated with sheetflow habitats with Mulga and/or Spinifex. Locally abundant to dominant in drainage lines downstream of the CDTSF, within extending eastwards from the NIMK CDTSF, towards sandplains to the east.	A regional estimate of 50,000 plants in 4 sub-populations made. Within the vicinity of MKS, an estimated 37,533 plants occur, with a further 12,467 plants estimated in three other sub-populations at Mt Keith, Lake Way and Barwidgee Stations, north of MKS. The population at Barwidgee Station, within the Lake Maitland catchment, is considered substantial and at Lake Way a small population is known in a narrow drainage line on the northern shore of the eastern part of the lake. A small number of plants are known to exist within Wanjarri Nature Reserve, south-east of the NIMK CDTSF within a drainage line, however, this population has not been assessed.
<i>Hibbertia</i> sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2)	<i>Hibbertia</i> sp. Sherwood Breakaways is a single stemmed perennial shrub up to 1 m high x 1.5 m wide, with dark green glabrous, glossy pungent need-like leaves to 15 mm long. It produces large yellow flowers following adequate rainfall and copious amounts of light brown seeds to 2 mm diameter in good seasons.	Grows in cracks in Archaean granite plateaux and on adjacent shallow lateritic caps of low rounded hills and associated drainage lines.	Two populations have been identified between Wanjarri NR and Yakabindie Station, with the total population estimated to be 13,715 plants. The majority (12,287 plants) occur at Yakabindie, in six sub-populations. The population within Wanjarri NR is estimated at 1,428 plants, growing east of a drainage divide east of the MKS Study Area.
<i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> (P3)	Multi-stemmed shrub growing to 0.7 m tall with blue-green foliage in the cooler, wetter months turning yellow-green in summer. It has pale blue flowers from August to October following adequate rainfall and produces copious amounts of round black seeds to 3 mm diameter.	Occurs in drainage foci in rocky areas, creek banks and along ephemeral drainage lines growing in fractures in the surface rock.	Five populations have been identified in Western Australia, with an estimated 241 plants in four subpopulations between MKS and NIMK. Locally, plants occur in a north-south alignment on the western margin of the Perseverance fault line. A further 220 plants have been recorded 5 km north of the study area. Regionally, the population is estimated at 1,679 plants with populations also identified from Yakabindie Station, Weebo Station and nearby Murrin nickel mine and Leinster.
<i>Verticordia jarmiesonii</i> (P3)	Perennial shrub growing 0.2-0.6 m tall. Produces pink to white flowers during September to October following adequate rainfall with potentially one seed per fruit, though seed fill within fruits is usually low for this genus.	Grows in rock cracks on granite breakaways.	Distributed through the Gibson Desert, Murchison and Yalgoo Biogeographic regions at three disjunct foci. At NIMK there is a large population (500 plants) on low breakaways within the south east portion of the study area and a small population (63 plants) at the propose haul road. Outside the area a population of 326 plants have been enumerated.

Table B-4 Weeds identified within the Proposal Study Area.

Weed Species	Description
<i>Rumex vesicarius</i> (Ruby Dock)	An aggressive coloniser species that responds rapidly to rainfall, producing seeds that are readily distributed by wind and water. It is well established at NMK and elsewhere in the north-eastern Goldfields on mine sites and disturbed lands.
<i>Cenchrus ciliaris</i> (Buffel Grass)	An aggressive coloniser that is well established in the Pilbara region but is only recently becoming a problem in the north-eastern Goldfields. It is allelopathic, meaning it suppresses other plants growing near it and can be a major management risk to the Proposal.
<i>Cenchrus setiger</i> (Birdwood Grass)	Is similar to Buffel Grass and is an aggressive, allelopathic coloniser that is well established in the Pilbara region but is only recently becoming a problem in the north-eastern Goldfields.
<i>Bidens bipinnata</i> (Bipinnate Beggartick)	Recorded within the bed of Jones Creek, downstream from the existing main crossing, and lies within the Study Area. It is a nuisance plant with spiny fruit that cling to clothing and is also readily transmitted via stock.
<i>Lysimachia arvensis</i> (Pimpernel)	Recorded at one site within Jones Creek and is a small annual species, which has seeds that are readily transported by wind and water.
<i>Mesembryanthemum nodiflorum</i> (Slender Iceplant)	Recorded at one site in the north-west of the Study Area, associated with a low granite breakaway. It is a small annual species with seeds which are readily transported by wind.

Schedule 1: MS 1087 Mt Keith Satellite (MKS) Project – Priority Flora

To meet the requirements of Condition 6 of Ministerial Statement 1087

<p>EPA Factor and objective: Flora and Vegetation – to protect flora and vegetation so that biological diversity and ecological integrity are maintained.</p>			
<p>Values: Wanjarri Nature Reserve (WNR) – A Class Nature Reserve.</p>			
<p>Objective: Condition 6-1 objective (1) – The proponent shall implement the proposal to avoid, where possible, and minimise indirect impacts as far as practicable to Priority flora.</p>			
<p>Outcome: No decline in condition of local populations of Priority taxa as a result of activities associated with the Proposal.</p>			
<p>Key impacts and risks: Risk to biological diversity and/or ecological integrity indicator Priority taxa populations, due direct impacts (clearing) and indirect impacts (habitat fragmentation, alteration of surface water flows, potential to spread or introduce weeds).</p>			
Management and Outcome Based Provisions			
Management Actions	Management Targets	Monitoring	Reporting
<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p> <p>Drainage measures designed and constructed to minimise changes to natural surface water flow, including diversion drains, rock cladding and contouring as required.</p> <p>Rehabilitation of waste rock landform and general disturbance areas upon completion of mining.</p>	<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>	<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>	<p>The proponent shall advise the CEO of any potential non-compliance within seven (7) days of a potential non-compliance being known. The proponent shall submit to the CEO the first Compliance Assessment Report fifteen (15) months from the date of issue of this Statement addressing the twelve (12) month period from the date of issue of this Statement and then annually from the date of submission of the first Compliance Assessment Report, or as otherwise agreed in writing by the CEO.</p> <p>The Compliance Assessment Report shall:</p> <ol style="list-style-type: none"> (1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1. <p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>
<p>Management actions -</p> <ul style="list-style-type: none"> • Implement the Environmental Heritage Impact Assessment process prior to land disturbance. • Conduct weed hygiene inspections on ground-engaging equipment prior to arriving at site. • Implement targeted biennial weed inspection and spraying regime post rainfall periods. • Drainage measures designed and constructed to minimise changes to natural surface water flow, including diversion drains, rock cladding and contouring as required. <p>Trigger Level Action – plant condition Undertake investigation into the source of decline in the indicator Priority species condition.</p> <p>Trigger level action – weeds Implement targeted spraying program.</p>	<p>Target No measurable decrease in vegetation condition and plant phenology values at impact sites, validated by statistically significant trends over time.</p> <p>Trigger criteria – plant condition A decrease in plant condition score or deviation from normal phenology of one or more of the indicator Priority flora species in the impact populations compared to analogue populations. The degree of decrease in plant condition is considered as an average plant condition score decrease ≥ 1 deviation from the average at analogue sites.</p> <p>Trigger criteria – weeds An increase of 10% in area of existing weed populations compared to baseline weed survey. No new weed species recorded within the Development Envelope.</p>	<p>Implementation of Before, After, Control, Impact (BACI) design comprising:</p> <ul style="list-style-type: none"> - Baseline survey to assess condition and reproductive phenology of Priority taxa, pre-disturbance and establish an analogue and potential impact sites based on indicative monitoring locations (Figures 1-1 to 1-4). - Installation of permanent photo monitoring points at impact and analogue sites. - Baseline weed survey within the Development Envelope to define weed populations pre-disturbance and establish analogue and potential impact sites. (Current weed species population shown in Figure 1-5). - Annual monitoring program to assess condition of Priority taxa and extent of weed populations - Priority taxa assessment to include an appropriate condition scale. <p>Rehabilitation monitoring undertaken in accordance with the Mine Closure Plan and BHP Rehabilitation monitoring standard.</p>	<p>Notification of potential management target or objective non-compliance will be provided to the DWER and the DBCA within 7 days of that potential non-compliance being known. A report including any corrective actions identified will be provided to the DWER and the DBCA following the completion of an investigation into the potential non-compliance.</p> <p>An annual compliance assessment report will be submitted as part of the Annual Compliance Assessment Report, which will be submitted to the DWER by 28 March each year.</p> <p>The Compliance Assessment Report shall:</p> <ol style="list-style-type: none"> (1) be endorsed by NIW's Asset President or a person delegated to sign on the Asset President's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.

