Mt Keith Satellite Ministerial Statement 1087 Compliance Assessment Report

BHP Nickel West

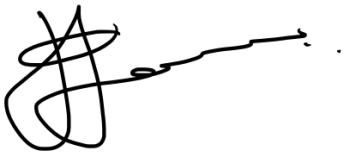
28/12/2024 – 27/12/2025

30 March 2026

Contents

Endorsement

I have reviewed this Compliance Assessment Report prepared to meet the requirements of Condition 4-6 of the Ministerial Statement 1087 approval for the Mt Keith Satellite Project and accept that the information provided is an accurate account of the activities undertaken during the reporting period.



Pieter Fourie

Manager Northern Operations

BHP Nickel West Pty Ltd

Executive Summary

BHP Nickel West Pty Ltd (BHP NiW) was granted environmental approval of the Mt Keith Satellite Project (the 'Project') in December 2018 by the Western Australian Minister for Environment (Ministerial Statement 1087 (MS1087)) in accordance with Section 45(5) of the *Environmental Protection Act 1986* (WA).

Implementation of the Project commenced in February 2019, which to date has included the clearing and establishment of the initial operating areas (Haul Road, Open Pits, Waste Rock Landform and run of mine Pad) and the productive mining of ore from both the Six Mile Well Pit and the Goliath Pit.

BHP announced in July 2024 that BHP NiW operations would be temporarily suspended from October 2024. As such, operations at the Project are currently suspended, and a temporary suspension program of work is being implemented. BHP intends to review the decision to temporarily suspend BHP NiW operations by February 2027.

Condition 4-6 of MS1087 approval requires BHP NiW to submit an annual Compliance Assessment Report that outlines the status of implementation of the Project and compliance with the approval conditions. This report outlines the implementation status and compliance for the Project covering the period of 28 December 2024 to 27 December 2025.

1. Introduction

The Mt Keith Satellite Project (the 'Project') is for a satellite mining operation to Mt Keith Nickel Mine[1]. The Project comprises two open mine pits, a waste rock landform, support infrastructure and a haul road, requiring the clearing of up to 1,069 hectares (ha) of native vegetation within a Development Envelope of 1,265 ha, as identified by Figure 1 Project Area.

BHP Nickel West Pty Ltd (BHP NiW) referred the Project to the Environmental Protection Authority (EPA) in May 2017, in accordance with Section 38 of the *Environmental Protection Act 1986* (WA) (BHP Nickel West 2017). The EPA (2017) determined the Project required an environmental assessment, with the key assessment factors including 'Flora and Vegetation', 'Inland Waters', 'Social Surroundings' (Aboriginal Heritage) and 'Air Quality'. An 'Environmental Review' document (Environmental Impact Assessment) assessing the potential environmental effects of the Project was additionally prepared to assist the EPA assessment (BHP Nickel West 2018a).

The EPA (2018) assessment concluded the Project could be implemented subject to recommended conditions to ensure the potential environmental impacts of the Project were appropriately managed. Following the advice of the EPA (2018), the Project was subsequently approved by the WA Minister for Environment (2018) through the issue of MS1087 approval, granted in accordance with Section 45(5) of the *Environmental Protection Act 1986* (WA).

Implementation of the Project commenced in February 2019, which to date has included the clearing and establishment of the initial operating areas (haul road, open pits, waste rock landform and run of mine pad) and the productive ore mining from both the Six Mile Well Mine Pit and the Goliath Mine Pit.

BHP announced in July 2024 that BHP NiW operations would be temporarily suspended from October 2024. As such, operations at the Project are currently suspended, and a temporary suspension program of work is being implemented. BHP intends to review the decision to temporarily suspend BHP NiW operations by February 2027.

2. Purpose and Scope

Condition 4-6 of MS1087 requires the submission of an annual Compliance Assessment Report (CAR), which outlines the progress of implementation of the Project and compliance status with the approval conditions.

This CAR outlines the implementation and compliance status of the Project for the period of 28 December 2024 to 27 December 2025 and aligns with the requirements of the approved Compliance Assessment Plan (CAP) (BHP Nickel West 2020a) under Condition 4-1 of MS1087.

This CAR document is the seventh CAR to be submitted for the Project under MS1087, following from the CAR documents submitted in 2020, 2021, 2022, 2023, 2024 and 2025.

[1] Note: The Mt Keith Nickel Mine commenced operations in 1993. The existing components of the Mt Keith Nickel Mine do not form part of the approved Project, and accordingly, are not addressed within this CAR document.

3. Project and Status

Operations at the Project are currently suspended, and a temporary suspension program of work has been implemented.

Prior to temporary suspension, BHP NiW commenced implementation of the Project in February 2019. To date, implementation of the Project has included:

- Clearing and establishment of the initial operating areas (haul road, mine pits, waste rock landform and run of mine pad)
- Productive mining of ore from both the Six Mile Well Mine Pit and Goliath Mine Pit
- Ore supplied from the Project was the primary product processed at the Mt Keith Nickel Operation Concentrator
- All compliance activities established and conducted.

4. Statement of Compliance

A completed Audit, consistent with the approved Compliance Assessment Plan (CAP) (BHP Nickel West 2020a), is provided in Table 1. This identifies the compliance status with the various conditions of MS1087. Table 1 verifies that BHP NiW was compliant with the majority of the conditions of MS1087 during the reporting period, however there may have been a potential non-compliance with condition M1.1.

A completed and signed Statement of Compliance form (prepared using the DWER (2018) form *'PAF2 - Statement of Compliance – 2018'*) is provided at Appendix 1.

AUDIT TABLE
Mt Keith Satellite Project, Ministerial Statement No.1087

• Phases that apply in this table = Pre-Construction, Construction, Operation, Decommissioning, Overall (several phases).
• This audit table is a summary and timetable of conditions and commitments applying to this project. Refer to the Minister's Statement for full detail/precise wording of individual elements.
• Code prefixes: M = Implementation condition; P = Proponent's commitment; N = Procedure.
• Compliance status: C = Compliant, CLD = Completed, NC = Non-compliant, NR = Not required at this stage. Please note terms NA = Not Audited and VR = Verification Required are only for EPA use. IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the *Post Assessment Guideline for Preparing an Audit Table*.

Table 1: Mt Keith Satellite Operation Audit Table (28 December 2024 to 27 December 2025).

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
1087:M1.1	**Proposal Implementation**	When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Table 2 of Schedule 1, unless amendments to the proposal and the authorised extent of the proposal have been approved under the EP Act.	Implement the Project in accordance with criteria outlined in Schedule 1.	Compliance Assessment Reports.	Overall	For the life of the Proposal.	POTENTIALLY NON-COMPLIANT	Table 2 of Schedule 1 of MS1087, as amended by Attachment 1 to the MS1087 approval under s45C in September 2020, authorises the clearing of up to 1,069 hectares (ha) of native vegetation within a 1,265 ha Development Envelope. As of 27th December 2025, a total of 938.05 ha of native vegetation has been cleared within the Development Envelope; being within the total 1,069 ha authorised limit. The area of native vegetation clearing undertaken to date, and the extent of the approved Development Envelope, is provided in Appendix 2. On 13 June 2025 BHP Nickel West identified a small portion (0.023 ha) of disturbance, outside of the MS1087 Development Envelope associated with access road maintenance following significant rainfall. In accordance with Condition 4-5 of MS1087, the occurrence was reported to the DWER CEO on the 19 June 2025, within seven days of being made aware of the disturbance. BHP Nickel West hold the relevant mining tenure and a native vegetation clearing permit (CPS 8877) for the land on which disturbance occurred outside of the MS1087 development envelope. Table 2 of Schedule 1 of the MS1087 approval authorises groundwater abstraction (mine pit dewatering) of up to 0.4 gigalitres (GL) per year (y) using bores and pit sumps. Given the temporary suspension status of the operation, there was no water abstracted during the reporting period (28/12/2024 – 27/12/2025). Groundwater abstractions records to verify the mine pit dewatering volumes from each bore/sump is provided in Appendix 3.
1087:M2.1	**Contact Details**	The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within twenty-eight (28) days of such change. Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.	Notify the CEO of any change in proponent details.	Written notification to the CEO of any change in proponent details.	Overall	Within 28 days of such change.	NOT REQUIRED	No change to the Proponent name, physical address or postal address has occurred during the reporting period, and accordingly, no notification to the DWER CEO has been required.
1087:M3.1	**Time Limit for Proposal Implementation**	The proponent shall not commence implementation of the proposal after five (5) years from the date on this Statement, and any commencement, prior to this date, must be substantial.	Notify the CEO advising proposal has not commenced implementation.	Written notification to the CEO.	Overall	After 28 December 2023.	COMPLETED	Implementation of the Project commenced in February 2019 with the construction and operation of the Project. Implementation of the Project is considered to be 'substantial'. Compliance with Condition 3-1 is now completed.
1087:M3.2	**Time Limit for Proposal Implementation**	Any commencement of implementation of the proposal, on or before five (5) years from the date of this Statement, must be demonstrated as substantial by providing the CEO with written evidence, on or before the expiration of five (5) years from the date of this Statement.	N/A.	Compliance Assessment Reports.	Overall	Within 5 years from the date of Statement 1087, being on or before 28 December 2023.	COMPLETED	Implementation of the Project commenced in February 2019 with the construction and operation of the Project. Implementation of the Project is considered to be 'substantial'. Written evidence demonstrating compliance was confirmed in the DWER Compliance Audit Report in May 2020. Compliance with Condition 3-2 is now completed.

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
1087:M4.1	**Compliance Reporting**	The proponent shall prepare and maintain a CAP which is submitted to the CEO at least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	Submit CAP to the CEO.	CAP	Pre-construction	At least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	COMPLIANT	CAP (BHP Nickel West 2019a) was initially submitted to the DWER CEO in September 2019, with the DWER CEO granting initial approval of the CAP document in October 2019. The current version of the CAP document (Revision 2, BHP Nickel West 2020a) was approved by the DWER CEO in October 2020 (DWER 2020b). BHP Nickel West will continue to review and maintain the CAP document, as required from time to time, to ensure ongoing compliance with Condition 4-1.
1087:M4.2	**Compliance Reporting**	The CAP shall indicate: (1) the frequency of compliance reporting. (2) the approach and timing of compliance assessments. (3) the retention of compliance assessments. (4) the method of reporting of potential non-compliances and corrective actions taken. (5) the table of contents of Compliance Assessment Reports and (6) public availability of Compliance Assessment Reports.	Submit CAP to the CEO.	CAP	Pre-construction	At least six (6) months prior to the first Compliance Assessment Report required by condition 4-6, or prior to implementation of the proposal, whichever is sooner.	COMPLIANT	A Compliance Assessment Plan (CAP) document (BHP Nickel West 2019a) was initially submitted to the DWER CEO in September 2019, with the DWER CEO granting initial approval of the CAP document in October 2019. The current version of the CAP document (Revision 2, BHP Nickel West 2020a) was approved by the DWER CEO in October 2020 (DWER 2020b). In accordance with Condition 4-2, the approved CAP document identifies: 1) frequency of compliance reporting. 2) approach and timing of compliance assessments. 3) retention of compliance assessments. 4) method of reporting of potential non-compliances and corrective actions taken. 5) table of contents of Compliance Assessment Reports; and 6) public availability of Compliance Assessment Reports. BHP Nickel West remains in compliance with the requirements of Condition 4-2.
1087:M4.3	**Compliance Reporting**	After receiving notice in writing from the CEO that the Compliance Assessment Plan satisfies the requirements of condition 4-2 the proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.	Implementation of Compliance Assessment Plan.	Notice in writing from the CEO and Compliance Assessment Reports.	Overall	Ongoing as per requirements of CAP.	COMPLIANT	This Compliance Assessment Report (CAR) document due for submission to DWER in March 2026 provides an assessment of compliance with the conditions of the MS1087 approval, consistent with the approved CAP document. Annual submission of this CAR document ensures that BHP Nickel West remains in compliance with the requirements of Condition 4-2.
1087:M4.4	**Compliance Reporting**	The proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.	Retain records in accordance with Compliance Assessment Plan.	Written response to request by CEO.	Overall	When requested by CEO.	COMPLIANT	Submitted CAR documents will be retained by BHP Nickel West for the duration of the Project in accordance with standard document control practices, as outlined within the approved CAP document. No requests were received from the DWER CEO during the reporting period to make additional copies of the submitted CAR documents available.
1087:M4.5	**Compliance Reporting**	The proponent shall advise the CEO of any potential non-compliance within seven (7) days of that non-compliance being known.	Notification of the CEO via an email to compliance@dwer.wa.gov.au which will include any corrective actions taken to address the potential non-compliance.	Written correspondence to CEO.	Overall	Within 7 days of the potential non-compliance being known.	COMPLIANT	During the 2025 reporting period BHP Nickel West reported a potential non-compliance event to DWER. On 13 June 2025 BHP Nickel West identified a small portion (0.023 ha) of disturbance, outside of the MS1087 Development Envelope associated with access road maintenance following significant rainfall. The occurrence was reported to the DWER CEO on the 19 June 2025, within seven days of being made aware of the disturbance, in accordance with Condition 4-5 of MS1087. BHP Nickel West hold the relevant mining tenure and a native vegetation clearing permit (CPS 8877) for the land outside of the MS1087 Development Envelope.

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1087:M4.6.1	**Compliance Reporting**	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.	Submit Compliance Assessment to the CEO.	Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	The first CAR document (BHP Nickel West 2020b) was submitted to the DWER CEO in March 2020 addressing compliance with the conditions for the first 12-month period following the granting of the MS1087 approval. This CAR document presents the seventh report addressing compliance with the conditions of the MS1087approval.
1087:M4.6.2	**Compliance Reporting**	The Compliance Assessment Report shall: (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.	Compliance Assessment Report developed in accordance with the approved Compliance Assessment Plan.	Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	This CAR complies with reporting requirements, specifically: 1) Endorsement by the General Manager Northern Operations of BHP Nickel West, as an authorised delegate of the CEO of BHP Nickel West. 2) BHP Nickel West has identified one potential non-compliance with condition M1.1 of the MS1087 approval during the reporting period. Information related to this event are included within this CAR document. 3) One potential non-compliance with the conditions of the MS1087 approval occurred during the reporting period. Accordingly, corrective or preventative actions have been implemented to address the potential non-compliance. 4) Following approval of this CAR document by the DWER CEO, this CAR document will be made publicly available through the BHP Nickel West website as outlined by the approved CAP report (refer to https://www.bhp.com/sustainability/environment/regulatory-information/). 5) No changes to the Compliance Assessment Plan have been proposed.
1087:M5.1	**Public Availability of Data**	Subject to condition 5-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) management plans and reports relevant to the assessment of this proposal and implementation of this Statement.	To be determined in consultation with CEO.	Written advice from CEO confirming manner approved.	Overall	To be determined in consultation with the CEO.	COMPLIANT	Environmental data, management plans and reports relevant to the EPA assessment of the Project are publicly available through the EPA website (refer to https://www.epa.wa.gov.au/proposals/mt-keith-satellite-project). Management plans and reports(including environmental data) relevant to the ongoing implementation of the MS1087 approval are publicly available through the BHP website (refer to https://www.bhp.com/sustainability/environment/regulatory-information/). To date, this publicly available information includes: Flora and Vegetation Environmental Management Plan (EMP) (BHP Nickel West 2019) Compliance Assessment Plan (BHP Nickel West 2020a) Compliance Assessment Report 2019 Compliance Assessment Report 2020 Compliance Assessment Report 2021 Compliance Assessment Report 2022 Compliance Assessment Report 2023 Compliance Assessment Report 2024 Following approval by the DWER CEO, this CAR document will additionally be made publicly available through the BHP website. To note, the DWER CEO has not provided written advice to BHP Nickel West on the approved manner or the timing for the public availability of information required under Condition 5-1 of the MS1087 approval. BHP Nickel West consider the above actions for public