<p>Threshold Action – plant condition and reproductive phenology Increase the extent and frequency of indicator Priority species condition and reproductive phenology monitoring to determine extent of overall decline of condition and reproductive phenology in wider populations of the affected species. Develop mitigation action plan in consultation with EPA.</p> <p>Threshold action – weeds Review and implement revised weed monitoring and control frequency and methods until weed populations are measured to be below trigger criteria.</p>	<p>Threshold criteria – plant condition and phenology A decrease in the plant condition scale or phenology of one or more of the indicator Priority flora species in the impact populations compared to analogues. The degree (or duration) of decrease in plant condition is considered as an average plant condition score decrease ≥ 2 deviation from the average at analogue sites.</p> <p>Threshold criteria – weeds An increase of 20% in area of existing weed populations compared to baseline weed survey. No new weed species established within the Development Envelope.</p>		
<p>Vegetation Condition Monitoring Program</p>			
<p>Establish series of analogue and impact monitoring plots at indicative locations which include:</p>			
<ul style="list-style-type: none"> • Delineated quadrats, with corners marked and GPS coordinates recorded for each corner. • Photographic point marked at the north west corner of each plot. • For Priority species, establish subset of at least 25 permanently marked individuals of each species in each population. • Individual plants tagged with unique identification number and GPS coordinates recorded. 			
<p>Information to be recorded at each monitoring plot, at each repeat measure:</p>			
<ul style="list-style-type: none"> • Date and time of monitoring • Weather conditions at time of monitoring • Photograph from the north west corner • Any maintenance required for the site • Any presence of weeds, and if present, estimate percentage weed cover • Dust observations • Vegetation condition observations <ul style="list-style-type: none"> ◦ Estimated % of live canopy with the appropriate score as per Table 1 • Individual plant observations for tagged plants: <ul style="list-style-type: none"> ◦ Plant condition score as per Table 1 ◦ Photographic record of each tagged plant ◦ Percentage of Priority species population within each condition category as per Table 1 • Additional comments (including evidence of grazing on monitoring plants within the plot). 			
<p>Assessment of Monitoring data to include:</p>			
<ul style="list-style-type: none"> • Preceding and current weather records reflecting seasonal conditions. • Likely expression of impacts on vegetation in response to potential risks, as per Table 2. • Consideration of each indicator Priority species' preferred habitat and phenology in response to seasonal conditions, as per Table 3. • Use of remote sensing data to assess whole of site vs regional assessment of vegetation condition, described below. 			
<p>Use of Remote Sensing</p>			
<p>It is intended to use the Normalised Difference Vegetation Index (NDVI) tool, which is developed through the interpretation of satellite imagery. NDVI is calculated from the visible and near-infrared light reflected by vegetation. The chlorophyll in plant leaves strongly absorbs visible light for use in photosynthesis. The cell structure of the leaves however strongly reflects near-infrared. Healthy vegetation absorbs most of the visible light that hits it and reflects a large portion of the near-infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared. NDVI imagery will be obtained for dry seasonal conditions and wet seasonal conditions existing prior to the project commencement. This tool provides standardised, high resolution imagery that can identify areas of change in vegetation vigour outside the small point focussed monitoring plots.</p>			
<p>Monitoring Schedule</p>			
<p>Baseline monitoring to be undertaken for the first two years following implementation of the clearing program as per schedule provided in Table 4. The frequency of monitoring will then be reassessed following the winter 2020 monitoring cycle with a view to reduction to an annual monitoring program. Collection of baseline data will commence prior to clearing occurring in Spring 2018. For Priority species, this will include assessment of plant condition every 2 to 3 months for the first two years following implementation of the clearing program, to gauge plant condition. This frequency will provide a relatively fine-scale record of the annual cycle of aestivation in dry seasons and response to rainfall demonstrated by each species.</p>			

Table 1 Observable Plant Condition Scale

Score	Descriptor	Prevailing conditions	Observations
7 a-d	Plants vegetative	Normal, dry season	Foliage healthy and normal for prevailing seasonal conditions. Foliage may be (a) actively growing, (b) static or (c) reduced and/or (d) may demonstrate variable levels of auxiliary pigments (anthocyanins). No flower buds initiated, no flowers present, no fruits attached to plant.
6	Plants pre-reproductive	Normal, soon after rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flower buds initiated but no flowers open, no fruits attached to plant.
5	Plants reproductive	Normal, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flowers open, developing fruits may be attached to plant.
4	Plants post-reproductive	Normal, drying season, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. No flowers present. Current season fruits containing viable seeds may be attached to plant and/or the plant may have recently dehisced viable seeds.
3	Plants exhibiting reduced foliage	Either (a) Reflecting extended dry seasonal conditions; or (b) Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. Plants exhibiting discoloured-yellowed leaves, increased leaf fall.
2	Plants with partial dead canopies	Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. A portion (estimate % of plant canopy is alive) of the plant canopy is alive while a proportion is dead (dried leaves attached or dead stems held within plant canopy).
1	Plant completely dead	Abnormal, localised impacts possible, requires investigation	No live foliage held on plant, no live bark observable, irreversible death of plant.

Table 2. Potential Risks and Expression in Vegetation

Risk	Expression in Vegetation
Dust deposition	Observable and recordable dust on foliage causing reduced photosynthetic and transpirational efficiencies. Gradual decline in vegetation vigour, reduced canopies, reduced growth rates, reduced flowering and fruiting success, deaths of some individuals.
Salt water over-spray	Immediate death of susceptible plants.
Salt water migration in surface runoff	Immediate death of susceptible plants affected and a progressive expansion of the impact area.
Salt water migration in sub soil through-profile drainage	Immediate death of susceptible plants affected and a progressive expansion of the impact area. Salt migrates slowly in soils with a high silt or clay content but resides within that soil for long periods. Salt migrates through sandy soils rapidly and can leach away leaving non-saline soils in a short time frame.
Interruptions to sheet flow causing decreased infiltration	Gradual decline in vegetation vigour, reduced canopies, reduced growth rates, reduced flowering and fruiting success; deaths of areas of vegetation noted rapidly after infrastructure development, particularly after extended dry periods and then a stabilisation of the impact zone with limited successful recruitment.
Concentrated surface runoff exacerbating erosion	Obvious new areas of channelised flow, erosion and potential waterlogging, decline in condition and deaths of vegetation.

Table 3. Summary Phenology of Indicator Priority Flora Species

Species	Preferred habitat	Normal response to Dry Seasonal Conditions	Recovery following Dry Conditions
<i>Hibbertia</i> sp. Sherwood Breakaways P2	Growing on the granitoid breakaway system traversed by the proposed MKS haul road	Aestivates, minimal foliage retained, anthocyanins elevated	New growth produced, flowers produced, fruits and seeds produced
<i>Eremophila</i> sp. long pedicels P3	Found in a small population at the northern end of the haul road growing in sandplains on the margins of drainage lines which are subject to sheet flow	Aestivates, minimal foliage retained, anthocyanins elevated	New growth produced, flowers produced, fruits and seeds produced
<i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i> P3	is found growing on the banks of rocky ephemeral creek lines on the western side of the Six Mile orebody area	Aestivates, foliage retained but turns yellow	Retained foliage turns green rapidly after rainfall, new growth produced, flowers produced, fruits and seeds produced
<i>Verticordia jamiesonii</i> P3	Growing on the granitoid breakaway system traversed by the proposed MKS haul road	Aestivates, minimal foliage retained, anthocyanins elevated	New growth produced, flowers produced, fruits and seeds produced

Notes:

These species, as is the case for the majority of flora in the Eremaean region of W.A., which are reliant on incident rainfall and short term soil moisture availability, reduce their physiological activity in response to dry conditions and increase their new leaf growth, flowering and fruiting in response to highly variable rainfall. It is important to understand the normal response of each species in relation to changing seasonal conditions so that erroneous records of abnormal plant condition indicating negative impacts are not mistakenly recorded. And similarly, if negative impacts are responsible for declines in plant condition, one needs to recognise this early so that reasons for, and measures addressing, plant condition decline can be implemented in a timely fashion.

Glossary:

Anthocyanins are water-soluble scarlet, magenta, purple and blue pigments that colour the fruit and flowers of many plants. They also provide the red colours of many autumn leaves. They are flavonoids, formed by phenylpropanoid metabolism from phenylalanine. In addition to colouring specific plant organs, often to attract pollinators and dispersers, they may serve to protect photosynthetic tissues from oxidative stress induced by light under stressful conditions. They are synthesised by gymnosperms and most angiosperms except the Caryophyllales (beets, cacti, *Bougainvillia*, *Amaranthus*), which synthesise the unrelated betalain pigments from tyrosine instead. (Current Biology).

Phenology is the study of the timing of life cycle events at the population level, most often focusing on how they respond to (prevailing weather conditions) climate change. It often makes use of long-term records and includes events such as flowering, leaf fall, hatching and annual migration. (Nature.com).

References:

Current Biology
[https://www.cell.com/current-biology/abstract/S0960-9822\(12\)00022-X](https://www.cell.com/current-biology/abstract/S0960-9822(12)00022-X) accessed 7 August 2018.
 Nature.com
<https://www.nature.com/subjects/phenology> accessed 7 August 2018.

Table 4. Monitoring program schedule

Monitoring	Spring 2018	Summer 2018-19	Autumn 2019	Winter 2019	Spring 2019	Summer 2019-20	Autumn 2020	Winter 2020	Spring 2020 and annually thereafter
Vegetation Condition (annually)	Baseline				Baseline				Condition monitoring
Priority Flora (every 2-3 months)	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Condition monitoring

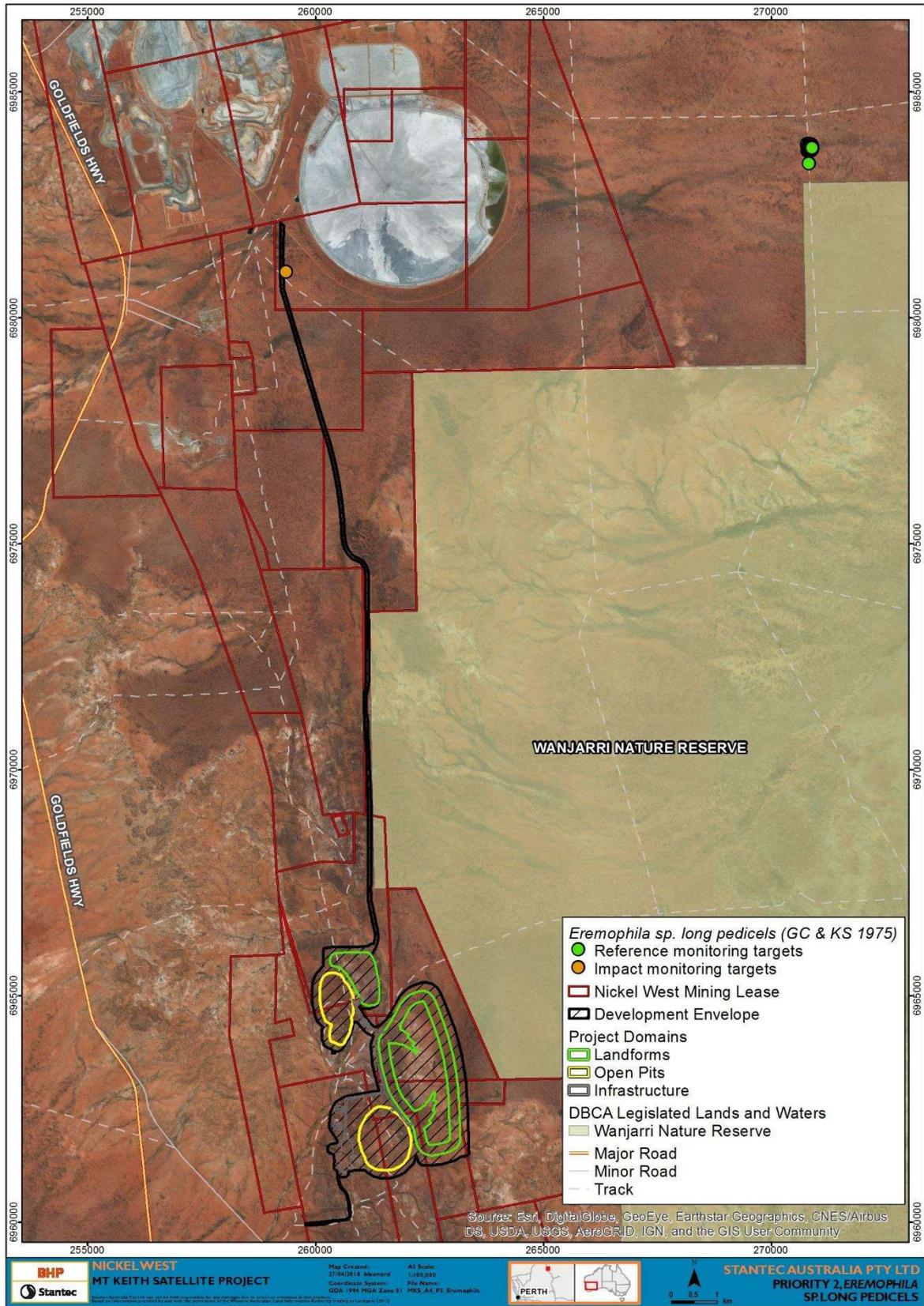


Figure 1-1: Indicative monitoring locations for *Eremophila sp. long pedicels* (G. Cockerton 1975).