AUDIT CODE	SUBJECT	REQUIREMENT	HOW	EVIDENCE	PHASE	TIMEFRAME	STATUS	FURTHER INFORMATION
								availability to meet the intent of Condition 5-1 and the objectives of the DWER CEO for the public availability of environmental data, management plans and reports.
1087:M5.2	**Public Availability of Data**	If any data referred to in condition 5-1 contains particulars of: (1) a secret formula or process; or (2) confidential commercially sensitive information; the proponent may submit a request for approval from the CEO to not make these data publicly available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publicly available.	Proponent request to CEO to not make certain data publicly available, including explanation and reason why.	Notice in writing to CEO notifying of any information not to be made publicly available.	Overall	As required from time to time.	NOT REQUIRED	No requests were made by BHP Nickel West to the CEO DWER to not make environmental data publicly available during the reporting period. Consistent with standard practices, BHP Nickel West will seek to ensure public availability of all environmental data which relates to the implementation of, and compliance with, the MS1087 approval.
1087:M6.1	**Flora and Vegetation Management Plan**	The proponent shall implement the proposal to meet the following environmental objective: (1) Avoid, where possible, and minimise indirect impacts as far as practicable to Priority flora, the Violet Range PEC and the Wanjarri Nature Reserve.	Implement the proposal in accordance with the Flora and Vegetation Environmental Management Plan (FVEMP).	MKS FVEMP. Compliance Assessment Reports.	Overall	The first report to be submitted by 28 March 2020 and from then on annual by 28 March each year.	COMPLIANT	BHP Nickel West has implemented the Project to avoid and minimise, where possible, indirect effects to DBCA-classified 'priority' flora taxa, the Violet Range 'priority' ecological community and the adjacent 'Class A' Wanjarri Nature Reserve. The avoidance/minimisation measures have been implemented through the FVEMP (BHP Nickel West 2019b) (as described below under Condition 6-3).
1087:M6.2	**Flora and Vegetation Management Plan**	In order to meet the requirements of condition 6-1, the proponent shall implement the Flora and Vegetation Environmental Management Plan (Version 0, September 2018).	Implement the proposal in accordance with the FVEMP.	MKS FVEMP Compliance Assessment Reports.	Overall	Throughout the life of the Project. Annual compliance assessment reporting commencing 28 March 2020.	NOT REQUIRED	The FVEMP dated December 2019 (Revision 0.2) was prepared in accordance with Condition 6-3 (below). Accordingly, implementation of the previous revision of the FVEMP under Condition 6-2 is no longer required, with implementation of the revised/approved FV EMP to be regulated in accordance with Condition 6-3 (as addressed below).
1087:M6.3	**Flora and Vegetation Management Plan**	The proponent shall implement the most recent version of the Flora and Vegetation Environmental Management Plan which the CEO has confirmed by notice in writing, addresses the requirements of condition 6-1, on advice of the Department of Biodiversity, Conservation and Attractions.	Implement the current and most recent version of the FVEMP.	Written notice from CEO confirming the FVEMP addresses condition 6-1, on advice from DBCA. Compliance Assessment Reports	Overall	Throughout the life of the Project. Annual compliance assessment reporting commencing 28 March 2020.	COMPLIANT	The current revision of the FVEMP (BHP Nickel West 2019b, Revision 0.2) was approved by the DWER CEO in February 2021 (DWER 2021). Consistent with the approved FVEMP, the environmental management actions implemented to minimise the direct and potential indirect effects of the Project to flora and vegetation values has included: Implementation of the Environmental Heritage Impact Assessment process (internal process) prior to land disturbance (control of direct effects). Environmental monitoring within pre-defined quadrats for: 1. DBCA-classified 'priority' native flora taxa (tagged individuals) 2. vegetation communities; and 3. introduced flora taxa (weeds) at defined monitoring sites located in close proximity to the Project and distant from the Project (control sites). Weed inspections have been conducted with targeted weed spraying programs to minimise the risk of introduction or spreading of introduced flora taxa (weeds). Clearing activities undertaken utilising the existing mining equipment fleet based at MKS. All site vehicles utilise approved road networks to minimise the risk of introduction of weeds. Note that an increase of pastoral stock movements around the site has been observed and new fencing has been installed around the perimeter

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								boundary to prevent cattle ingress into the site. The control of cattle and weed movements are challenging for all landholders. Review of the FVEMP is required to update the plan in accordance with site weed hygiene activities. A proposed change to a risk-based approach shall be undertaken in relation to the requirement of hygiene decelerations. This change will be reflected with a new proposed baseline audit to be completed. The key environmental outcomes from the implementation of the management actions in the FVEMP has notably included: Plant health condition of tagged DBCA-classified 'priority' flora taxa adjacent to the Project is consistent with variability compared to control sites. No measurable effect to vegetation condition in proximity to the Project (including for the Violet Range 'priority' ecological community and the adjacent 'Class A' Wanjarri Nature Reserve), with no measured exceedance of trigger criteria or threshold criteria; and No recorded new infestations of introduced flora taxa, and no exceedance of trigger criteria or threshold criteria for the extent of weed occurrence. The results of the environmental monitoring which demonstrate the above key outcomes are outlined within the following consultant reports and a summary is provided below: Stantec Australia Pty Ltd (2025) *Mt Keith Satellite Flora and Vegetation Monitoring Report (2024)*. Report prepared by Stantec Australia Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2025. A copy of the environmental monitoring report by Stantec (2025) is provided in Appendix 4. The report related to the monitoring completed in 2025 is not yet available and will be provided in the next CAR. Astron Environmental Services Pty Ltd (2025) *Mt Keith Satellite Project - Vegetation Remote Sensing Analysis, May 2025.* Report prepared by Hannah Koh (Remote Sensing Analyst) and reviewed by Dr Mark Broomhall (Principal Remote Sensing Analyst) and Dr Paul Drake (Principal Environmental Scientist) of Astron Environmental Services Pty Ltd for BHP Billiton Nickel West Pty Ltd. May 2025. A copy of the report by Astron (2025) is provided in Appendix 5. In 2025 Astron Environmental Services found overall, vegetation health across the study area showed a slight but consistent improvement from 2023 to 2024, with increases in both MSAVI (Modified Soil-Adjusted Vegetation Index) values and vegetation cover likely due to wetter-than-average conditions. The longer-term trend from 2017 to 2024 also showed increases, particularly in vegetation only areas. Spatial analysis revealed that vegetation health generally improves with distance from infrastructure, even though the cluster analysis demonstrated that areas close to the infrastructure have shown a greater relative improvement compared to the surrounding areas. Areas close to riparian corridors show a large MSAVI, but MSAVI drops sharply within 100–125 m before gradually recovering. Although the Violet Ranges PEC has lower vegetation cover than the rest of the site, there were increases in vegetation condition since 2017 which suggest some improvement is occurring. The Stantec (2025) monitoring report found that in general, plant health at the MKS Priority Flora populations varied, despite the region recording above average annual rainfall in the 12 months prior to monitoring. There were two new deaths in each of the *Pigea sp. Chloroxantha* (E. Bennett & D. Bright EUC 1810) and Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771) impact populations, and five new deaths in the Eremophila sp. long pedicels (G. Cockerton 1975) control populations, while health at the *Verticordia jamiesonii* impact and control populations

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								remained stable or improved. One of the five *Pigea sp. Chloroxantha* control population was not monitored in 2024 due to access restrictions. Deaths in the *Eremophila sp*. long pedicels population can likely be attributed to grazing and cattle tracks that were noted at both control sites in 2024. Stantec (2025) also noted that within the vegetation condition monitoring quadrats vegetation condition ratings ranged from 'excellent' to 'degraded' across impact and control quadrats with condition ratings consistent with previous assessment results, with the exception of two haul road impact quadrats that decreased in condition rating due to a reduction of plant cover or deaths of lower storey plants impacting overall vegetation structure. Plant health ratings of the dominant species within quadrats varied in 2024, however were generally similar to the 2023 assessment. While most sites observed evidence of dust, vegetation was in relatively good condition with little to no evidence of grazing pressure. Most sites were stable with minimal changes in vegetation condition since the previous year monitored. Overall, species richness improved at most sites in 2024, while dominant species cover and health scores varied across sites. Trees and shrubs, particularly of the *Acacia* genera, were consistently the dominating strata across quadrats. Perennial shrub species *Sida ectogama*, was also common amongst quadrats occurring at 12 sites at varying cover. Pastoral activities were considered unlikely to have a notable impact on vegetation condition in 2024, with only historical grazing observed at the control and impact quadrats. No weeds were recorded at any of the quadrats assessed in 2024. Review of meteorological data for the local area indicated that annual rainfall in 2024 was significantly above the long-term average of from 1890 to 2023.
1087:M6.4	**Flora and Vegetation Management Plan**	The proponent shall continue to implement the Flora and Vegetation Environmental Management Plan (Version 0, September 2018), or any subsequent revisions as approved by the CEO in condition 6-3, until the CEO has confirmed by notice in writing that the plan meets the objective specified in condition 6-1.	Implement the current and most recent version of the FVEMP.	Compliance Assessment Reports. Written notice from CEO confirming that the objective specified in condition 6-1 has been met.	Overall	Throughout the life of the Project until CEO confirms in writing that the objective specified in condition 6-1 has been met. Annual compliance assessment reporting commencing 28 March 2020.	COMPLIANT	The FVEMP (BHP NiW 2019b, Revision 0.2) continues to be implemented for the Project as described above under Condition 6-3.
1087:M7.1	**Aboriginal Heritage**	Prior to the commencement of ground-disturbing activities, the proponent shall consult with the Tjiwarl Native Title Claim Group and ensure that the proponent has complied with its obligations under the *Aboriginal Heritage Act 1972.*	Consult with the Tjiwarl Native Title Claim Group and comply with obligations under the *Aboriginal Heritage Act 1972.*	Compliance Assessment Report.	Pre-construction	Prior to commencement of ground-disturbing activities.	COMPLETED	As described within the first CAR document (BHP Nickel West 2020b), consultation with the Tjiwarl Native Title Claim Group and BHP Nickel West occurred prior to the commencement of ground disturbing activities for the Project, with a summary of this consultation supplied to the DWER CEO to verify compliance with Condition 7-1. The requirements of Condition 7-1 for consultation prior to the commencement of ground disturbing activities has been completed. To note, ongoing consultation with the Tjiwarl Native Title Claim Group and BHP Nickel West will continue to occur during operation of the Project in accordance with the cultural and heritage agreement between the parties. Further reporting under Condition 7-1 of the MS1087 for consultation with the Tjiwarl Native Title Claim Group during ongoing operations is not proposed (as Condition 7-1 relates only to pre-construction consultation). BHP Nickel West obtained Consent approval under Section 18 of the *Aboriginal Heritage Act 1972* (WA) prior to the commencement of commencement of ground disturbing activities for the Project which may affect sites or objects of Aboriginal heritage value (WA Minister for

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								Aboriginal Affairs 2019). The requirements of Condition 7-1 for compliance with obligations under the *Aboriginal Heritage Act 1972* (WA) prior to the commencement of ground disturbing activities has been completed. To note, ongoing compliance with the *Aboriginal Heritage Act 1972* (WA) will continue to occur during operation of the Project in accordance with the granted Section 18 Consent approval. BHP has confirmed to the Tjiwarl Native Title Claim Group that, consistent with its normal processes, BHP will only act on this existing section 18 approval following extensive consultation. Further reporting under Condition 7-1 of the MS1087 for compliance with the *Aboriginal Heritage Act 1972* (WA) and the conditions of the Section 18 Consent is not proposed (as Condition 7-1 is only applicable for pre-construction), with ongoing compliance to be reported through the State Department of Planning, Lands and Heritage.
1087:M8.1	**Greenhouse Gas Reporting**	The proponent shall publicly report the greenhouse gas emissions from the proposal on an annual basis, in a manner approved by the CEO.	To be determined in consultation with CEO.	Written notice form CEO approving manner of reporting.	Overall	Throughout the life of the Project. Annual reporting in accordance with the National Greenhouse and Energy Reporting Scheme (NGERS).	COMPLIANT	As identified in the first CAR document, BHP Nickel West reports greenhouse gas emissions through the NGERS, with the first report on greenhouse gas emissions from the Project submitted during 2020, and a further report in 2021, 2022, 2023, 2024 and 2025. The NGERS provides a national framework for all large companies to report emissions data, with the NGERS website providing the repository for all emissions data across Australia. As acknowledged by the DWER (2020a) Compliance Audit, emissions data from the Project will continue to be publicly reported through the NGER framework as the manner approved by the DWER CEO (in lieu of reporting through an annual CAR document).

5. Proposed Changes to the Compliance Assessment Plan

BHP Nickel West has reviewed the approved CAP document (BHP Nickel West 2020a) and proposes no changes to the current CAP revision.

6. Bibliography

Astron Environmental Services Pty Ltd (2025) *Mt Keith Satellite Project - Vegetation Remote Sensing Analysis, May 2025.* Report prepared by Hannah Koh (Remote Sensing Analyst) and reviewed by Dr Mark Broomhall (Principal Remote Sensing Analyst) and Dr Paul Drake (Principal Environmental Scientist) of Astron Environmental Services Pty Ltd for BHP Billiton Nickel West Pty Ltd. May 2025BHP Billiton Nickel West Pty Ltd (2017) *Mt Keith Satellite Project*. Form for the referral of a proposal to the Environmental Protection Authority under Section 38 of the Environmental Protection Act 1986. May 2017.

BHP Billiton Nickel West Pty Ltd (2018a) *Mt Keith Satellite Project Environmental Review*. Revision D. July 2018.

BHP Billiton Nickel West Pty Ltd (2018b) *Hydrological Processes Environmental Management Plan – Mt Keith Satellite Project*. Revision A. April 2018.

BHP Billiton Nickel West Pty Ltd (2019a) *Nickel West Mt Keith Satellite Project – Compliance Assessment Plan*. Version 1. September 2019.

BHP Billiton Nickel West Pty Ltd (2019b) *Flora and Vegetation Environmental Management Plan – Mt Keith Satellite Project*. Version 0.2. December 2019.

BHP Nickel West Pty Ltd (2020a) *Nickel West Mt Keith Satellite Project – Compliance Assessment Plan*. Version 2. October 2020.

Department of Water and Environmental Regulation (2018) Post Assessment Form 2 – Statement of Compliance.

Department of Water and Environmental Regulation (2020a) *Statement 1087 - Mt Keith Satellite Project*. Compliance audit of the Statement 1087 approval for the Mt Keith Satellite Project prepared by Da Silva K of the Department of Water and Environmental Regulation. May 2020.

Department of Water and Environmental Regulation (2020b) *Ministerial Statement 1087 – Proposal – Compliance Assessment Plan Approval*. Letter of the Department of Water and Environmental Regulation to BHP Billiton Nickel West Pty Ltd approving a revised Compliance Assessment Plan (Revision 2) under Condition 4-1 of the Statement 1087 approval. October 2020.

Department of Water and Environmental Regulation (2021) *Mt Keith Satellite Project – Ministerial Statement 1087 – Flora and Vegetation Management Plan - Approved.* Letter of the Department of Water and Environmental Regulation to BHP Billiton Nickel West Pty Ltd approving a revised Flora and Vegetation Environmental Management Plan (Revision 0.2) under Condition 6 of the Statement 1087 approval. February 2021.

Environmental Protection Authority (2017) *Decisions Pursuant to s.39(1) under the Environmental Protection Act 1986 - Mt Keith Satellite Project.* Assessment decision of the Environmental Protection Authority on the Mt Keith Satellite Project Referral. July 2017.

Environmental Protection Authority (2018) *Mt Keith Satellite Project.* Report and recommendations of the Environmental Protection Authority to the Western Australian Minister for Environment under Section 44 of the Environmental Protection Act 1986 (WA). Report 1625. November 2018.

Stantec Australia Pty Ltd (2025) Mt Keith Satellite 2024 Flora and Vegetation Monitoring Report. Report prepared by Duncan L of Stantec Australia Pty Ltd for BHP Billiton Nickel West Pty Ltd. March 2024.

Western Australian Minister for Aboriginal Affairs (2019) *Aboriginal Heritage Act 1972 Consent Pursuant to Section 18(3)*. Consent approval granted to BHP Billiton Nickel West Pty Ltd by the Western Australian Minister for Aboriginal Affairs for the Mt Keith Satellite Project. January 2019.

Western Australian Minister for Environment (2018) *Mt Keith Satellite Project*. Statement 1087 approval granted to BHP Billiton Nickel West Pty Ltd by the Western Australian Minister for Environment under s45(5) of the Environmental Protection Act 1986 (WA). December 2018.

Appendix 1 – Statement of Compliance

Proposal and Proponent Details

Proposal Title	Mt Keith Satellite Project
Statement Number	1087
Proponent Name	BHP Nickel West Pty Ltd
Proponent's Australian Company Number *(where relevant)*	ACN 004 184 598

Statement of Compliance Details

Reporting Period	28/12/2024 to 27/12/2025

Implementation phase(s) during reporting period (please tick ✓ relevant phase(s))							
Pre-construction		Construction		Operation	✓	Decommissioning	

Audit Table for Statement addressed in this Statement of Compliance is provided at Attachment:	Table 1
An audit table for the Statement addressed in this Statement of Compliance must be provided as an Attachment to this Statement of Compliance. The audit table must be prepared and maintained in accordance with the Department of Water and Environmental Regulation (DWER) *Post Assessment Guideline for Preparing an Audit Table*, as amended from time to time. The 'Status Column' of the audit table must accurately describe the compliance status of each implementation condition and/or procedure for the reporting period of this Statement of Compliance. The terms that may be used by the proponent in the 'Status Column' of the audit table are limited to the Compliance Status Terms listed and defined in Table 1 of Attachment 1.	

Were all implementation conditions and/or procedures of the Statement complied with within the reporting period? (please tick the appropriate box)			
No (please proceed to Section 3)	✓	Yes (please proceed to Section 4)	

Details of Non-compliance(s) and/or Potential Non-compliance(s)

The information required Section 3 must be provided for each non-compliance or potential non-compliance identified during the reporting period covered by this Statement of Compliance.

Non-compliance/potential non-compliance 3-1

Which implementation condition or procedure was non-compliant or potentially non-compliant?
Condition M1.1 Proposal Implementation When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Table 2 of Schedule 1, unless amendments to the proposal and the authorised extent of the proposal have been approved under the EP Act.
Was the implementation condition or procedure non-compliant or potentially non-compliant?
Potentially Non-Compliant
On what date(s) did the non-compliance or potential non-compliance occur (if applicable)?
Disturbance outside of the development envelope was identified in June 2025.
Was this non-compliance or potential non-compliance reported to the Chief Executive Officer, DWER?
☒ Yes ☐ Reported to DWER verbally Date _____ ☒ Reported to DWER in writing Date 19 June 2025 ☐ No
What are the details of the non-compliance or potential non-compliance and where relevant, the extent of and impacts associated with the non-compliance or potential non-compliance?
During reconciliation of disturbance associated with the implementation of the Project, NiW identified a small portion of disturbance outside of the Development Envelope (as detailed in Table 2, Schedule 1 of MS1087). NiW understands that the disturbance relates to maintenance of an access road following significant rainfall.
What is the precise location where the non-compliance or potential non-compliance occurred (if applicable)? (please provide this information as a map or GIS co-ordinates)
A map has been enclosed as Appendix 6
What was the cause(s) of the non-compliance or potential non-compliance?
In an attempt to remove water and accumulated fine material from an inundated portion of the road, material appears to have been spread outside of the Development Envelope, impacting an area of 0.023 hectares (ha). No vegetation was cleared however it appears some grasses and small shrubs were covered with material from the road or driven over with a front-end loader. No known priority or declared rare flora are located in the vicinity of the impacted area. Additionally, there are no known areas of cultural heritage in the impacted area.
What remedial and/or corrective action(s), if any, were taken or are proposed to be taken in response to the non-compliance or potential non-compliance?
Remove deposited fine road base material from undisturbed area and dispose of within a waste rock landform
What measures, if any, were in place to prevent the non-compliance or potential non-compliance before it occurred? What, if any, amendments have been made to those measures to prevent reoccurrence?
NiW utilises an internal Land Use Permit (Environment, Heritage Impact Assessment (EHIA)) system to assess and approve land disturbing activities. Unfortunately, in this case an internal permit was not requested and the task undertaken as it was deemed low risk by the operator. Following the event, NiW has: 1. Physically demarcated of the MS1087 Development Envelope boundary with marker posts in areas where the Project disturbance is within 10 metres of the Development Envelope boundary. 2. Communicated to machine operators that no works are to occur outside of previously disturbed areas without a NiW Environment, Heritage Impact Assessment (EHIA) being completed and approved.

Please provide information/documentation collected and recorded in relation to this implementation condition or procedure:

- in the reporting period addressed in this Statement of Compliance; and
- as outlined in the approved Compliance Assessment Plan for the Statement addressed in this Statement of Compliance.

(the above information may be provided as an attachment to this Statement of Compliance)

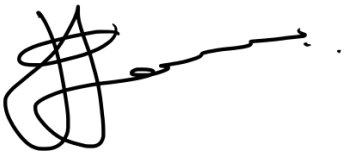
For additional non-compliance or potential non-compliance, please duplicate this page as required.

Proponent Declaration

I, Pieter Fourie, **Manager Northern Operations** declare that I am

authorised on behalf of BHP Nickel West Pty Ltd

(being the person responsible for the proposal) to submit this form and that the information contained in this form is true and not misleading.

Signature:.....  ..... Date:30/03/2026.....

Please note that:

- it is an offence under section 112 of the *Environmental Protection Act 1986* for a person to give or cause to be given information that to his knowledge is false or misleading in a material particular; and
- the Chief Executive Officer of the DWER has powers under section 47(2) of the *Environmental Protection Act 1986* to require reports and information about implementation of the proposal to which the statement relates and compliance with the implementation conditions.

Submission of Statement of Compliance

One hard copy and one electronic copy (preferably PDF on CD or thumb drive) of the Statement of Compliance are required to be submitted to the Chief Executive Officer, DWER, marked to the attention of Manager, Compliance (Ministerial Statements).

Please note, the DWER has adopted a procedure of providing written acknowledgment of receipt of all Statements of Compliance submitted by the proponent, however, the DWER does not approve Statements of Compliance.

Contact Information

Queries regarding Statements of Compliance, or other issues of compliance relevant to a Statement may be directed to Compliance (Ministerial Statements), DWER:

Manager, Compliance (Ministerial Statements)

Department of Water and Environmental Regulation

Postal Address:	Locked Bag 10 Joondalup DC WA 6919
Phone:	(08) 6364 7000
Email:	compliance@dwer.wa.gov.au

7. Post Assessment Guidelines and Forms

Post assessment documents can be found at www.epa.wa.gov.au

Compliance Status Terms

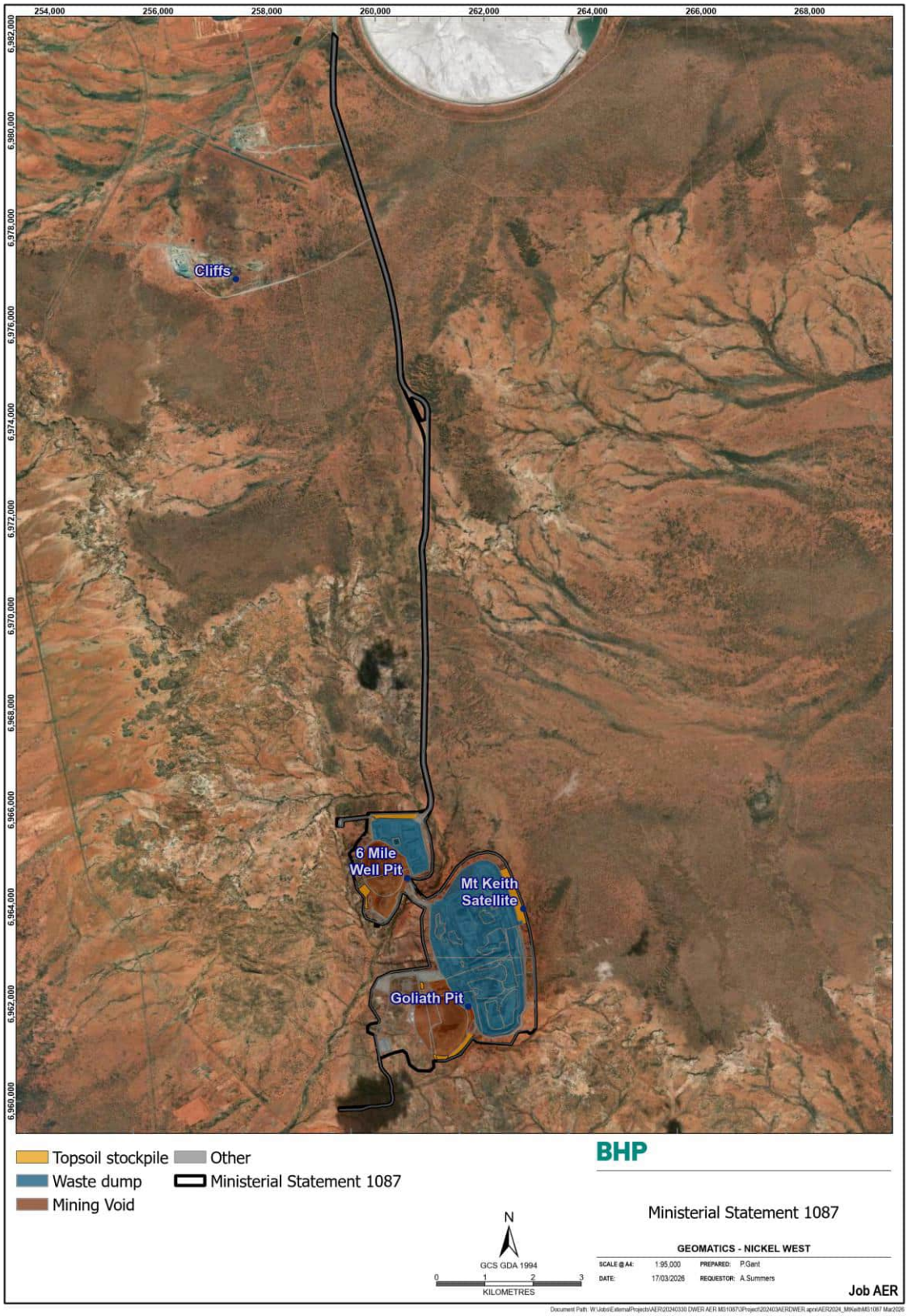
Compliance Status Terms	Abbrev	Definition	Notes
Compliant	C	Implementation of the proposal has been carried out in accordance with the requirements of the audit element.	This term applies to audit elements with: • ongoing requirements that have been met during the reporting period; and • requirements with a finite period of application that have been met during the reporting period, but whose status has not yet been classified as 'completed'.
Completed	CLD	A requirement with a finite period of application has been satisfactorily completed.	This term may only be used where: • audit elements have a finite period of application (e.g. construction activities, development of a document); • the action has been satisfactorily completed; and • the DWER has provided written acceptance of 'completed' status for the audit element.
Not required at this stage	NR	The requirements of the audit element were not triggered during the reporting period.	This should be consistent with the 'Phase' column of the audit table.
Potentially Non-compliant	PNC	Possible or likely failure to meet the requirements of the audit element.	This term may apply where during the reporting period the proponent has identified a potential non-compliance and has not yet finalized its investigations to determine whether non-compliance has occurred.
Non-compliant	NC	Implementation of the proposal has not been carried out in accordance with the requirements of the audit element.	This term applies where the requirements of the audit element are not "complete" have not been met during the reporting period.
In Process	IP	Where an audit element requires a management or monitoring plan be submitted to the DWER or another government agency for approval, that submission has been made and no further information or changes have been requested by the DWER or the other government agency and assessment by the DWER or other government agency for approval is still pending.	**The term 'In Process' may not be used for any purpose other than that stated in the Definition Column.** The term 'In Process' may not be used to describe the compliance status of an implementation condition and/or procedure that requires implementation throughout the life of the project (e.g. implementation of a management plan).

Appendix 2 – MKS Native Vegetation Clearing and Development Envelope

Table 2- MKS disturbance figures

Disturbance Type	Area (ha)
Land (other than land under rehabilitation or rehabilitated land) that has been disturbed by exploration operations or is the subject of a programme of work	6.55
Land (other than land under rehabilitation or rehabilitated land) that is cleared of vegetation and is not otherwise described in this Table	28.80
Laydown or hardstand area	26.23
Mining void (with a depth of at least 5 metres) below ground water level	217.94
Run-of-mine pad	74.30
Topsoil stockpile	36.90
Transport or service infrastructure corridor	89.50
Waste dump or overburden stockpile (class 1)	457.85
Total Clearing as of December 2024	**938.05**
Authorised clearing	**1069.00**
Development Envelope	**1265.00**

Figure 1 MKS Disturbance Map



Appendix 3 – MKS Water Meter Readings - Abstraction

Table 3 - MKS pit abstraction rates 2025

ID	METER DESCRIPTION	VOLUMES (KL)												
		JAN-25	FEB-25	MAR-25	APR-25	MAY-25	JUN-25	JUL-25	AUG-25	SEP-25	OCT-25	NOV-25	DEC-25	2025 ANNUAL TOTAL*
MKS1	MKS MINE - In pit	0	0	0	0	0	0	0	0	0	0	0	0	0
MKS2	MKS MINE - Ex pit	0	0	0	0	0	0	0	0	0	0	0	0	0
MKS3	MKS MINE – SMW	0	0	0	0	0	0	0	0	0	0	0	0	0
MONTHLY TOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0

*Annual total is for the reporting period (28/12/2024 – 27/12/2025)

Appendix 4 – Stantec (2025) Mt Keith Satellite 2024 Flora and Vegetation Monitoring Report

2025 Monitoring Report to be provided in the 2026 CAR (due March 2027)

BHP Nickel West Northern Operations Environmental Monitoring 2024

Mt Keith Satellite – Flora and Vegetation Monitoring Report

DATE: 16/12/2025

Ref: 304501663

PREPARED FOR:

BHP Nickel West Pty Ltd

PREPARED BY:

Stantec Australia Pty Ltd

Stantec

Revision Schedule

Rev. No.	Date	Description	Prepared by	Quality Reviewer	Technical Independent Reviewer	Project Manager Final Approval
A	13/03/2025	Draft report for client review	Jaimee Tilley	Christy Visser	Michelle Luinstra	Stephanie Kemp
B	18/03/2025	Draft report for client review	-	-	Shiona Macdonald	Stephanie Kemp
0	12/12/2025	Final report				Stephanie Kemp

Disclaimer

The conclusions in the report are Stantec's professional opinion, as of the time of the report, and concerning the scope described in the report. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. The report relates solely to the specific project for which Stantec was retained and the stated purpose for which the report was prepared. The report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorised use or reliance is at the recipient's own risk.

Stantec has assumed all information received from the client and third parties in the preparation of the report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

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Executive Summary

Stantec Australia Pty Ltd (Stantec) was commissioned in 2024 by BHP Nickel West to undertake flora and vegetation monitoring at the Mt Keith Satellite Project (MKS project) to meet the requirements of the Flora and Vegetation Environmental Management Plan – Mt Keith Satellite Project (FVEMP), approved under Ministerial Statement (MS) 1087. This report details the findings of the annual vegetation condition monitoring program, a summary of the annual Priority Flora assessments and soil sampling at the MKS Haul Road undertaken in November 2024.

With the development of the MKS project, there was a potential for indirect environmental impacts associated with the construction and operation of the haul road and other mine infrastructure. Those impacts include habitat fragmentation, alteration of surface water flows, and the spread of weeds. As required by the FVEMP, 37 Environment Impact Assessment (EIA) vegetation quadrats were planned to be monitored in November 2024, however only 35 were assessed due to access restrictions. These consisted of 17 haul road impact quadrats within or adjacent to the MKS development envelope, six infrastructure impact quadrats, and 12 control quadrats in areas considered unaffected by MKS operations. Vegetation condition ratings at impact and control quadrats ranged from 'degraded' to 'excellent' in 2024 with minor changes in vegetation condition from the previous assessment, except for decreases in condition ratings at two impact quadrats (MKSEAI 35 and MKSEIA 37) due to a reduction of plant cover or deaths of lower storey plants.

Additionally, four Priority Flora species across 11 populations were assessed in 2024. Of these 11 populations, six impact populations were monitored located adjacent to mine infrastructure or the haul road. One of the five control sites (control population of *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810)) was not monitored in 2024 due to access restrictions.

Between November 2023 and November 2024, plant health at the Priority Flora populations varied, despite the region recording above average annual rainfall in the 12 months prior to monitoring (November 2023-October 2024). There were two new deaths in each of the *Pigea* sp. Chloroxantha and *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) impact populations, and five new deaths in the *Eremophila* sp. long pedicels (G. Cockerton 1975) control populations, while health at the *Verticordia jamiesonii* impact and control populations remained stable or improved. Deaths in the *Eremophila* sp. long pedicels population can likely be attributed to grazing and cattle tracks that were noted at both control sites in 2024.

A soil assessment was included in the monitoring methods for the first time during the 2024 monitoring period. Soil samples were collected from three 'Impact' sites along creek lines draining away from the haul road, in order to assess potential downstream impacts. Four 'Control' sites were also assessed. Overall, the results of the soil analyses suggest that potential impacts from the Mt Keith Satellite Haul Road may be contributing to changes in pH and EC and increased concentrations of several total metals (Ba, Cu, Cr and Ni) in the soil adjacent to, and extending from, the haul road.

It is recommended that annual monitoring of priority flora, vegetation condition, and soil assessments around the haul road continue, ensuring that any changes in vegetation health and soil characteristics are identified. Across all priority flora populations, it is recommended that should the individuals not be located after two monitoring rounds, they be replaced by a new individual in the respective population.

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1. Introduction

The Mt Keith Satellite (MKS) project is located in the north-eastern Goldfields region of Western Australia, within the Yakabindie and Mt Keith pastoral leases. The MKS operation is approximately 52 kilometres (km) northwest of Leinster, 15 km south of the Mt Keith Nickel Operation and immediately west of the Wanjarri Nature Reserve (WNR). Additionally, it resides within the Violet Range Priority Ecological Community (PEC) with Priority Flora populations adjacent to mine infrastructure. The MKS project was approved under Ministerial Statement (MS) 1087 and requires the implementation of the approved Flora and Vegetation Environmental Management Plan (FVEMP).