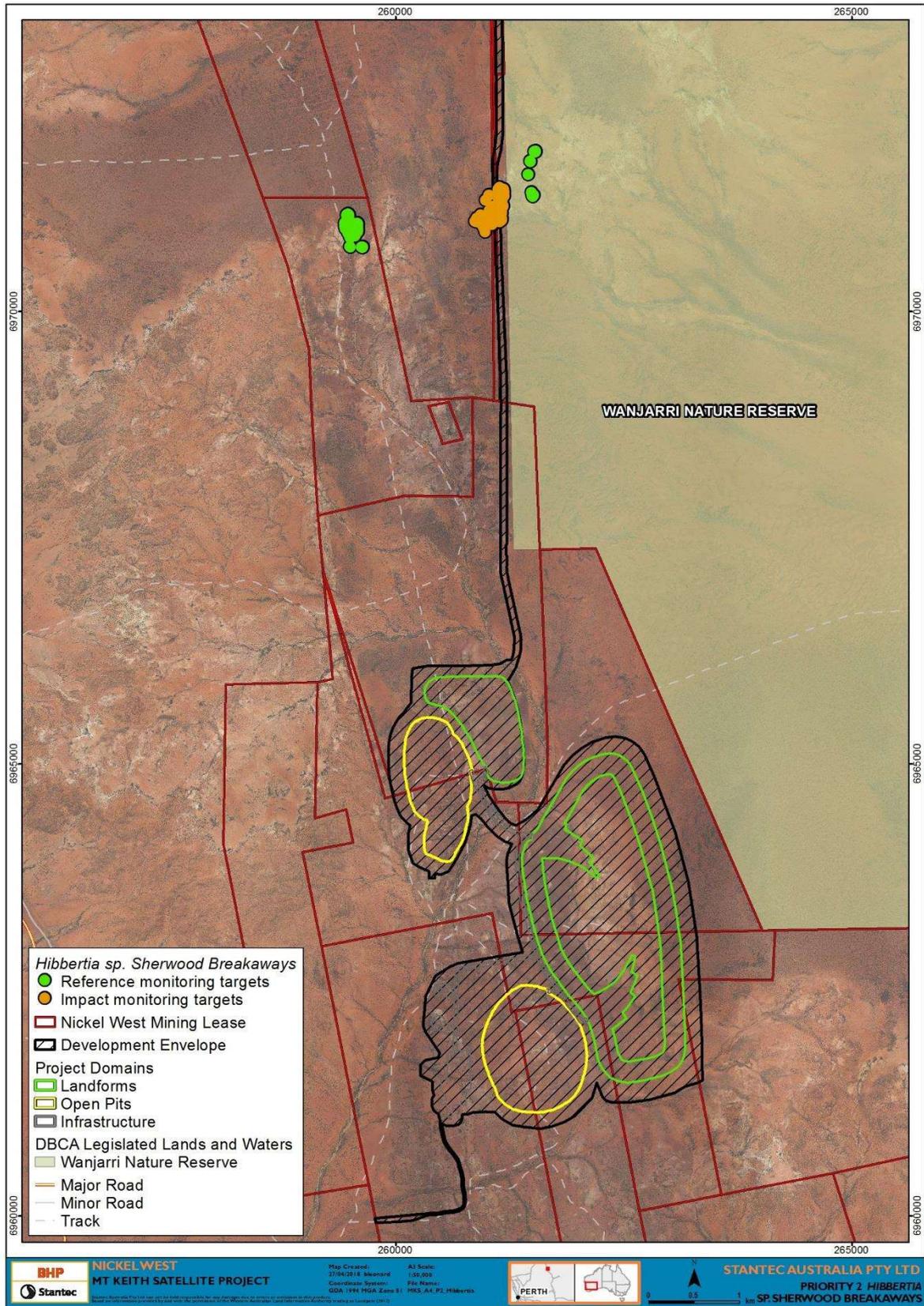


Figure 1-2 Indicative Monitoring Sites for Hibbertia sp. Sherwood Breakaways (R.J.Cranfield 6771)

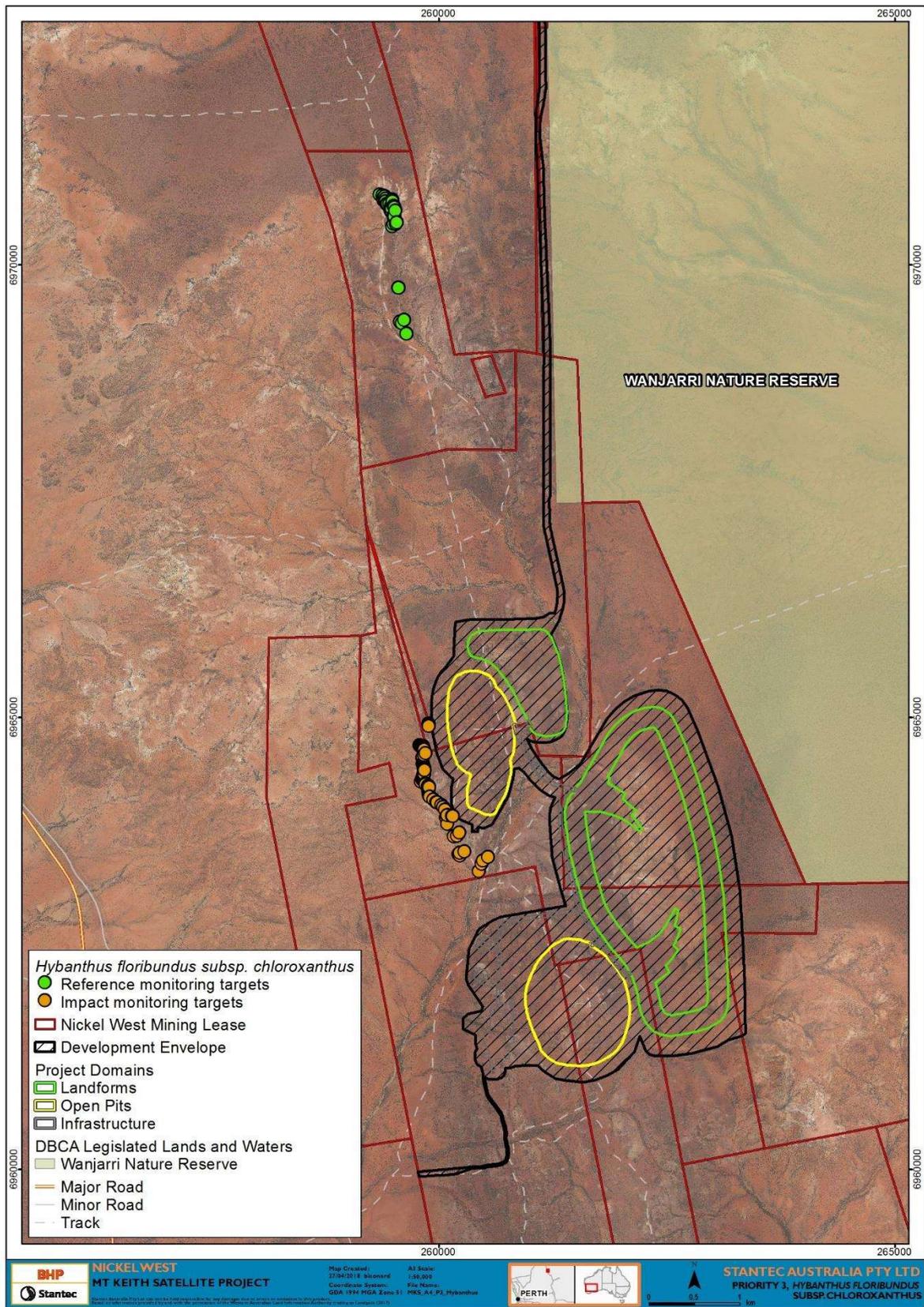


Figure 1-3: Indicative monitoring locations for *Hybanthus floribundus subsp. chloroxanthus*.