The initial disturbance at MKS began in February 2019 with vegetation clearing and construction works followed by the commencement of mining operations in April 2019. With the development of the MKS project, potential indirect impacts on WNR, Violet Range PEC and Priority Flora were identified, primarily attributed to the clearing of native vegetation associated with the construction of mine landforms (pits and waste rock dumps) and the transport corridor (haul road) (BHP Nickel West 2019). These potential indirect impacts include habitat fragmentation, the introduction or spread of weeds, altered fire regimes, altered surface water flows and dust deposition (BHP Nickel West 2019). Outside of MKS operations, impacts from grazing can occur due pastoral grazing, as well as dry seasonal conditions both of which have a considerable impact on vegetation health as most of the flora in this bioregion is reliant on sporadic rainfall and short-term moisture availability.

To assess potential impacts from the development of the MKS operation on the Violet Range PEC and WNR, 37 vegetation quadrats were established and monitored in December 2018, prior to any operation disturbance. Of the vegetation quadrats, 25 are classified as 'impact' quadrats, and 12 as 'control' quadrats (that lie outside of the impact area).

Out of the 14 priority-listed taxa recorded within the MKS project area, four were selected as indicator species of concern for monitoring due to their proximity to the MKS haul road or other mine features (BHP Nickel West 2019):

- *Eremophila* sp. long pedicels (G. Cockerton 1975) (P2);
- *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2);
- *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) (P3), previously *Hybanthus floribundus* subsp. *chloroxanthus*; and
- *Verticordia jamiesonii* (P3).

Both impact and control sites were monitored for Priority Flora.

From December 2018 to March 2020, Western Botanical monitored vegetation condition and Priority Flora health quarterly. Stantec Australia Pty Ltd (Stantec) completed the quarterly Priority Flora health assessments in July, September and December 2020, and annual vegetation condition monitoring in September 2020, as per the FVEMP. In 2021, the timing of the Priority Flora health assessments was changed from quarterly to annually (Spring) with the vegetation condition monitoring remaining as annual (Spring).

The objectives of the 2024 Priority Flora and vegetation condition monitoring program were to:

- undertake field monitoring of 37 vegetation quadrats and 11 Priority Flora sites according to the FVEMP (and the previous methodology of Western Botanical);
- compare vegetation condition over time between impact and control vegetation quadrats assessed;
- compare plant health between impact and control Priority Flora sites; and
- identify factors (if any) affecting vegetation condition and Priority Flora health, including impacts from mining related disturbances.

This report details the findings of the annual vegetation condition monitoring program as well as a summary of the bi-annual Priority Flora assessments conducted by Stantec in 2024. Assessments prior to July 2020 were completed and reported on by Western Botanical, but the data has been presented in this report for comparison.

2. Climate and environment

The MKS project is located within the Eastern Murchison sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA version 7) (Department of Agriculture, Water, and the Environment 2012). This subregion consists of extensive areas of elevated red/red-brown desert sandplains with minimal dune development, breakaway complexes, internal drainage, and saline lake systems (Cowan 2001). The vegetation surrounding the MKS development envelope is primarily comprised of stony, mulga shrublands (*Acacia aneura* complex) in association with various understorey genera, including *Senna*, *Eremophila*, and *Maireana* (BHP Nickel West 2019).

The climate is characterised as semi-desert to arid with hot, dry summers and cool, mild winters. The closest Bureau of Meteorology (BOM) weather station is Leinster Aero (station number 12314), located approximately 47 km away from the MKS project area. Leinster Aero had an average annual rainfall of 251 millimetres (mm) between 1994 and 2024 (BOM 2025). It is assumed that the monthly rainfall volume recorded at the Leinster Aero weather station reflects the average rainfall received at the Priority Flora monitoring sites and the vegetation condition quadrats (Figure 2-1). Generally, more rainfall is received in summer and early autumn, mainly linked to local thunderstorms or the influence of tropical cyclones to the north (Beard 1990, Pringle et al. 1994).

Annual rainfall totals were below the long-term average between 2019 and 2023 (Figure 2-1). However, in the 12 months prior to the November 2024 monitoring (November 2023 to October 2024), 275 mm of rainfall was received at Leinster Airport, which was 28 mm above the long-term average of 247 mm over the same time period (BOM 2025).

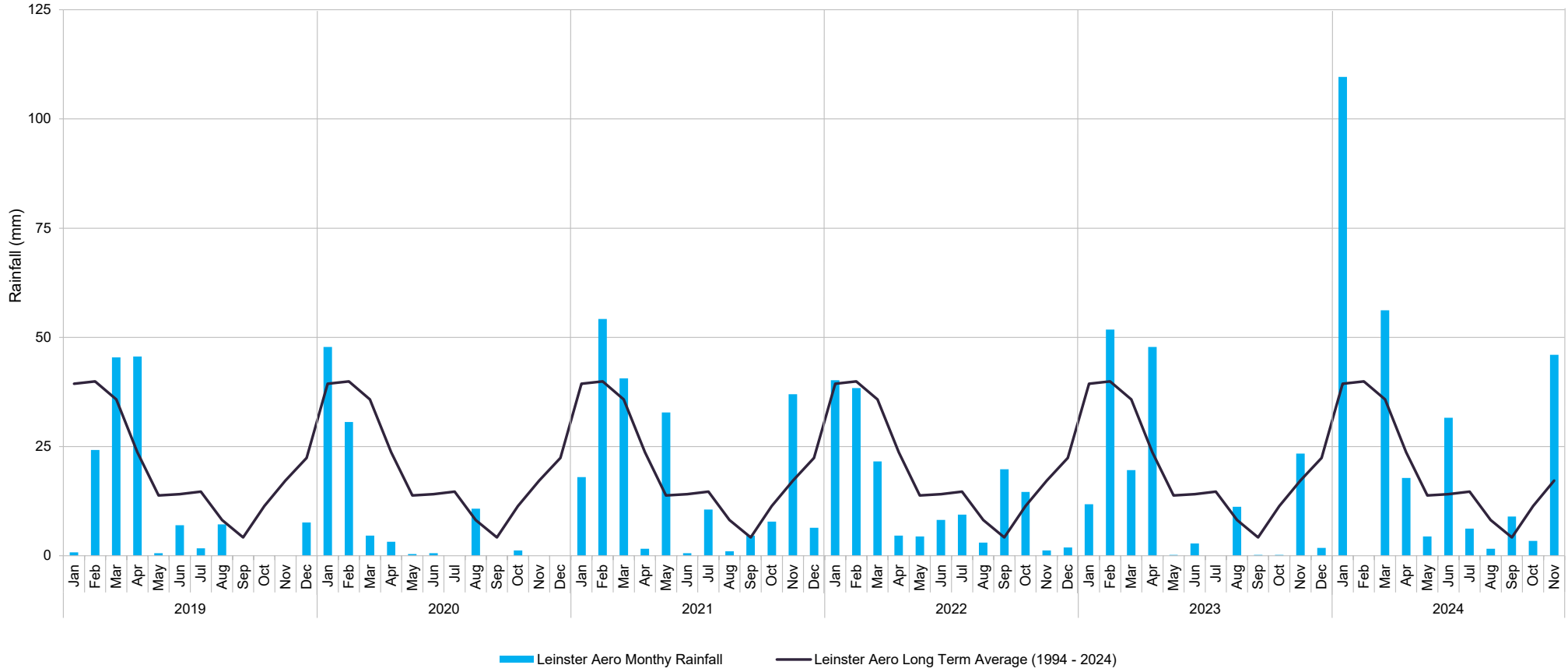


Figure 2-1: Monthly rainfall recorded at Leinster Aero weather station (number 012314) from January 2019 to November 2024

3. Monitoring Methods

3.1 Stantec personnel

In 2024, monitoring was undertaken by Stantec Environmental Scientists; Michelle Luinstra, Christy Visser, Michael Scott and Stantec Graduate Environmental Scientists, Jessi Waldron (Table 3-1). The field staff have previously conducted Priority Flora and vegetation condition assessments as well as rehabilitation monitoring across multiple BHP Nickle West sites in the Goldfields region.

Table 3-1: Stantec project staff experience and flora licenses

Stantec Staff	Qualifications	Professional Experience	Flora License
Michelle Luinstra	BSc. (Biology)	6 years	FB62000395-3
Christy Visser	BSc (Animal and Veterinary Biosciences), MSc (Wildlife and Forestry Management)	6 years	
Jessi Waldron	BSc. (Conservation and Wildlife Biology)	2 years	FB62000631
Michael Scott	BSc. (Environment Science)	3 years	FB62000710

3.2 Priority flora monitoring

3.2.1 Methodology

In 2024, 11 out of ten Priority flora sites were assessed comprising of four species. Populations were selected due to their proximity to either the haul road or mine landforms and therefore categorized as at risk of potential indirect impacts from MKS operations. The species monitored as part of the MKS program included:

- *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) (P3), previously *Hybanthus floribundus* subsp. *Chloroxanthus*;
- *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2);
- *Verticordia jamiesonii* (P3); and
- *Eremophila* sp. long pedicels (G. Cockerton 1975) (P2).

The sites of each Priority Flora population were assigned as either an ‘impact’ or ‘control’ site. ‘Impact’ sites were in areas where there was assumed to be a potential for indirect environmental impacts on Priority Flora individuals to occur due to the MKS project activities. ‘Control’ sites were assumed to be situated a sufficient distance from the MKS project that they were considered unlikely to be impacted by potential indirect environmental impacts. Across each of the Priority Flora sites, up to 25 individuals of each taxon at each site were assessed according to the monitoring methods detailed in the MKS FVEMP (BHP Nickel West 2019). Amongst the data collected for each plant was a plant health score based on foliage and the presence of reproductive features such as flowers, seeds, or pods. The scores range from 1 to 7(a-d) and were split into four main categories:

- ‘Vegetative’ - 7a, 7b, 7c, and 7d. Plant foliage is healthy, but may be actively growing (a), static (b), reduced (c), and/or pigmented (d) if it is normal for prevailing seasonal conditions.
- ‘Reproductive’ - Does not directly measure plant health but indicates the Priority Flora site is reproducing. Scores can range from 4 to 6 depending on the stage of reproduction. While healthy foliage is expected there have been cases where observable reduced foliage has been recorded on reproductive plants.
- ‘Declining’ - Which represents observably reduced foliage (3) and/or partial canopy loss (2) due to extended dry seasonal conditions or abnormal localised impacts.
- ‘Dead’ - Which is the irreversible death of the plant (1).

'Dead' individuals in the population are not replaced but are retained in the dataset. In the event a dead plant can no longer be visibly located and assessed, sampling intensity can be maintained by including new individuals at the site where feasible. Methodology limitations are discussed in (Appendix A.1).

3.2.2 Monitoring locations

Ten Priority Flora populations were monitored between the 6th and 13th of November 2024 (Table 3-2; Figure 3-1). The location of the populations in relation to the MKS project and haul road is provided in Figure 3-1.

Two *Eremophila* sp. long pedicels control sites were established and first monitored during the July 2020 monitoring round upon request by BHP Nickel West (Stantec 2021). Additionally, in 2020, 17 *Pigea* sp. Chloroxantha individuals were tagged and added to the existing sites near the Six Mile Well Pit, to increase the number of individuals assessed towards the ideal site count of 25, as outlined in the FVEMP (BHP Nickel West 2019).

Table 3-2: Number of individuals assessed in November 2024 at Priority Flora populations. Grey shading indicates populations not monitored in 2024.

Priority Species	Tag ID	Site Type	Site Location	Count
Pigea sp. Chloroxantha (E. Bennett & D. Bright) EUC 1810) (P3)	HFC_51 to 62 and 253 to 257	Control	South of Six Mile Well Pit	17
	HFC_63 to 74 and 250 to 252	Impact	Southwest of Six Mile Well Pit	15
	HFC_75 to 90 and 241 to 249	Impact	West of Six Mile Well Pit	25
Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2)	HSPSB_91 to 115	Control-east	Wanjarri Nature Reserve	25
	HSPSB_166 to 190	Control-west	Far West of Haul Road	25
	HSPSB_1 to 25	Impact	East of Haul Road	25
	HSPSB_141 to 165	Impact	West of Haul Road	25
Verticordia jamiesonii (P3)	VJ_116 to 140	Control	Wanjarri Nature Reserve	25
	VJ_26 to 50	Impact	East of Haul Road	25
Eremophila sp. long pedicels (G. Cockerton 1975) (P2)	ESPLP_191 to 215	Control-west	Western edge of Wanjarri Nature Reserve	25
	ESPLP_216 to 240	Control-north	Northern edge of Wanjarri Nature Reserve	25

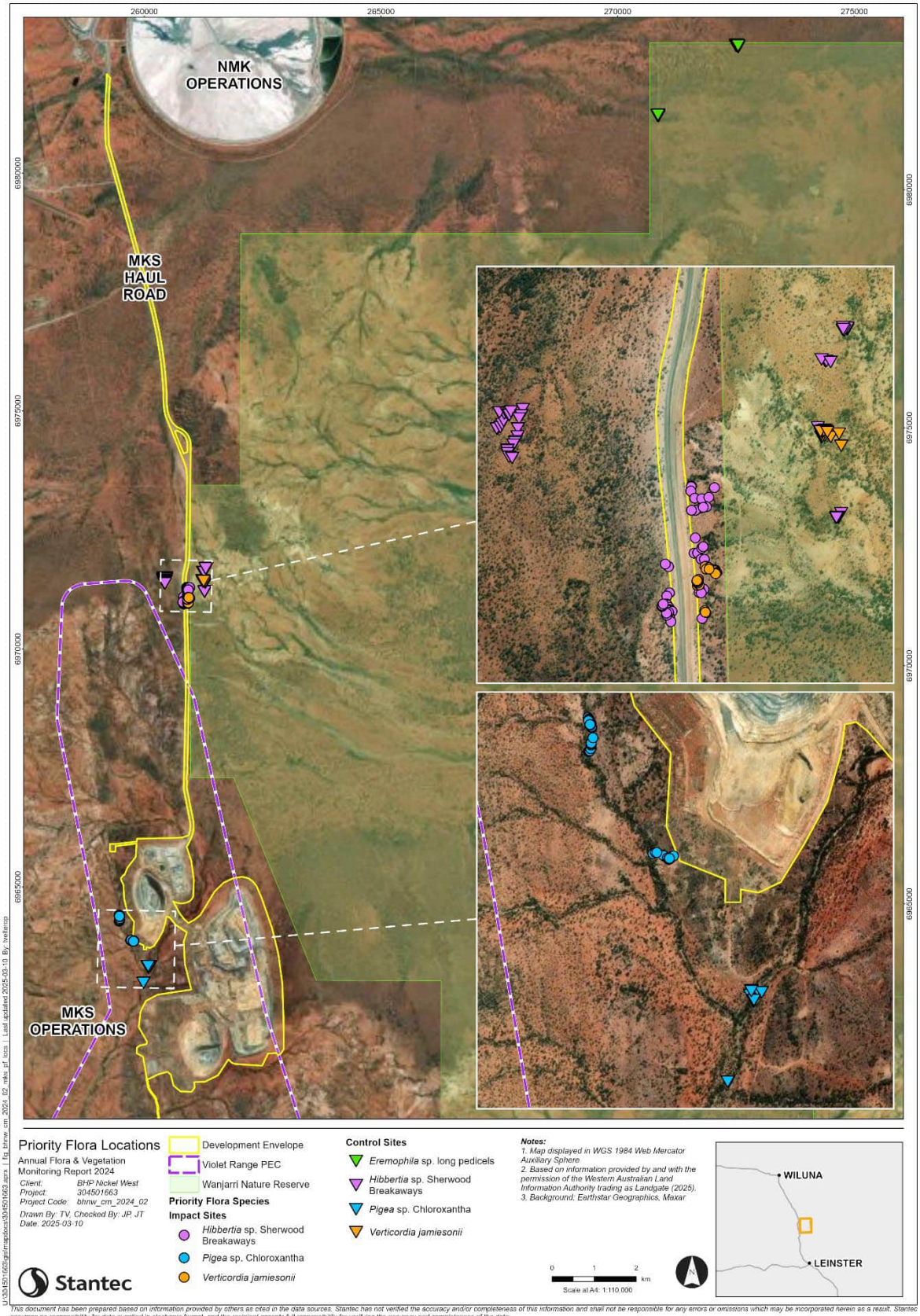


Figure 3-1: Overview of Priority Flora sites monitored in November 2024

3.3 EIA Vegetation condition monitoring

3.3.1 Methodology

The Environment Impact Assessment (EIA) vegetation condition monitoring was based on assessing 14 m x 14 m quadrats, permanently marked by steel posts (Figure 3-2). A total of 37 vegetation condition quadrats were established in December 2018 by Western Botanical and assigned as either an impact or control quadrat. Impact quadrats were assumed to be situated within the spatial area where potential environmental impacts may be occurring. Whilst control quadrats were assumed to be situated a sufficient distance away from the MKS project that it was unlikely to be indirectly impacted by mining activities.

In September 2021, the impact quadrats were categorised based on their location to either the haul road or to mine infrastructure. The 37 monitoring quadrats were classified as follows:

- 17 impact – haul road quadrats;
- 8 impact – infrastructure quadrats; and
- 12 control.

The broad vegetation community associations of each quadrat, determined from previous monitoring (BHP Nickel West 2019), are provided in Table 3-3, as well as their location relative to the MKS project.

- Generally, the quadrats were marked with four posts: one centre post and three corner posts situated at the North/North-West, South/South-West, and East/North-East corners of the quadrat (Figure 3-2). However, due to the presence of tracks and bank structures which overlap onto the quadrat area, not all quadrats have corner posts. Furthermore, some quadrats situated within the Wanjarri Nature Reserve do not have any posts and are only marked by GPS.

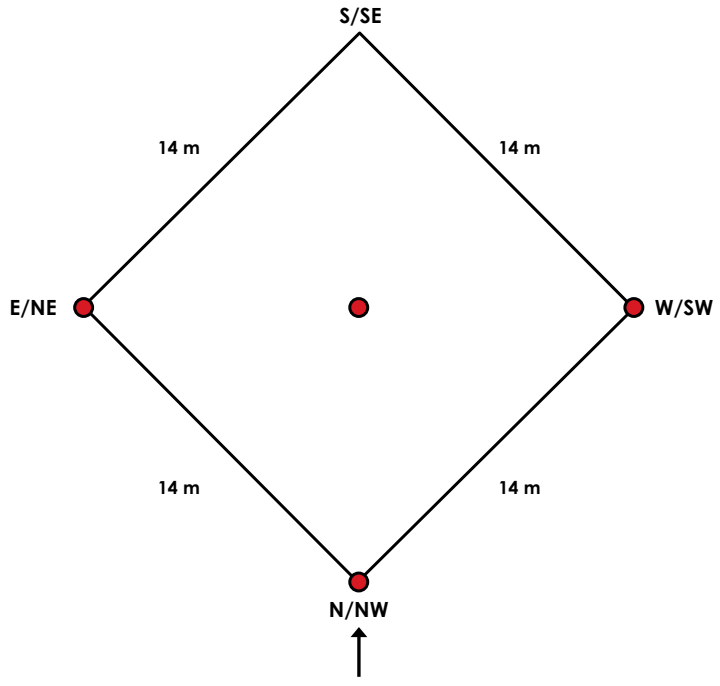


Figure 3-2: Schematic of a typical vegetation condition monitoring quadrat with corner posts at the North/North-West, South/South-West and East/North-East corner of the quadrat. Photo direction indicated by the arrow.

For each monitoring quadrat the following data was collected:

- One quadrat photograph; taken from the North or North-West corner of the quadrat;
- Overall vegetation condition, assessed using the scale outlined by Keighery (1994) (Appendix B);

- Overall extent of grazing impacts recorded as nil, light, medium, or heavy (any grazing which appeared to have occurred within the last 12 months was considered 'recent grazing' and was determined by the field observer using evidence such as freshly broken stems and leaves. Without such evidence it would be considered 'historic grazing');
- Dust deposition from nearby mine infrastructure was recorded, considering dust on the soil surface as well as on vegetation;
- Any maintenance required for the sites was noted in the quadrat comments;
- If any weeds were present, the species was noted and the total weed cover estimated;
- The percentage cover of up to five dominant species were estimated (for this assessment, dominant species were defined as having a cover of 2% or more, or, more than one individual within the quadrat, where cover can be less than 2%);
- The general plant health exhibited by each dominant species was assessed using the observable plant health scale which was based on plant foliage and the presence of reproductive features such as flowers, seeds or pods (BHP Nickel West 2019) (Appendix B); and
- A species list of native perennials and annuals were also recorded.

While most plants were identified to species level, some plants were only identified to genus level due to a lack of identifying features (e.g., flowers or fruiting bodies) present at the time of assessment. The taxonomy of Mulga (*Acacia aneura* complex) was reviewed in 2012 and divided into several species that belong to the Mulga group (Maslin and Reid, 2012). Where possible, each *Acacia aneura* complex individual recorded was identified to species level but if there were not enough identifying features it was recorded as *Acacia aneura*.

Limitations to current methodology are discussed in (Appendix A.2).

3.3.2 Monitoring locations

Thirty-five (35) of the 37 monitoring quadrats were monitored between the 6th and 13th of November 2024. Twenty-three were classed as 'impact' quadrats and twelve were 'control' quadrats, these are depicted in Table 3-3 along with broad vegetation community associations as determined from previous monitoring. The remaining quadrats (two) were unable to be monitored due to access issues. A broad overview of EIA quadrat locations in relation to the MKS project site has been provided (Table 3-3). More detailed maps of each individual quadrat location have been provided as part of the Results and discussion (Section 4).

Table 3-3: Vegetation quadrats at Mt Keith Satellite Operations. Quadrats not monitored during the 2024 survey round are shaded red.

Quadrat	Disturbance category	Coordinates (GDA94) 51J	Approximate location	Vegetation association (BHP Nickel West 2019)
MKS EIA 1	Impact – Haul Road	261082 6973489	~ 40 m west of MKS haul road	Drainage line Mulga shrubland
MKS EIA 2	Impact – Haul Road	261089 6972365	~ 40 m west of MKS haul road	Groved Mulga shrubland
MKS EIA 3	Impact – Haul Road	261117 6971563	~ 9 m west of haul road	Groved Mulga shrubland / Archaean granite geology
MKS EIA 4	Impact – Haul Road	261049 6971565	~ 75 m west of haul road	Groved Mulga shrubland/ Stony ironstone Mulga shrubland
MKS EIA 5	Impact – Haul Road	261204 6970774	~ 80 m east of haul road	Drainage line Mulga shrubland
MKS EIA 6	Impact – Haul Road	261139 6971172	~13 m east of haul road	Archaean granite geology
MKS EIA 7	Impact – Haul Road	261216 6970204	~ 90 m east of haul road	Drainage line Mulga shrubland
MKS EIA 8	Impact – Haul Road	261231 6969060	~ 60 m east of haul road	Stony ironstone Mulga shrubland
MKS EIA 9	Impact – Haul Road	261218 6969942	~95 m east of haul road	Weathered basalt, *Hakea leucoptera* subsp. *sericipes* / *Eremophila pantonii* shrubland
MKS EIA 35	Impact – Haul Road (formerly Control)	261071 6971248	~ 3 m west of haul road	Stony ironstone Mulga shrubland
MKS EIA 36	Impact – Haul Road (formerly Control)	261071 6971159	~ 52 m west of haul road	Stony ironstone Mulga shrubland
MKS EIA 37	Impact – Haul Road (formerly Control)	261077 6971050	~ 48 m west of the haul road	Stoney ironstone low shrubland
MKS EIA 10	Impact - Infrastructure	260553 6966093	~ 320 m north of Run-of-mine	Stony ironstone Mulga shrubland
MKS EIA 11	Impact - Infrastructure	260029 6965525	~ 250 m east of Run-of-mine	Stony ironstone low/Mulga shrubland
MKS EIA 12	Impact - Infrastructure	259909 6964937	~ 150 m east of Six Mile Well pit	Weathered basalt, *Hakea leucoptera* subsp. *sericipes* / *Eremophila pantonii* shrubland
MKS EIA 13	Impact - Infrastructure	260866 6964098	~ 80 m from Six Mile Well pit	Drainage line Mulga shrubland
MKS EIA 14	Impact - Infrastructure	263217 6963155	~ 400 m south-east of WRL	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland

Quadrat	Disturbance category	Coordinates (GDA94) 51J	Approximate location	Vegetation association (BHP Nickel West 2019)
MKS EIA 15	Impact - Infrastructure	260412 6961163	~ 2.2 km south west of WRL, ~ 450 m from Jones Creek track	Mulga over *Maireana triptera* shrubland/ Drainage line Mulga shrubland
MKS EIA 16	Impact - Infrastructure	260261 6961683	~ 1.8 km south west of WRL, ~ 250 m from Jones Creek track	Drainage line Mulga shrubland
MKS EIA 18	Impact - Infrastructure	261285 6964460	~ 195 m south east of Run-of-Mine/ Six Mile Well	Drainage line Mulga shrubland
MKS EIA 23	Impact – Haul Road	261105 6971373	~ 25 m east of haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 24	Impact – Haul Road	261118 6971266	~ 10 m west from haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 25	Impact – Haul Road	261127 6971134	~ 2 m east of haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 26	Impact – Haul Road	261131 6971093	~ 7 m east of haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 27	Impact – Haul Road	261122 6971012	~ 4 m west of haul road	Granitic Mulga shrubland on Archaean geology
MKS EIA 19	Control (formerly Impact – Haul Road)	270893 6981469	~ 12 km east of haul road in Wanjarri Nature Reserve	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland
MKS EIA 20	Control (formerly Impact – Haul Road)	272524 6982988	~ 15 km east of haul road in Wanjarri Nature Reserve	Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland
MKS EIA 21	Control	261186 6973491	~ 60 m east of haul road, within Wanjarri Nature Reserve	Hardpan Mulga shrubland with *Acacia thoma* co- dominant
MKS EIA 22	Control	261218 6972404	~ 87 m east of haul road, within Wanjarri Nature Reserve	Groved Mulga woodland
MKS EIA 28	Control (formerly Impact – Haul Road)	261239 6970770	~ 110 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 29	Control	261255 6970160	~ 100 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 30	Control	261261 6969699	~ 125 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland
MKS EIA 31	Control	261263 6969421	~ 114 m east of haul road, within Wanjarri Nature Reserve	Drainage line Mulga shrubland

Quadrat	Disturbance category	Coordinates (GDA94) 51J	Approximate location	Vegetation association (BHP Nickel West 2019)
MKS EIA 32	Control	261277 6968983	~ 110 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone Mulga shrubland
MKS EIA 33	Control	261280 6968863	~ 114 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone Mulga shrubland
MKS EIA 34	Control	261298 6968771	~ 114 m east of haul road, within Wanjarri Nature Reserve	Stony ironstone low shrubland
MKS EIA 38	Control	261304 6967527	~ 130 m east of haul road	Stony ironstone low shrubland

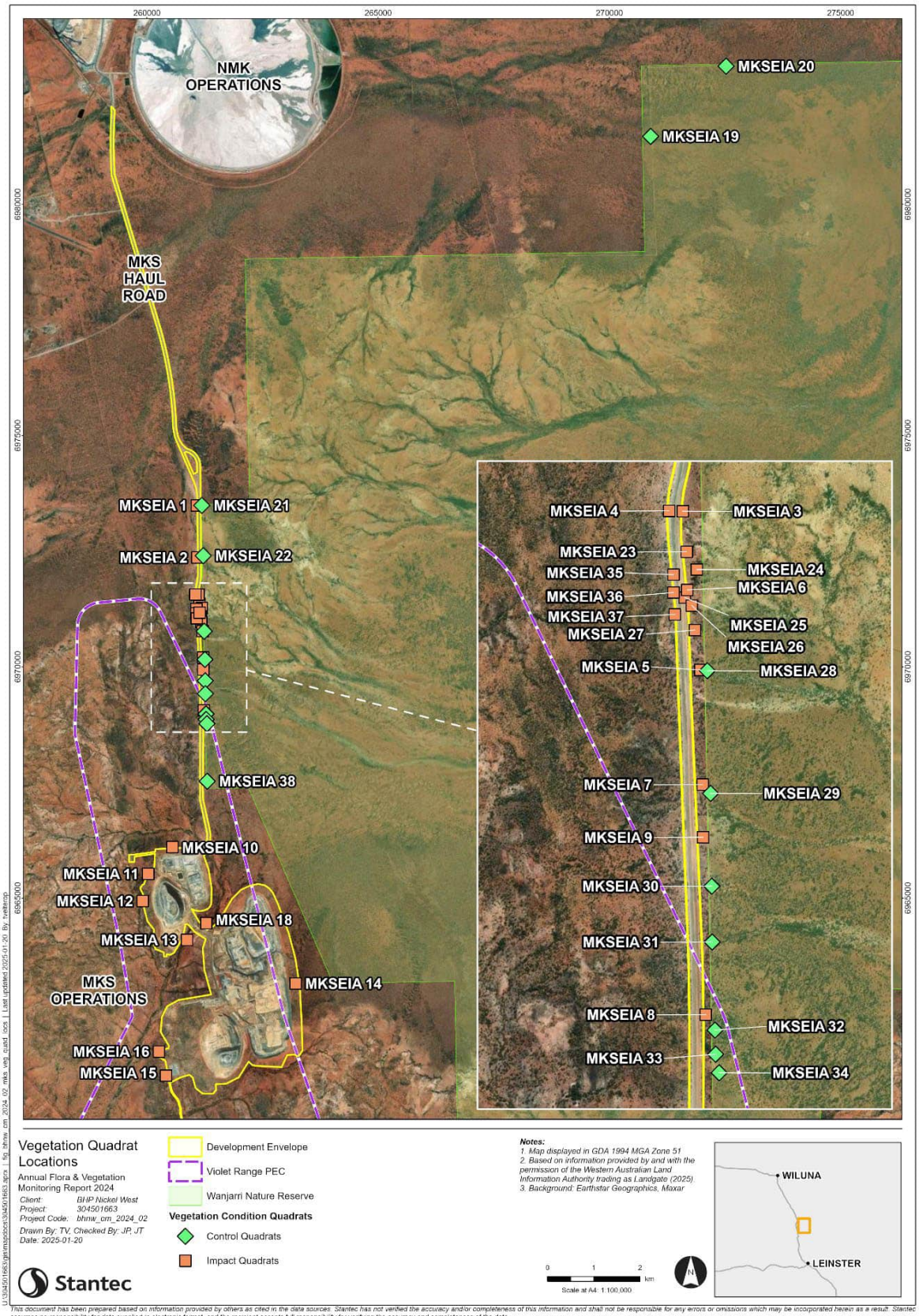


Figure 3-3: Overview of impact and control vegetation quadrats within the scope of the 2024 Flora and Vegetation Monitoring Report

3.4 Soil sampling and analysis

3.4.1 Objective

The main objectives of the soil sampling and analysis was to:

- determine if there was a substantial difference in the soil parameters between the Impact sites and the Control sites; and
- determine if there was a substantial trend in soil parameters, at the Impact sites, with increasing distance from the haul road.

3.4.2 Sample collection

Surface soil sampling and analysis was undertaken at three 'Impact' sites and four 'Control' sites in November 2024. The Impact sites were adjacent to the Mt Keith Satellite Haul Road (the 'haul road'), while the Control sites were located outside of the expected zone of influence for both the the NMK central discharge tailings storage facility (CDTSF) and the MKS haul road (Figure 3-4). Coordinates of soil sampling locations are provided in Table 3-4.

The three Impact sites were selected at various locations to ensure a representative distribution of sampling sites along the haul road (Sites 1, 2 and 3). Each Impact Site had two or three sampling points extending away from the haul road into the surrounding area and along creek lines. The sampling points were 30 m (A), 70 m (B) and occasionally 160 m (C) distances from the haul road. Surface soil samples were also collected and analysed from four Control sites. At each site, a minimum of three surface (0-10 cm) soil sub-samples were collected by Stantec personnel and combined into one bulked sample, placed in sample jars and transported to the laboratory.

Soil analyses were performed by ALS Environmental Division in Perth, a National Association of Testing Authorities (NATA) accredited laboratory. All samples were analysed for soil moisture content, pH (H_2O), electrical conductivity (salinity) and total concentrations of 15 heavy metals: barium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, zinc, arsenic, beryllium, boron, cadmium, mercury, and selenium (Appendix I).