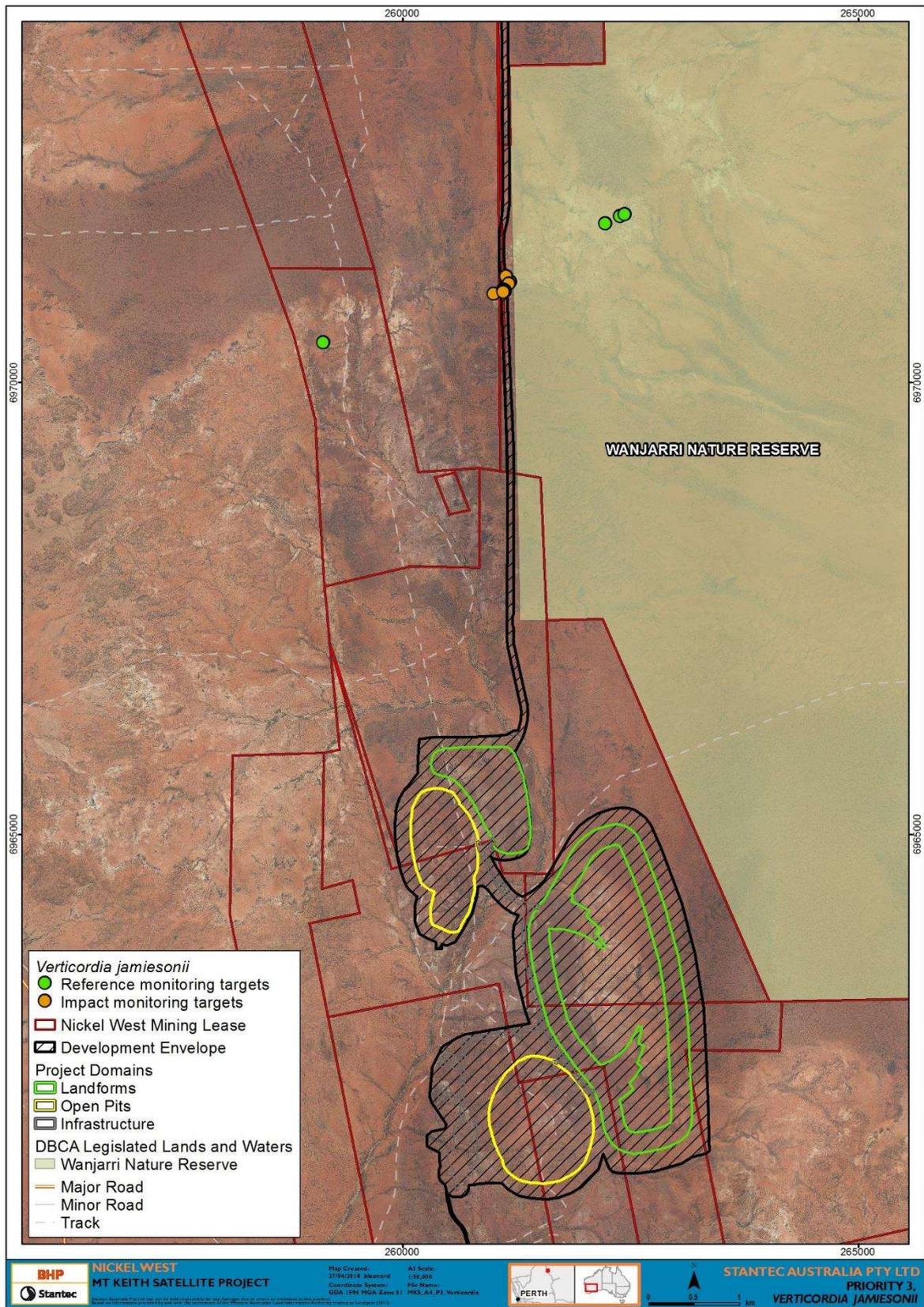


Figure 1-4: Indicative monitoring locations for *Verticordia jamiesonii*

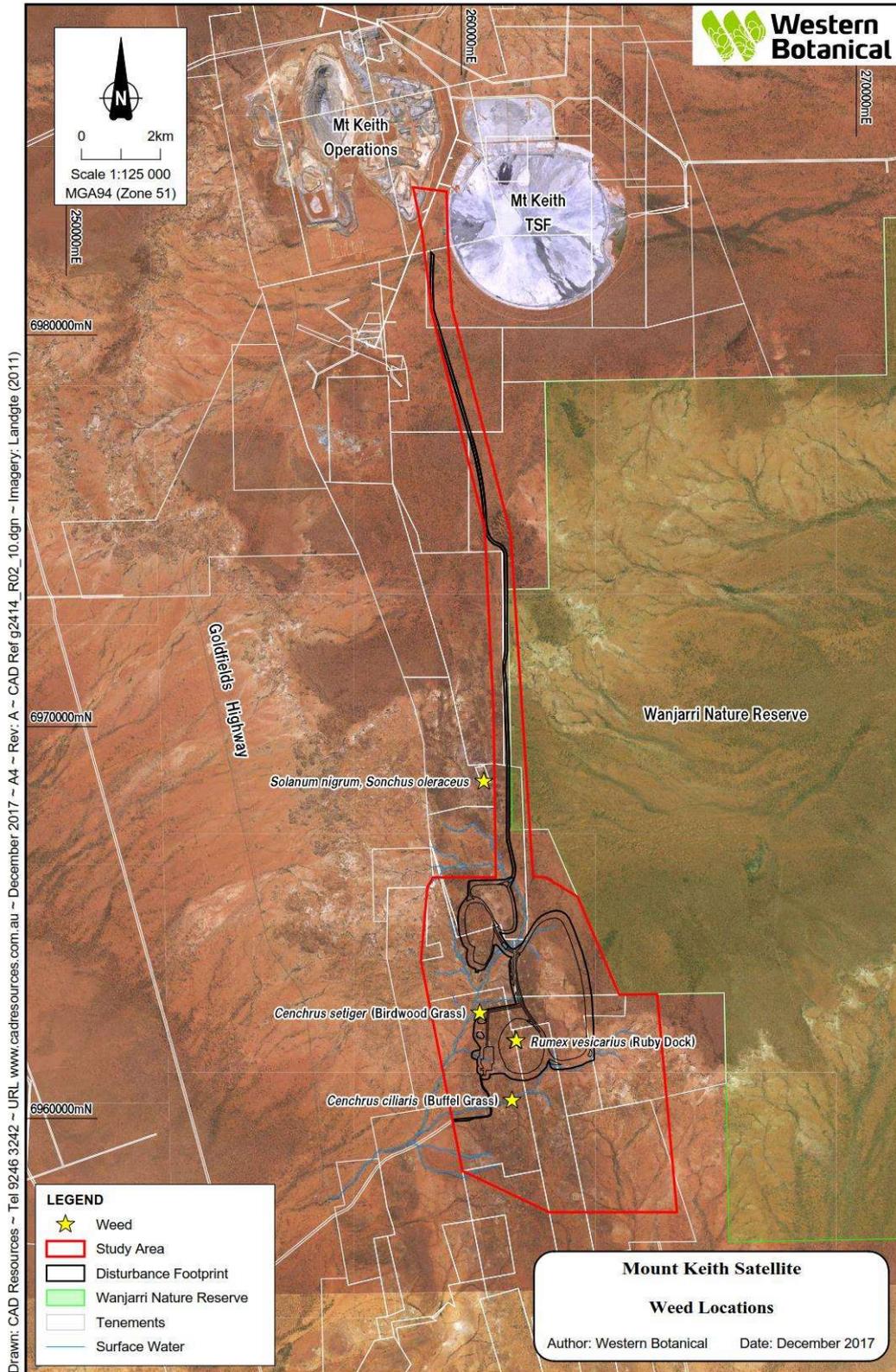


Figure 1-5 Current weed species populations

Schedule 2: MS 1087 Mt Keith Satellite (MKS) Project – Violet Range PEC

To meet the requirements of Condition 6 of Ministerial Statement 1087

EPA Factor and objective: Flora and Vegetation – to protect flora and vegetation so that biological diversity and ecological integrity are maintained.			
Values: Violet Range – Priority Ecological Community.			
Objective: Condition 6-1 objective (1) – The proponent shall implement the proposal to avoid, where possible, and minimise indirect impacts as far as practicable to the Violet Range PEC.			
Outcome: No decline in condition of Violet Range PEC as a result of impacts from the proposal.			
Key impacts and risks: Risk to biological diversity and/or ecological integrity of Violet Range PEC due to direct impacts (clearing) and potential indirect impact (habitat fragmentation, altered fire regime, weeds).			
Management-based provisions			
Management Actions	Management Targets	Monitoring	Reporting
<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>	<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>	<p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>	<p>The proponent shall advise the CEO of any potential non-compliance within seven (7) days of a potential non-compliance being known. The proponent shall submit to the CEO the first Compliance Assessment Report fifteen (15) months from the date of issue of this Statement addressing the twelve (12) month period from the date of issue of this Statement and then annually from the date of submission of the first Compliance Assessment Report, or as otherwise agreed in writing by the CEO.</p> <p>The Compliance Assessment Report shall:</p> <ol style="list-style-type: none"> (1) be endorsed by the proponent's Chief Executive Officer or a person delegated to sign on the Chief Executive Officer's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1. <p>The Plan shall specify Management Actions, Management Targets, Monitoring and Reporting to demonstrate that the objective in condition 6-1 will be met.</p>
<p>Management actions:</p> <ul style="list-style-type: none"> • Implement the Environmental Heritage Impact Assessment process prior to land disturbance. • Drainage measures designed and constructed to minimise changes to natural surface water flow, including diversion drains, rock cladding, and contouring as required. • Conduct weed hygiene inspections on ground-engaging equipment prior to arriving at site. • Implement targeted biennial weed inspection and spraying regime post rainfall periods <p>Trigger Level Action - vegetation condition and reproductive phenology Undertake investigation into the source of decline in the indicator PEC vegetation condition and reproductive phenology.</p> <p>Trigger level action – weeds Implement targeted spraying program</p> <p>Threshold Action – vegetation condition Increase the extent and frequency of PEC vegetation condition and reproductive phenology monitoring to determine extent of overall decline in condition or</p>	<p>Targets: No unauthorised disturbance beyond the Development Envelope.</p> <p>No measurable decrease in vegetation condition and plant condition values at impact sites only, validated by statistically significant trends over time.</p> <p>Achieve rehabilitation areas where weed presence and density is comparable to pre-mining analogue sites.</p> <p>Trigger criteria – vegetation condition A decrease in ≥ 1 value of the approved vegetation condition scale rating in the PEC impact populations only.</p> <p>Trigger criteria – weeds An increase of 10% in area of existing weed populations compared to baseline weed survey.</p> <p>No new weed species recorded within the Development Envelope.</p> <p>Threshold criteria – vegetation condition A decrease in ≥ 2 values of the approved vegetation condition and reproductive phenology scale rating in the PEC impact populations only.</p>	<p>Annual land disturbance reconciliation (hectares and spatial footprint). Implementation of Before, After, Control, Impact (BACI) design comprising:</p> <ul style="list-style-type: none"> - Baseline survey to assess condition of PEC vegetation associations pre-disturbance and establish analogue and potential impact sites. (Current weed species (Figure 2-1). - Installation of permanent photo monitoring points at impact and analogue sites. - Baseline weed survey within the Development Envelope to define weed populations pre-disturbance and establish analogue and potential impact sites. (Current weed species population shown in Figure 2-2). - Annual (spring) monitoring program to assess condition of PEC vegetation associations and to survey weed populations during operation. - PEC vegetation condition to be assessed using photographic monitoring and the vegetation scale and with consideration to the likely expression of impacts on vegetation in response to indirect risks. <p>Rehabilitation monitoring undertaken in accordance with the Mine Closure Plan.</p>	<p>Notification of potential management target or objective non-compliance will be provided to the DWER and the DBCA within 7 days of that potential non-compliance being known. A report including any corrective actions identified will be provided to the DWER and the DBCA following the completion of an investigation into the potential non-compliance. An annual compliance assessment report will be submitted as part of the Annual Compliance Assessment Report, which will be submitted to the DWER by 28 March each year.</p> <p>The Compliance Assessment Report shall:</p> <ol style="list-style-type: none"> (1) be endorsed by NIW's Asset President or a person delegated to sign on the Asset President's behalf; (2) include a statement as to whether the proponent has complied with the conditions; (3) identify all potential non-compliances and describe corrective and preventative actions taken; (4) be made publicly available in accordance with the approved Compliance Assessment Plan; and (5) indicate any proposed changes to the Compliance Assessment Plan required by condition 4-1.

<p>reproductive phenology in wider populations. Develop mitigation action plan in consultation with EPA.</p> <p>Threshold action – weeds Review and implement revised weed monitoring and control frequency and methods until weed populations are reduced to below trigger criteria.</p>	<p>Threshold criteria – weeds An increase of 20% in area of existing weed populations compared to baseline weed survey. No new weed species established within the Development Envelope.</p>		
Vegetation Condition Monitoring Program			
<p>Establish series of analogue and impact monitoring plots at indicative locations which include:</p>			
<ul style="list-style-type: none"> • Delineated quadrats, with corners marked and GPS coordinates recorded for each corner. • Photographic point marked at the northwest corner of each plot. 			
<p>Information to be recorded at each monitoring plot, at each repeat measure:</p>			
<ul style="list-style-type: none"> • Date and time of monitoring • Weather conditions at time of monitoring • Photograph from the northwest corner • Any maintenance required for the site • Any presence of weeds, and if present, estimate percentage weed cover • Dust observations • Vegetation condition observations <ul style="list-style-type: none"> ◦ Estimated % of live canopy with the appropriate score as per Table 1 • Additional comments (including evidence of grazing on monitoring plants within the plot). 			
<p>Assessment of Monitoring data to include:</p>			
<ul style="list-style-type: none"> • Preceding and current weather records reflecting seasonal conditions • Likely expression of impacts on vegetation in response to potential risks, as per Table 2. • Use of remote sensing data to assess whole of site vs regional assessment of vegetation condition, described below. 			
<p>Use of Remote Sensing</p>			
<p>It is intended to use the Normalised Difference Vegetation Index (NDVI) tool, which is developed through the interpretation of satellite imagery. NDVI is calculated from the visible and near-infrared light reflected by vegetation. The chlorophyll in plant leaves strongly absorbs visible light for use in photosynthesis. The cell structure of the leaves however strongly reflects near-infrared. Healthy vegetation absorbs most of the visible light that hits it and reflects a large portion of the near-infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared. NDVI imagery will be obtained for dry seasonal conditions and wet seasonal conditions and will provide baseline imagery for the Project. This tool provides standardised, high resolution imagery that can identify areas of change in vegetation vigour outside the small point focussed monitoring plots.</p>			
<p>Monitoring Schedule</p>			
<p>Collection of baseline data will commence prior to clearing, in Spring 2018 and will be undertaken for the first two years following implementation of the clearing program as per schedule provided in Table 3.</p>			

Table 1. Observable Plant Condition Scale

Score	Descriptor	Prevailing conditions	Observations
7 a-d	Plants vegetative	Normal, dry season	Foliage healthy and normal for prevailing seasonal conditions. Foliage may be (a) actively growing, (b) static or (c) reduced and/or (d) may demonstrate variable levels of auxiliary pigments (anthocyanins). No flower buds initiated, no flowers present, no fruits attached to plant.
6	Plants pre-reproductive	Normal, soon after rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flower buds initiated but no flowers open, no fruits attached to plant.
5	Plants reproductive	Normal, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. Flowers open, developing fruits may be attached to plant.
4	Plants post-reproductive	Normal, drying season, following sufficient rainfall	Foliage healthy and normal for prevailing seasonal conditions. No flowers present. Current season fruits containing viable seeds may be attached to plant and/or the plant may have recently dehisced viable seeds.
3	Plants exhibiting reduced foliage	Either (a) Reflecting extended dry seasonal conditions; or (b) Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. Plants exhibiting discoloured-yellowed leaves, increased leaf fall.
2	Plants with partial dead canopies	Abnormal, localised impacts possible, requires investigation	Foliage observably reduced and not normal for prevailing seasonal conditions. A portion (estimate % of plant canopy is alive) of the plant canopy is alive while a proportion is dead (dried leaves attached or dead stems held within plant canopy).
1	Plant completely dead	Abnormal, localised impacts possible, requires investigation	No live foliage held on plant, no live bark observable, irreversible death of plant.

Table 2. Potential Risks and Expression in Vegetation

Risk	Expression in Vegetation
Dust deposition	Observable and recordable dust on foliage causing reduced photosynthetic and transpirational efficiencies. Gradual decline in vegetation vigour, reduced canopies, reduced growth rates, reduced flowering and fruiting success, deaths of some individuals.
Salt water over-spray	Immediate death of susceptible plants.
Salt water migration in surface runoff	Immediate death of susceptible plants affected and a progressive expansion of the impact area.
Salt water migration in sub soil through-profile drainage	Immediate death of susceptible plants affected and a progressive expansion of the impact area. Salt migrates slowly in soils with a high silt or clay content but resides within that soil for long periods. Salt migrates through sandy soils rapidly and can leach away leaving non-saline soils in a short time frame.
Interruptions to sheet flow causing decreased infiltration	Gradual decline in vegetation vigour, reduced canopies, reduced growth rates, reduced flowering and fruiting success; deaths of areas of vegetation noted rapidly after infrastructure development, particularly after extended dry periods and then a stabilisation of the impact zone with limited successful recruitment.
Concentrated surface runoff exacerbating erosion	Obvious new areas of channelised flow, erosion and potential waterlogging, decline in condition and deaths of vegetation.

Table 3. Monitoring program schedule

Monitoring	Spring 2018	Summer 2018-19	Autumn 2019	Winter 2019	Spring 2019	Summer 2019-20	Autumn 2020	Winter 2020	Spring 2020 and annually thereafter
Vegetation Condition (annually)	Baseline				Baseline				Monitoring for assessment of impacts