Table 3-4: Soil sampling site details

Site	Sample point	Approx. distance from haul road (m)	Co-ordinates (GDA)
Impact Site 1	1A	0	51 J 261147 6970782
	1B	70	51 J 261222 6970760
Impact Site 2	2A	0	51 J 261201 6968310
	2B	70	51 J 261270 6968303
Impact Site 3	3A	0	51 J 261271 6966795
	3B	30	51 J 261302 6966791
	3C	160	51 J 261417 6966893
Control	C-A	N/A	51 J 266116 6984198
	C-B	N/A	51 J 266119 6984218
	C-C	N/A	51 J 266131 6984235
	C-D	N/A	51 J 266142 6984252

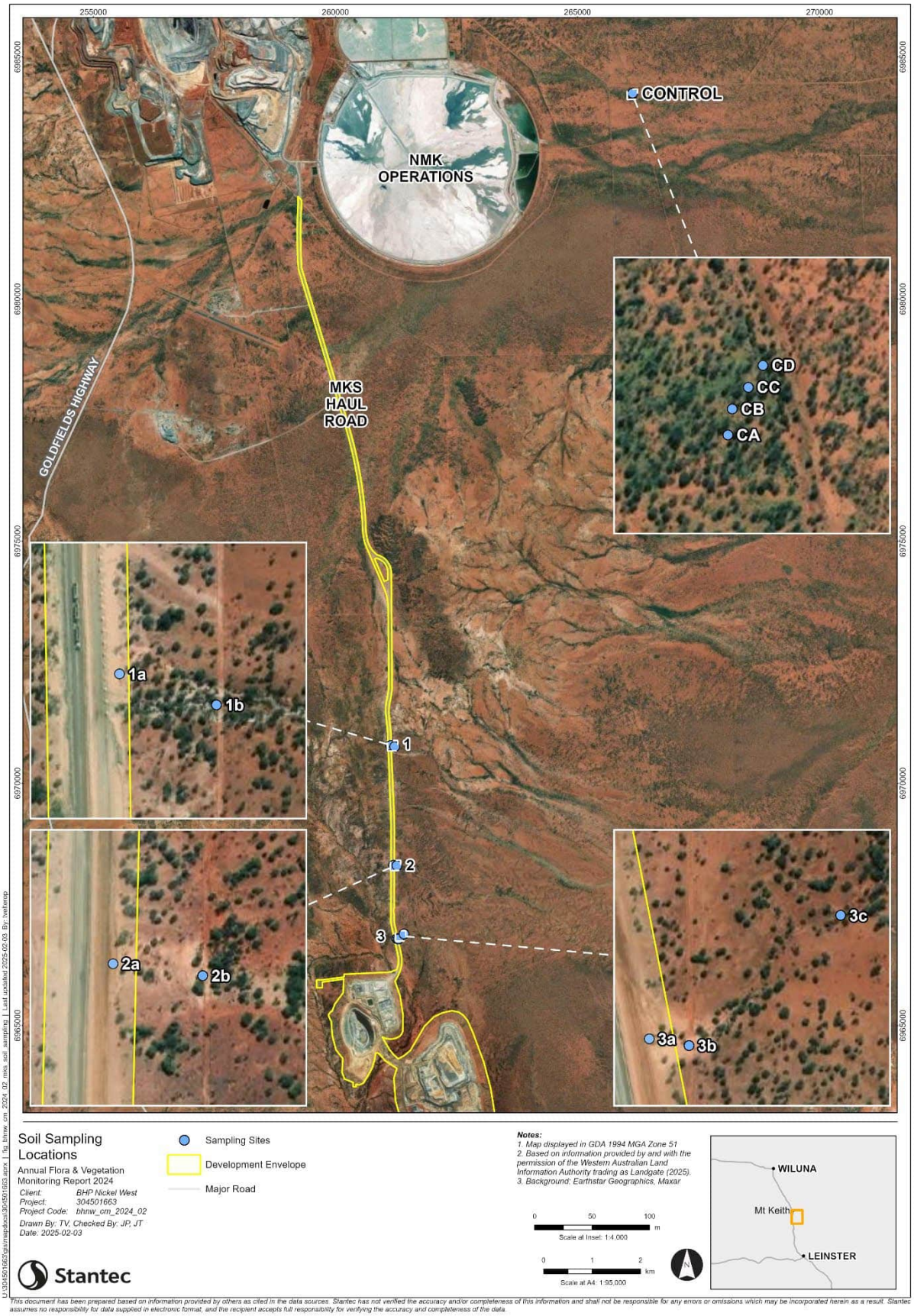


Figure 3-4: Soil sampling locations

3.4.3 Testwork and procedures

3.4.3.1 Soil physical properties

Soil physical properties that were measured included:

- moisture content.

Soil moisture content was determined by ALS by weighing the soil before and after oven-drying at 105 to 110 degrees Celsius (°C) and converting the difference in mass to a percentage of the total, i.e. % moisture.

3.4.3.2 Soil chemical properties

The soil chemical properties that were determined, using a combination of testwork procedures, included:

- Soil pH (in H_2O);
- Soil salinity; and
- Total metal concentrations.

Soil pH provides a measure of the activity of hydrogen ions in a soil solution made from a 1:5 soil to liquid suspension. Ratings are assigned from very strongly acidic to strongly alkaline based on the recorded pH measured in deionised water (pH_W) and other solutions (Van Gool, Tille, and Moore, 2005). The ideal pH range for growth of most agricultural plant species is considered to be between 5.0 and 7.5 (Moore, 1998).

Soil salinity, or electrical conductivity (EC, measured as deciSiemens/metre (dS/m)), is a measure of the amount of readily-soluble salts in soil and soil pore water (Moore, 1998). The salinity is measured from a suspension of soil in deionised water (1:5, soil to water). Soil salinity classes are rated from non-saline to extremely saline based on the measured EC and the soil texture. The classes used for rating are equivalent to those commonly used by the United States Department of Agriculture (USDA) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Appendix I).

Assessment of potential toxicology is made through comparison of total metal concentrations to site-specific soil and rock elemental concentrations (where available), as well as published guideline criteria. It is noted that this represents a conservative estimate as local soil and groundwater in mineralised areas is likely to contain more naturally elevated concentrations of metals and salts compared to guideline criteria.

To assess the potential for elemental enrichment, waste materials are generally tested for total metal concentration. In accordance with the GARD Guide, the results are then compared to standard median soil abundance values (Bowen 1979) to evaluate the extent of elemental enrichment. The result is reported as a geochemical abundance index (GAI). In general, a GAI of 3 or greater is considered indicative of enrichment that may require additional examination to assess potential environmental concerns.

In addition to GAI, the total concentration of elements of potential environmental concern are assessed in accordance with the DER Contaminated Sites Guidelines (DER 2014). For the purposes of this assessment, total elemental concentrations were determined via acid-digest. As a conservative approach, the materials have been assessed as both soil material, which may enter the ecosystem via dust or bulk movement of material, and sediment material which may enter the ecosystem via water-driven erosion and transport. The latter is considered to represent the more bioavailable form of the metal. In the absence of site-specific screening criteria, criteria for assessment of potential impacts as soil have been developed using the National Environment Protection Measure (NEPM) (NEPM, 2013) EIL that applies to 99% protection of areas of ecological significance. It is noted that this represents a conservative approach to screening. Criteria for assessment of potential impacts as sediment has been developed using Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) (ANZECC 2000) interim sediment quality guidelines (ISQG) low and high probable effects values. It is noted that for the purposes of this study, an exceedance of a trigger value under the guideline does not indicate a concentration of environment significance, but rather as an indication of potential contamination or migration with respect to that element. A summary of assessment criteria for the elements assessed as part of this study is provided in Table 3-5.

Table 3-5: Assessment criteria for multi-elements in soil materials

Element	EIL[1]	ISQG-Low[2] (mg/kg)	ISQG – High[3] (mg/kg)
Arsenic	40	20	70
Barium	ND	ND	ND
Beryllium	ND	ND	ND
Boron	ND	ND	ND
Cadmium	ND	1.5	10
Chromium[4]	170	80	370
Cobalt	ND	ND	ND
Copper[5]	30	65	270
Lead	480	50	220
Manganese	ND	ND	ND
Mercury	ND	0.15	1
Nickel[6]	15	21	52
Selenium	ND	ND	ND
Vanadium	ND	ND	ND
Zinc[7]	35	200	410

Notes:
[1] NEPM EIL for 99% protection of areas of ecological significance derived from ACL where appropriate
[2] ISQG – Low: sediment concentrations above which biological effects rarely occur
[3] ISQG – High: sediment concentrations above which biological effects would possible occur
[4] Assumed all Chromium is present as Cr III (conservative approach based on mineralogy). EIL value adopted based on average clay content for each material type (based on results presented in Appendix I)
[5] EIL value adopted based on average CEC and pH for each material type (based on results presented in Appendix I)
[6] EIL value adopted based on average CEC for each material type (based on results presented in Appendix I)
[7] EIL value adopted based on average CEC and pH for each material type (based on results presented in Appendix I)
ND = No trigger value data is published

4. Results and discussion

4.1 Priority flora monitoring

Monitoring results for 2024 Priority flora populations are provided in the Appendices including plant health scores by area (Appendix C), photographs and health ratings of individuals (Appendix D) and 2018 – 2024 data (Appendix E).

4.1.1 *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810)

Two of the three sites containing *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) populations were assessed in 2024 (Table 3-2). These sites are located within the mulga-dominated ephemeral drainage line that runs southward on the western side of the Six Mile Well Pit (Figure 3-1). The two impact sites were located west and south-west of the pit, and one control site was located south of the pit. Due to access issues, the control site was not monitored in 2024. In July 2020, 17 additional *Pigea* sp. Chloroxantha individuals were tagged and added to the existing impact and control sites near the pit in order to increase the number of individuals assessed. The western impact site now contains 25 individuals, while the south-western impact site has 15 individuals, and the control site has 17 individuals (Table 3-2). Each individual plant location is presented in Appendix C. Individual plant health scores and photographs from the most recent assessment in November 2024 are shown in Appendix D, while long term scores are presented in Appendix E. Photographs and scores from assessments prior to 2024 have been provided previously to BHP Nickel West.

Between 2023 and 2024 there was one new death of *Pigea* sp. Chloroxantha recorded at the western impact site (Figure 4-1) and three individuals were not assessed (Figure 4-2). At the south-western population one individual was confirmed as dead, one individual was not assessed, and all other plants were listed as vegetative. No individuals were assessed in the control population due to access issues.

For both impact populations, there were no individuals recorded as ‘reproductive’ for the 2024 assessment. However, the monitoring event for 2024 fell outside of the flowering cycle of *Pigea* sp. Chloroxantha which is from August to October (Western Australian Herbarium, 2024).

In previous assessment, it has been noted that the control population of *Pigea* sp. Chloroxantha is downstream and relatively close to the southern boundary of the operations. It is recommended that the suitability of this population as a control site is reassessed for future monitoring (Appendix A.1).

Figure 4-1: *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) individual HFC_84 assessed as ‘declining’ in 2023 (left) and ‘dead’ in 2024 (right)

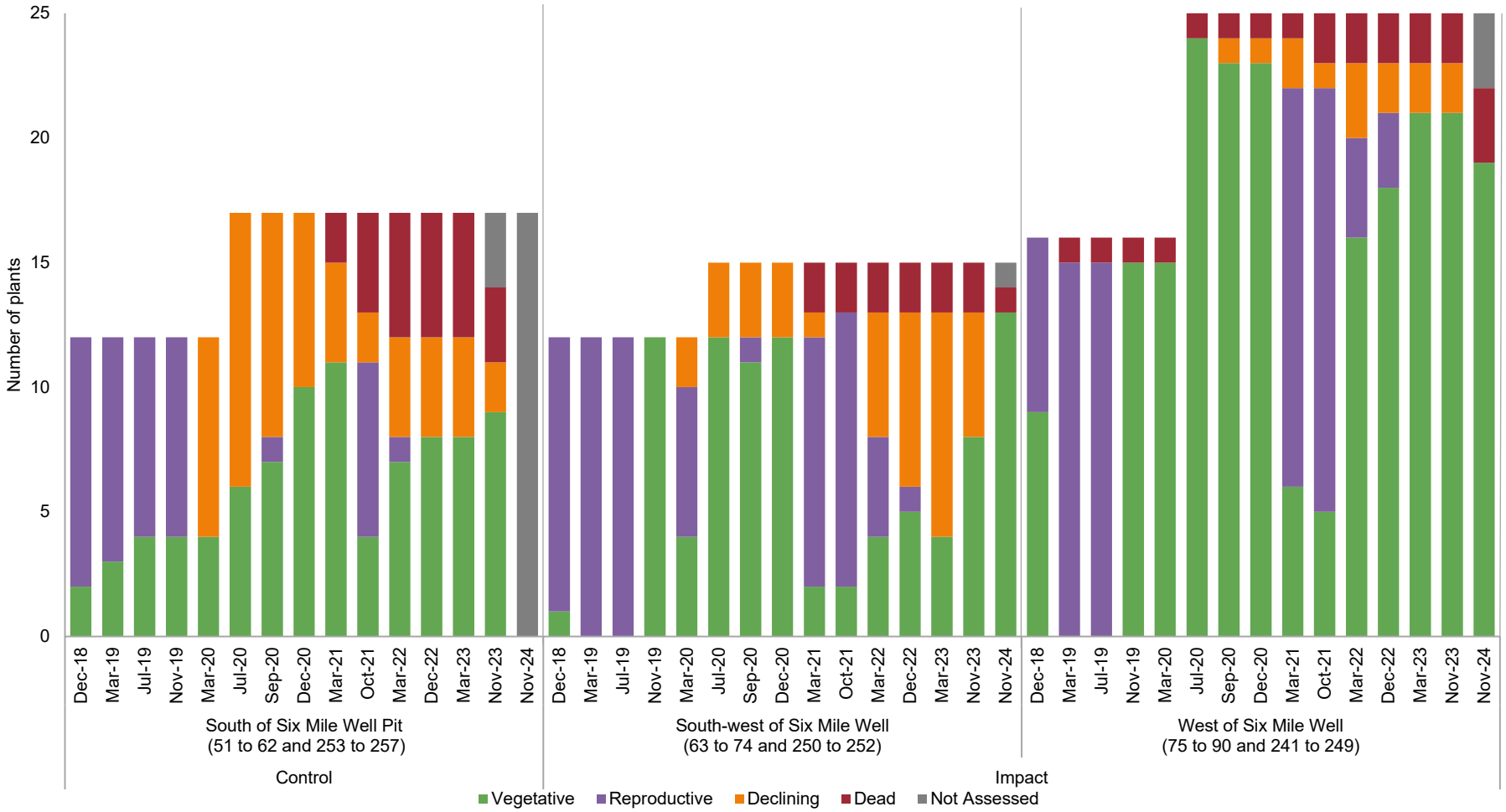


Figure 4-2: Number of *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) individuals within each plant health category, across each impact and control site, from 2018 to 2024.

4.1.2 *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)

Four *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) populations were monitored in 2024 (Table 3-2). The sites are located on granitoid breakaways and laterite-capped hills to the west and east of the MKS haul road (Figure 3-1). One impact and one control site were located on each side of the haul road. Detailed maps of each individual plant location are in Appendix C. Individual plant health scores and photographs from the most recent assessment in November 2024 are shown in Appendix D and long-term plant health scores presented in Appendix E.

Since November 2023, overall plant health has improved at the impact site located west of the MKS haul road (Figure 4-3). This *Hibbertia* sp. Sherwood Breakaways population recorded the largest change of the sites, with the number of individuals recorded as 'vegetative' in the population increasing from nine in 2023 to 13 in 2024 (Figure 4-3). The number of 'declining' individuals in this population decreased from six in 2023, to only one individual in 2024. Two new individuals were recorded as 'dead' during the 2024 assessment (Figure 4-4 & Figure 4-5), however one individual recorded as 'dead' in 2023 was given a rating of 'vegetative' in 2024, resulting in an increase of only one dead individual between 2023 and 2024 (Figure 4-3).

Overall plant health of the population located east of the MKS haul road has declined since the 2023 monitoring period (Figure 4-3). The number of 'vegetative' individuals decreased from seven in 2023 to four in 2024. One new death was recorded in 2024, which is the first recorded death of an individual since 2021 (Figure 4-6). One individual increased from 'declining' to 'vegetative' in 2024 (Figure 4-7).

Plant health varied at the control sites between 2023 and 2024 (Figure 4-3). The number of 'vegetative' individuals at the Wanjarri Nature Reserve control population decreased from 17 in 2023 to 12 in 2024. However, an increase in vegetative health was recorded at the control site west of the haul road, where the percentage of 'vegetative' individuals increased from 17 in 2023 to 24 in 2024.

Overall, the health of *Hibbertia* sp. Sherwood Breakaways plants at the impact sites was lower than at the control sites.