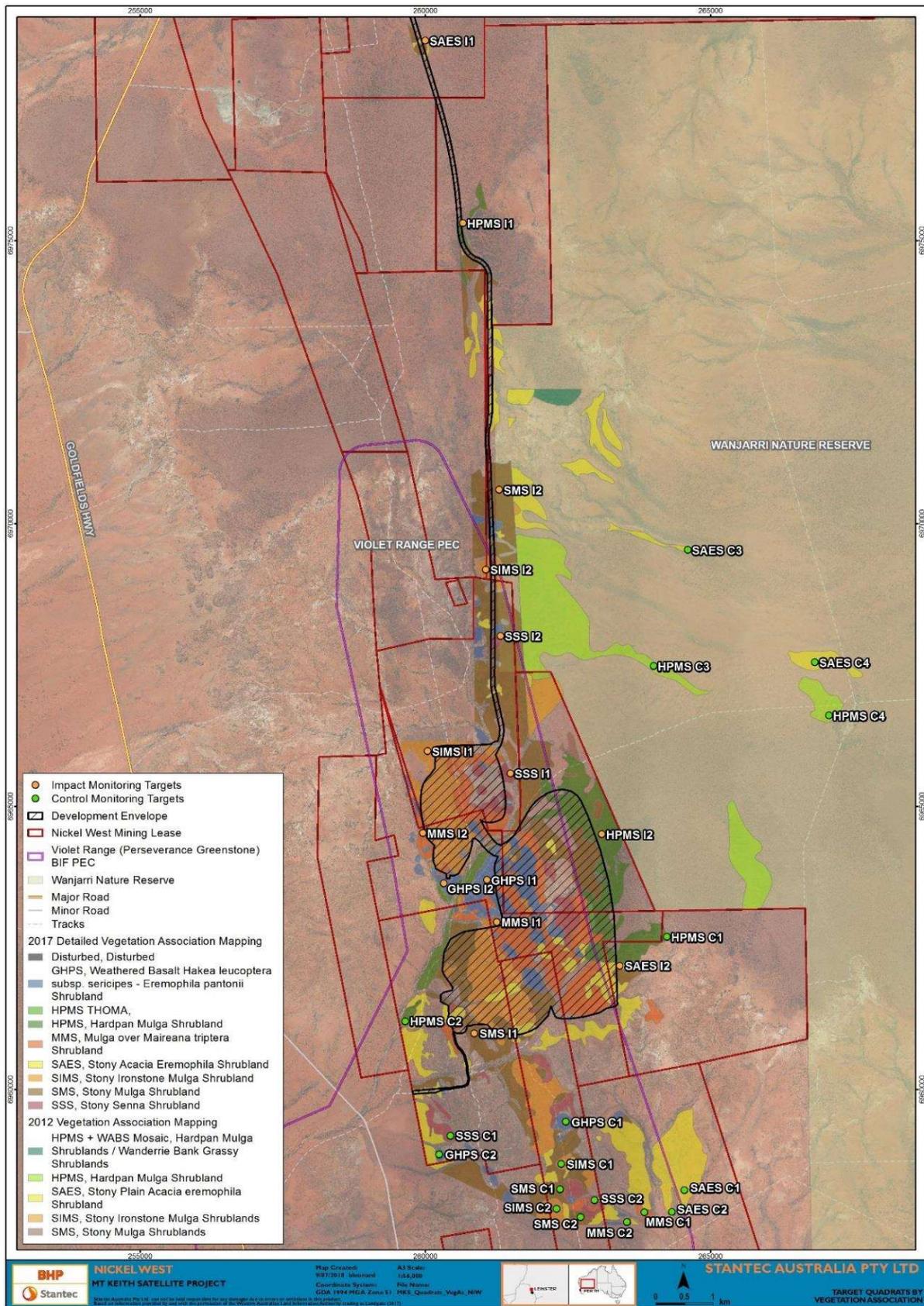


Figure 2-1 Indicative Monitoring Locations for Violet Range PEC

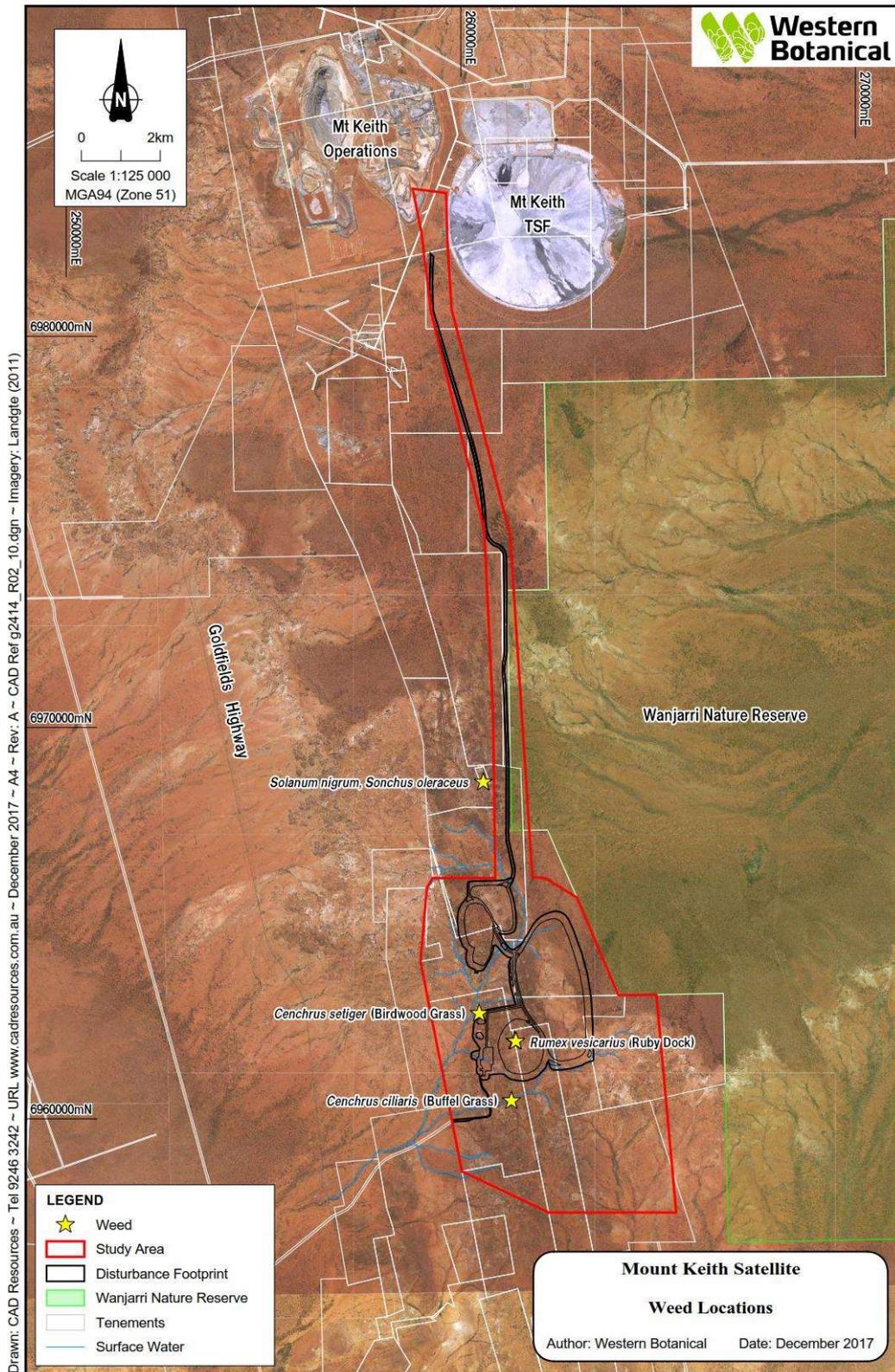


Figure 2-2 Current weed species populations

<p>Increase the extent and frequency of indicator WNR vegetation condition monitoring to determine extent of overall decline of condition in wider areas of analogue vegetation. Develop mitigation action plan in consultation with EPA.</p> <p>Threshold action – weeds Review and implement revised weed monitoring and control frequency and methods until weed populations are reduced to below trigger criteria.</p>	<p>Threshold criteria – vegetation condition A decrease in ≥2 values of the approved vegetation condition scale rating in the WNR impact populations only.</p> <p>Threshold criteria – weeds An increase of 20% in area of existing weed populations compared to baseline weed survey.</p> <p>No new weed species established within the Development Envelope adjacent to the WNR.</p>	
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Vegetation Condition Monitoring Program

Establish series of analogue and impact monitoring plots at indicative locations which include:

- Demarcated quadrats, with corners marked and GPS coordinates recorded for each corner.
- Photographic point marked at the northwest corner of each plot.

Information to be recorded at each monitoring plot, at each repeat measure:

- Date and time of monitoring
- Weather conditions at time of monitoring
- Photograph from the northwest corner
- Any maintenance required for the site
- Any presence of weeds, and if present, estimate percentage weed cover
- Dust observations
- Vegetation condition observations
 - Estimated % of live canopy with the appropriate score as per Table 1
- Additional comments (including evidence of grazing on monitoring plants within the plot).

Assessment of Monitoring data to include:

- Preceding and current weather records reflecting seasonal conditions.
- Likely expression of impacts on vegetation in response to potential risks, as per Table 2.
- Use of remote sensing data to assess whole of site vs regional assessment of vegetation condition, described below.