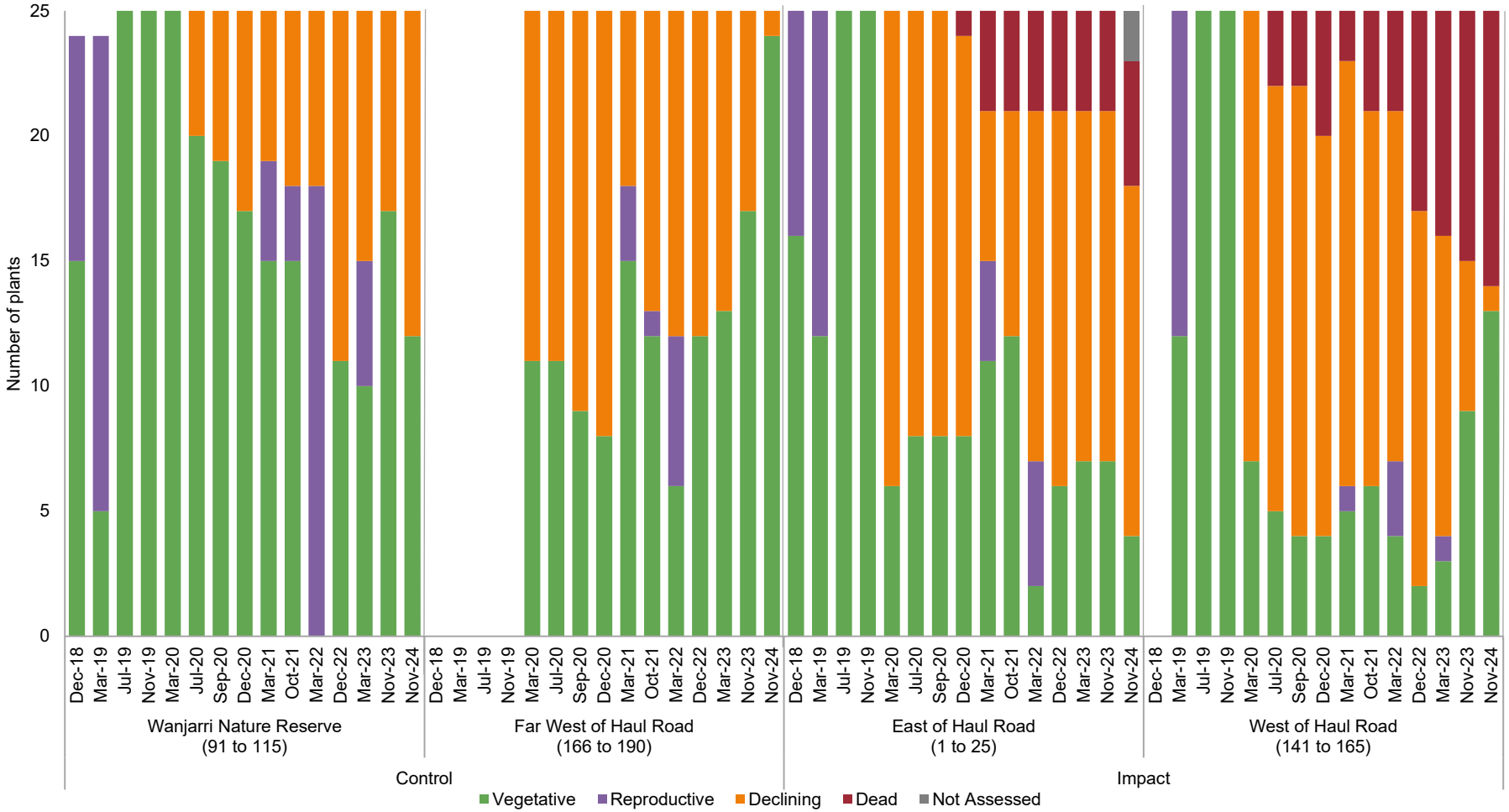


Figure 4-3: Number of *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) individuals within each plant health category, across each impact and control site from 2018 to 2024.

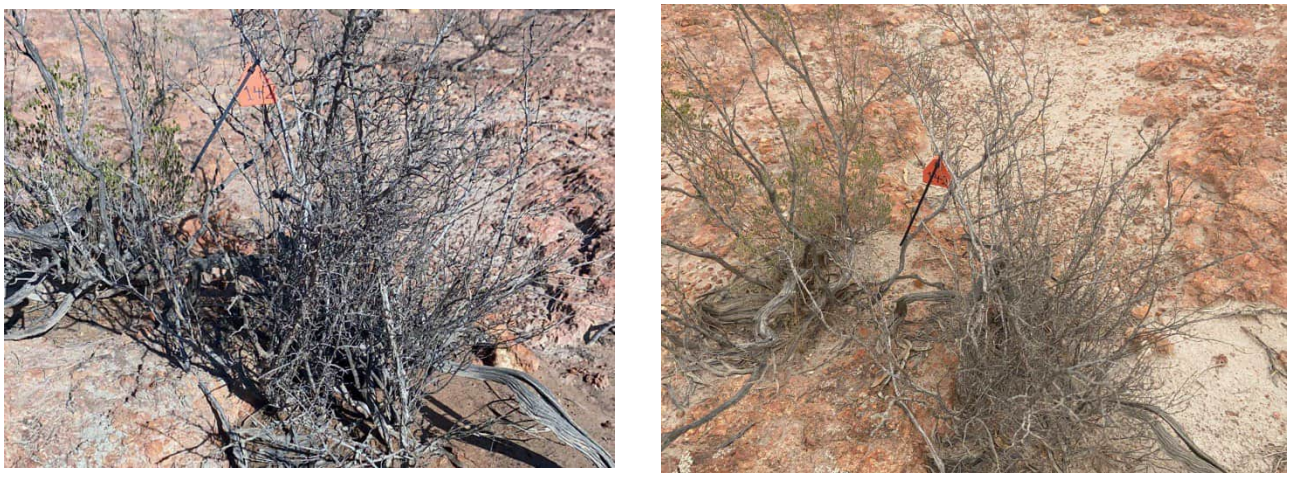


Figure 4-4: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) individual HSPSB_142, assessed as 'declining' in 2023 (left) and 'dead' in 2024 (right)

Figure 4-5: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) individual HSPSB_162, assessed as 'declining' in 2023 (left) and 'dead' in 2024 (right)

Figure 4-6: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) individual HSPSB_14, assessed as 'declining' in 2023 (left) and 'dead' in 2024 (right)

Figure 4-7: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) individual HSPSB_8, assessed as 'declining' in 2023 (left) and 'vegetative' in 2024 (right)

4.1.3 *Verticordia jamiesonii*

One impact and one control *Verticordia jamiesonii* site were monitored in 2024 (Table 3-2). Both sites are situated on the eastern side of the MKS haul road on the same granitoid breakaways and laterite capped hills as *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771). Each individual plant location is presented in Appendix C, with plant health scores and photographs from the November 2024 assessment presented in Appendix D, and long-term plant health scores presented in Appendix E.

Overall, plant health of *Verticordia jamiesonii* remained stable at the impact and control populations between 2023 to 2024 (Figure 4-8). At the impact site 4 individuals were listed as 'reproductive' (Figure 4-9) and one individual was not assessed in 2024. Plant health ratings at the control population were consistent between the November 2023 and 2024 assessments (Figure 4-8), however individuals did experience variations with some changing from 'vegetative' to 'declining' and vice versa (Figure 4-10, Figure 4-11). 'Reproductive' individuals have not been observed at the control site since 2022. No new plant deaths were observed at either control or impact populations in 2024.

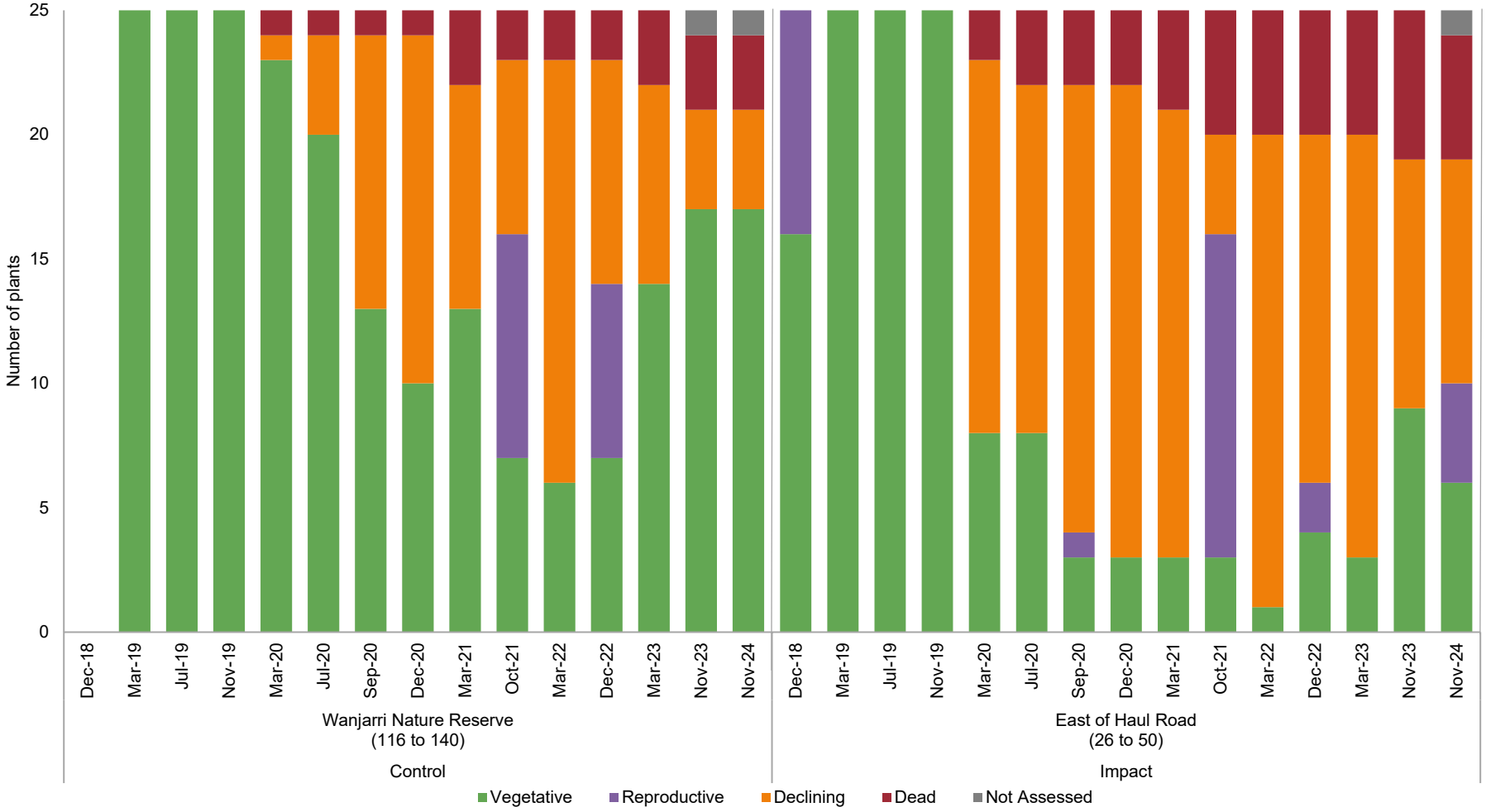


Figure 4-8: Number of *Verticordia jamiesonii* individuals within each plant health category across each impact and control site from 2018 to 2024

Figure 4-9: East of haul road *Verticordia jamiesonii* individual VJ_41, assessed in 2023 as 'vegetative' (left) and 'reproductive' in 2024 (right)

Figure 4-10: *Verticordia jamiesonii* individual VJ_139, assessed as 'vegetative' in 2023 (left) and 'declining' in 2024 (right)

Figure 4-11: *Verticordia jamiesonii* individual VJ_137, assessed as 'declining' in 2023 (left) and 'vegetative' in 2024 (right)

4.1.4 *Eremophila* sp. long pedicels (G. Cockerton 1975)

Eremophila sp. long pedicels (G. Cockerton 1975) was first discovered at NMK in 1996 and is locally abundant on hardpan plains and adjacent sandplains near the margins of drainage lines downstream of the NMK CDTSF (Figure 3-1). Two control sites have been assessed since July 2020, both situated along the north-western corner of Wanjarri Nature Reserve. No impact sites for this species have been identified. Prior to the July 2020 assessment, data on the health of individual plants was not collected, but descriptive data was recorded during the vegetation condition assessments (detailed in Stantec 2021). Each individual plant location is presented in Appendix C, with plant health scores and photographs from the November 2024 monitoring period presented in Appendix D. Long term plant health scores are provided in Appendix E.

Plant health at the control site located on the western edge of the Wanjarri Nature Reserve has declined since March 2022, with the number of 'declining' individuals increasing from 11 in 2023 to 16 in 2024 (Figure 4-12). One individual was recorded as 'reproductive' in the 2024 monitoring period. Four new deaths were recorded in the western population during the November 2024 monitoring round (Figure 4-13 to Figure 4-16), and one individual was not assessed.

The control site on the northern edge of the Wanjarri Nature Reserve noted a slight increase in plant health between November 2023 and November 2024, with three individuals improving from 'declining' to 'vegetative' (Figure 4-17, Figure 4-18). However, an additional death was recorded in 2024 (Figure 4-19), and two individuals could not be located and were not assessed in 2024.

Grazing and cattle tracks were noted at both control sites in 2024 and likely impacted the overall health of the populations. The disturbance likely resulted in the inability to locate several individuals in 2024 as well.

No impact site has been established for this species as there is no known population of this species close to the MKS disturbance footprint (Appendix A.1).

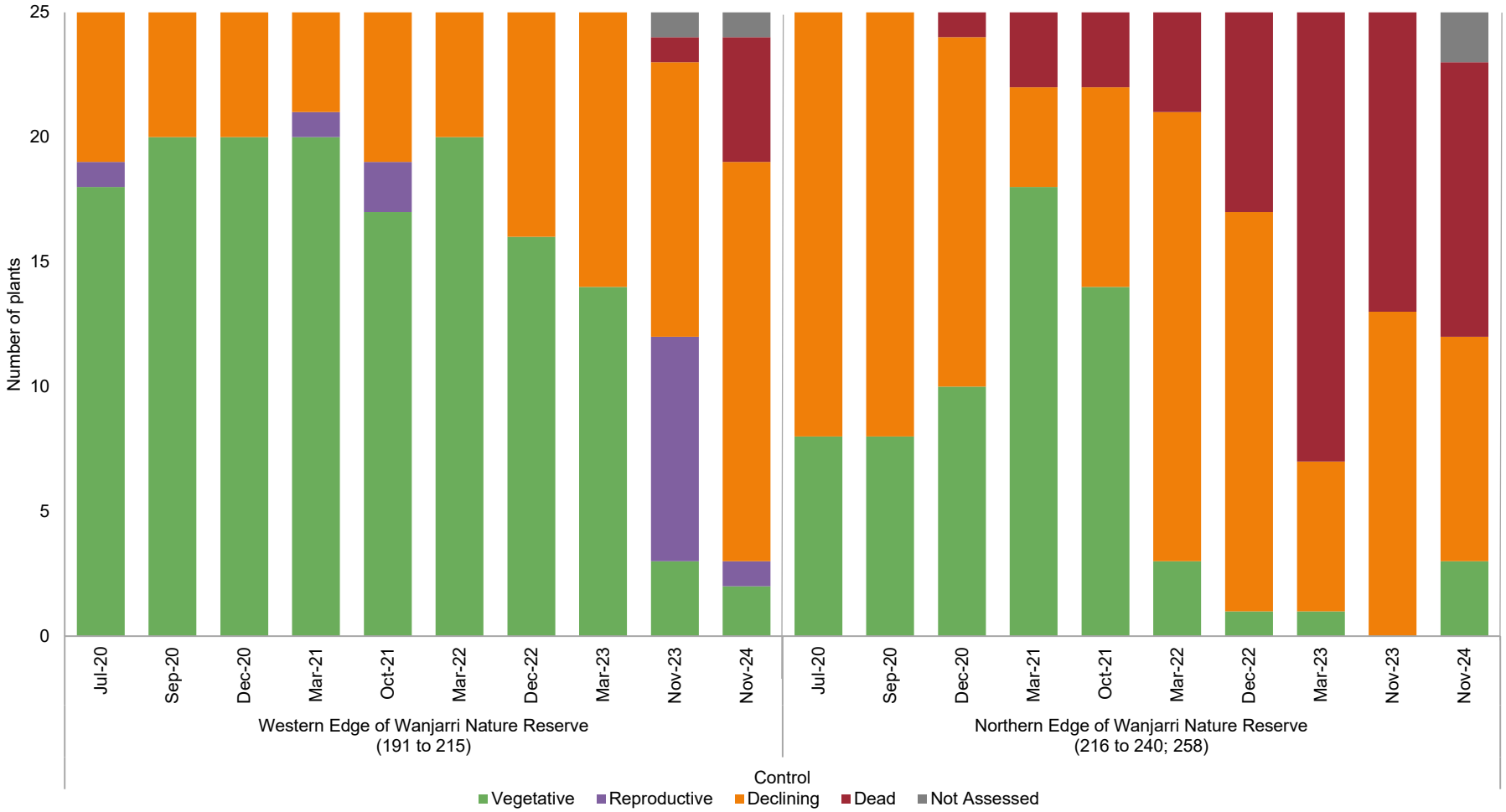


Figure 4-12: Number of *Eremophila* sp. long pedicels (G. Cockerton 1975) individuals within each plant health category across both control sites from 2020 to 2024.