Use of Remote Sensing

It is intended to use the Normalised Difference Vegetation Index (NDVI) tool, which is developed through the interrelation of satellite imagery. NDVI is calculated from the visible and near-infrared light reflected by vegetation. The chlorophyll in plant leaves strongly absorbs visible light for use in photosynthesis. The cell structure of the leaves however strongly reflects near-infrared. Healthy vegetation absorbs most of the visible light that hits it and reflects a large portion of the near infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared. NDVI imagery will be obtained for dry seasonal conditions and wet seasonal conditions existing prior to the project commencement. This will provide baseline imagery for the Project. This tool provides standardised, high resolution imagery that can identify areas of change in vegetation vigour outside the small point focussed monitoring plots.

Monitoring Schedule

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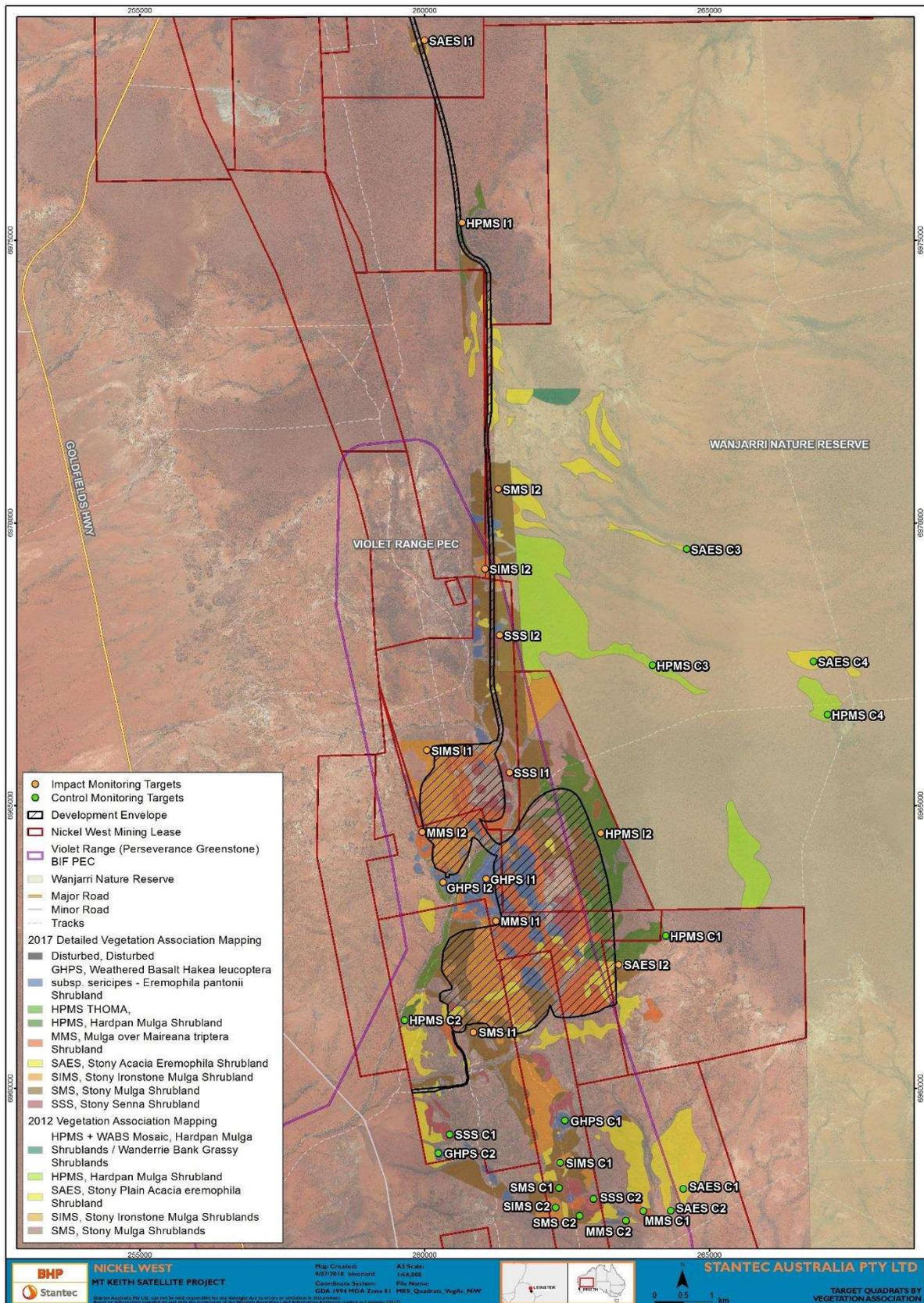


Figure 3-1 Indicative Monitoring Locations for Wanjarri Nature Reserve

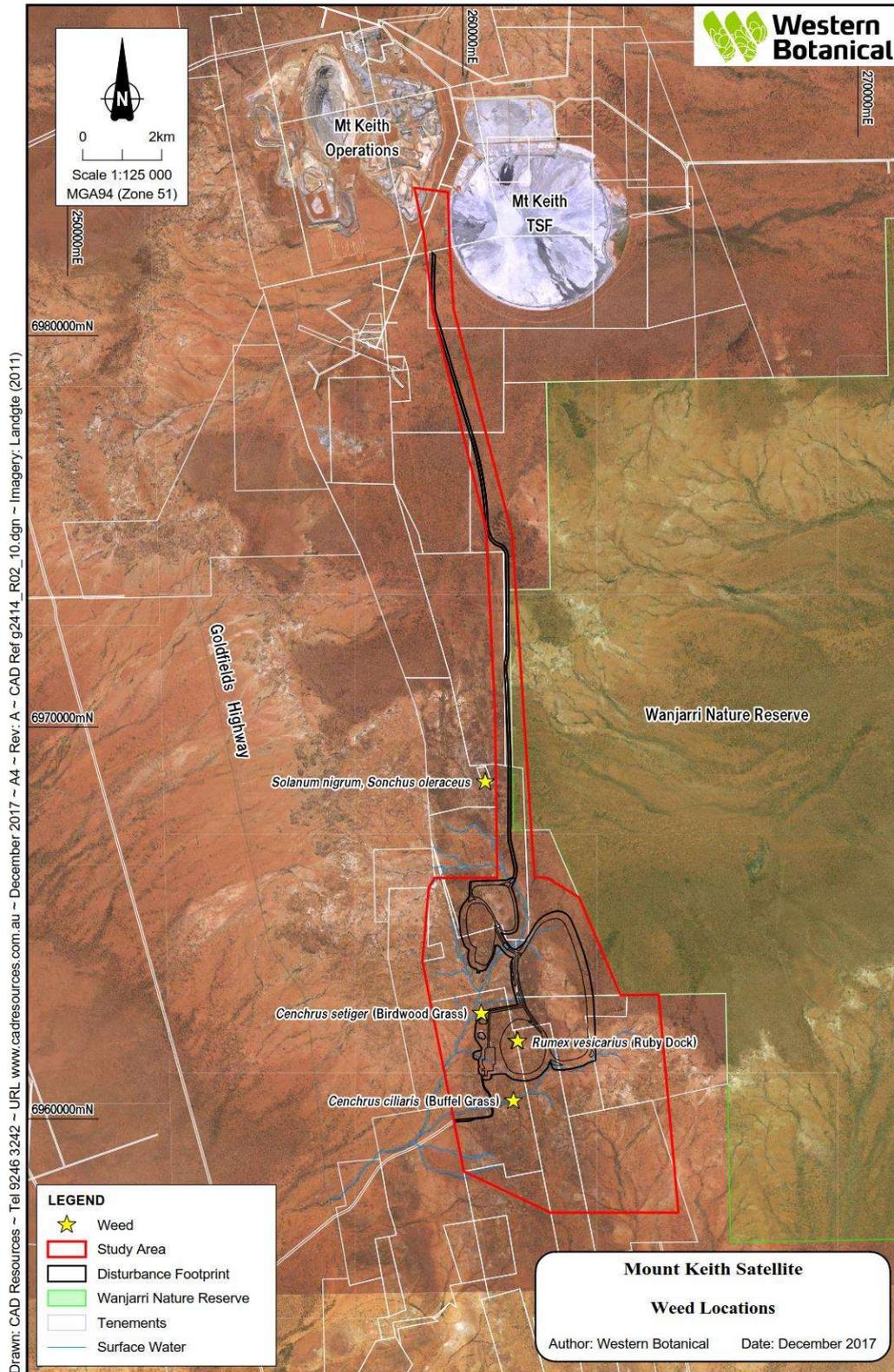


Figure 3-2 Current weed species populations