Figure 4-13: *Eremophila* sp. long pedicels individual ESPLP_195 reported as 'declining' in 2023 (left) and 'dead' in 2024

Figure 4-14: *Eremophila* sp. long pedicels individual ESPLP_204 reported as 'declining' in 2023 (left) and 'dead' in November 2024

Figure 4-15: *Eremophila* sp. long pedicels individual ESPLP_213 reported as 'declining' in 2023 (left) and 'dead' in November 2024

Figure 4-16: *Eremophila* sp. long pedicels individual ESPLP_214 reported as 'declining' in 2023 (left) and 'dead' in 2024

Figure 4-17: *Eremophila* sp. long pedicels individual ESPLP_218 that improved in rating from 'declining' in 2023 (left) to 'vegetative' in November 2024 (right)

Figure 4-18: *Eremophila* sp. long pedicels individual ESPLP_227 that improved in rating from 'declining' in 2023 (left) to 'vegetative' in 2024 (right)

Figure 4-19: *Eremophila* sp. long pedicels individual ESPLP_220 that improved in rating from 'declining' in 2023 (left) to 'dead' in 2024 (right)

4.2 EIA Vegetation condition monitoring

In 2024, 35 out of 37 vegetation condition monitoring quadrats were assessed in 2024 as two infrastructure impact sites (MKSEAI 13 and MKSEAI 18) were not assessed in 2024 due to access restrictions. 2024 results by quadrat are provided in Appendix F, vegetation quadrat condition by area are provided in Appendix G, and species diversity results (2020 – 2024) are provided in Appendix H. Overall, vegetation condition ranged from 'excellent' to 'degraded' at the 23 assessed impact quadrats, and 'excellent' to 'good' at the 12 control quadrats monitored in 2024 (Figure 4-20 & Figure 4-21). Raw data is presented in Appendix F, and long-term species diversity data for the monitored quadrats presented in Appendix H. Since the previous assessments in 2023 and 2022, there was little change in the vegetation condition ratings for the sites monitored, however there was a slight decrease in the vegetation health in two of the haul road impact quadrats (Figure 4-22, Figure 4-23).

Overall, control quadrats had consistently higher health scores compared to impact sites, with quadrats rated as 'good' to 'excellent' The impact infrastructure quadrats had the lowest overall vegetation rating with 50% of the quadrats rated as 'good', 25% rated as 'very good' and the remaining 25% not assessed (Figure 4-20) The haul road impact sites had the most variation in vegetation condition with sites ranging from 'excellent' to 'degraded', 24% of the quadrats were rated as 'degraded' and 35% rated as 'excellent' Only two quadrats (MKS EIA 35 & MKS EIA 37) recorded declines in vegetation condition rating, both were haul road impact sites, all other transects had scores consistent with the previous assessment. No sites recorded overall improvement in vegetation condition scores in 2024.

While most sites had evidence of dust, the vegetation was in relatively good condition with little to no evidence of grazing pressure. Most sites were also relatively stable, with no substantial change in vegetation condition since the previous assessment. Overall species richness improved at most sites in 2024, while dominant species cover and health scores varied across sites (Appendix F, Appendix H). Most of the dominant species assessed across the impact and control quadrats in 2024 were considered 'reproductive' or 'vegetative' (Appendix F).

Acacia aneura was the most dominant species among the quadrats occurring at 14 of 35 sites in high percentage covers, including both the haul road impact, infrastructure impact and control sites (Appendix F). Trees and shrubs, particularly of the *Acacia* genera were consistently the dominating strata across quadrats. Perennial shrub, *Sida ectogama* was also common amongst quadrats occurring at 12 sites in ranging percentage covers (Appendix F).

Priority 2 species *Eremophila* sp. long pedicels (G. Cockerton 1975) was observed at two of the control sites (MKSEIA 19 and 20) at relatively high cover, however it was observed as stressed and in poor health. Priority 4 species' *Eremophila pungens* and *Grevillea inconspicua* were also listed as a dominant species at one haul road impact site and one infrastructure impact site respectively (MKS EIA 5 & MKS EIA 12). *Thryptomene decussata* (W.Fitzg.) (previously named *Thryptomene* sp. Leinster (B.J. Lepschi & L.A. Craven 4362)), was listed as a dominant species at eight quadrats in 2024 (Appendix F). This species was previously listed as a Priority 3 species, however following formal naming its priority status was dropped (Western Australian Herbarium, 2024).

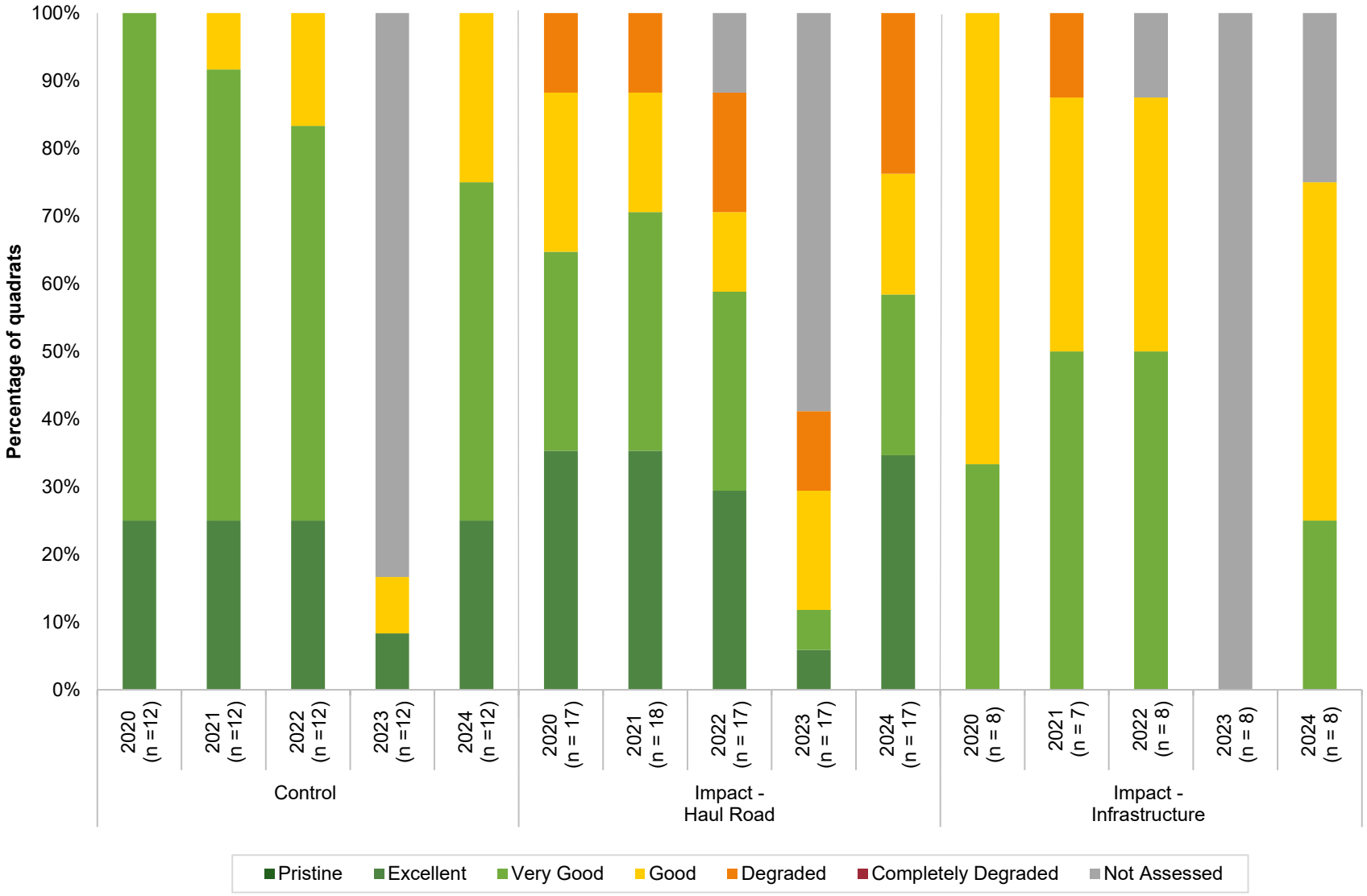


Figure 4-20: Percentage of impact and control quadrats within each vegetation condition category between 2020 and 2024.

Figure 4-21: Examples of the range in vegetation condition across the vegetation quadrats assessed in 2024; MKS EIA 19 (left) was rated 'excellent' while MKS EIA 4 (right) was rated 'degraded'

Figure 4-22: MKS EIA 35 decreased from 'good' in 2023 (left) to 'degraded' in 2024 (right)

Figure 4-23: MKS EIA 37 decreased from 'very good' in 2023 (left) to 'good' in 2024 (right)

4.3 Soil analysis results

4.3.1 Soil pH

The soil pH provides a measure of the activity of hydrogen ions in a soil solution made from a 1:5 soil to liquid suspension. Soil pH (H_20) at the Impact sites ranged between pH 6.7 and 8.3, and were classified as 'neutral' to 'moderately alkaline' (Van Gool, Tille, and Moore, 2005). In comparison, soil pH (H_20) at all Control sites ranged between pH 5.8 and 5.9 and were classified as 'moderately acidic' (Figure 4-24, Appendix I). All Impact sites reported higher pH values than the Control sites (Figure 4-24).

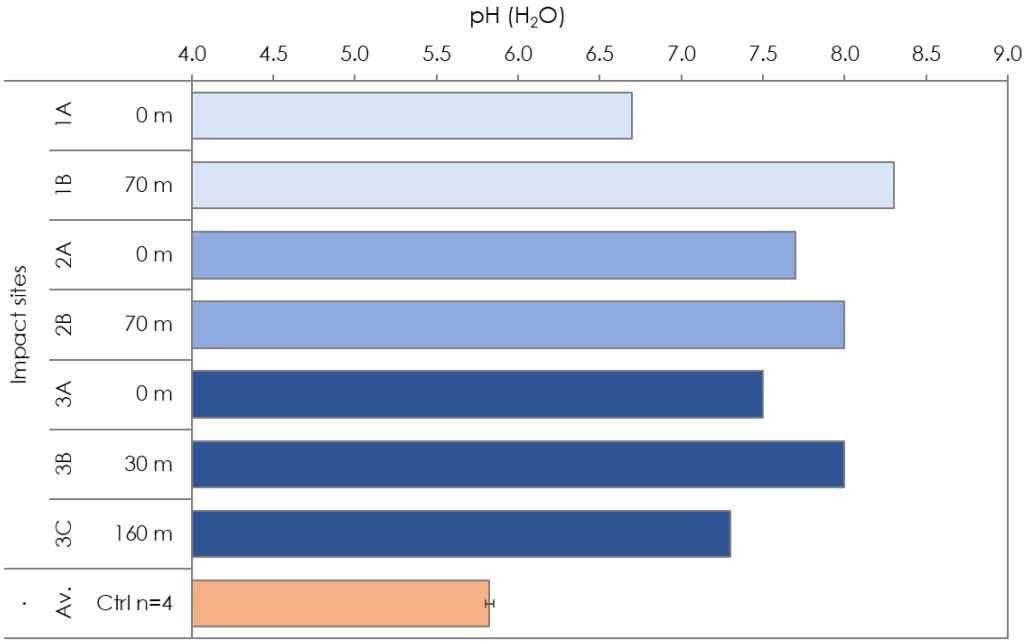


Figure 4-24: Individual and average soil pH (H_2O) results for the Haul Road Impact and Control sites (error bars represent standard error)

4.3.2 Soil salinity (electrical conductivity)

Soil salinity, or electrical conductivity (EC), is a measure of the amount of readily soluble salts in soil and soil pore water (Moore, 1998). Soil EC results at the Impact sites ranged between 0.02 and 1.31 deci-siemens per metre (dS/m) and were all classed as 'non-saline' to 'very saline' based on the standard USDA and CSIRO classes (Hunt and Gilkes, 1992). In comparison, soil EC results at the Control sites ranged between 0.02 and 0.03 dS/m (Appendix I) and were all classed as 'non-saline'.

A strong relationship between distance from the haul road and soil EC was observed. Soil EC was higher at the sample sites closest to haul road ('A') ranging between 0.49 and 1.31 d/Sm, compared with sample points further from the haul road ('B' and 'C'), ranging between 0.02 and 0.16 d/Sm (Figure 4-25). Impact Site 3C (furthest from the haul road) reported a soil EC result similar to the Control site average, while all other Impact sites reported results higher than that of the Control sites (Figure 4-25).

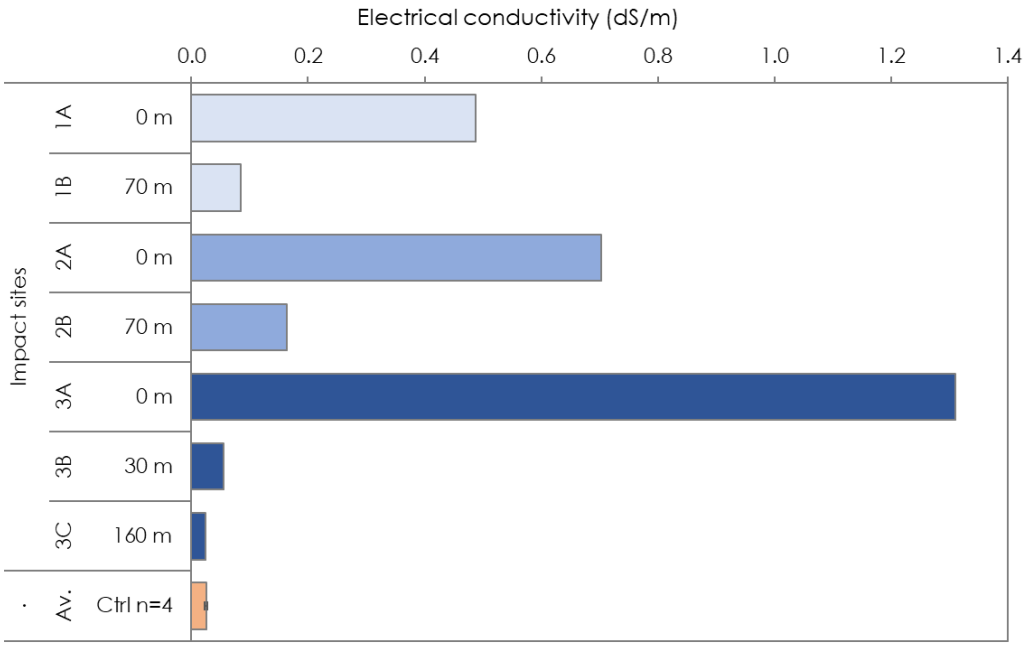


Figure 4-25: Individual and average soil electrical conductivity (dS/m) results for the Haul Road Impact and Control sites (error bars represent standard error)

4.3.3 Soil moisture

In 2024, soil moisture ranged between <1.0% and 3.9% at the Impact sites, and <1.0% at the Control sites (Appendix I). The majority of the Impact sites and all of the Control sites reported soil moisture levels below the limit of reporting (<1.0%).

4.3.4 Total metal concentrations

The majority of metals occur in inert forms in soils and rocks and only become available to plants and animals if they are chemically altered during oxidation reactions, or if severe weathering events occur (Hazelton & Murphy, 2007). Total concentrations of heavy metals in soil samples were screened against the NEPM (NEPM, 2013) calculated site-specific EILs for aged contaminants that apply to 99% protection of areas of ecological significance, and the ANZECC guidelines for Fresh and Marine Water Quality (ANZECC, 2000) ISQG low and high probable effects values. It is noted that for the purposes of this study, an exceedance of a trigger value under the guideline does not indicate a concentration of environment significance, but rather an indication that the natural surface soils are enriched with respect to that element.

Total concentrations of arsenic (As), beryllium (Be), boron (B), cadmium (Cd), lead (Pb), selenium (Se) and mercury (Hg) were not detected above the LOR in the majority of the Impact and Control site samples analysed. Additionally, concentrations of barium (Ba) and cobalt (Co) were not detected in the Control site samples analysed (Table 4-1). Exceedances of environmental criteria, based on the EIL, related to the Mt Keith site-specific calculated EIL values, as well as the ISQG – Low and ISQG – High level exceedances, were as follows:

- Chromium (Cr) exceeded the ISQG – low level in all seven (7) Impact site samples.
- Nickel (Ni) exceeded the site-specific calculated EIL level in all seven (7) Impact site samples. All seven (7) Impact site samples also exceeded the ISQG – low level for Ni, and six (6) samples further exceeded the ISQG – high level for Ni.

Table 4-1: Total metal concentrations analytical results

Sample Site			Total metal concentrations (mg/kg)														
			As	Ba	Be	B	Cd	Cr	Co	Cu	Pb	Mn	Ni	Se	Vn	Zn	Hg
LOR (mg/kg)			<5	<10	<1	<50	<1	<2	<2	<5	<5	<5	<2	<5	<5	<5	<0.1
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EIL – Site Specific			40	-	-	-	-	**170**	-	**30**	**480**	-	**15**	-	-	**35**	-
ISQG - Low			20	-	-	-	**1.5**	**80**	-	**65**	**50**	-	**21**	-	-	**200**	**0.15**
ISQG - High			70	-	-	-	**10**	**370**	-	**270**	**220**	-	**52**	-	-	**410**	**1**
Impact Site 1	1A	0 m	<5	**40**	<1	<50	<1	**82**	**6**	**16**	<5	**111**	**96**	<5	**58**	**11**	<0.1
	1B	70 m	<5	**20**	<1	<50	<1	**137**	**10**	**17**	<5	**140**	**176**	<5	**80**	**15**	<0.1
Impact Site 2	2A	0 m	<5	**110**	<1	<50	<1	**94**	**14**	**26**	**5**	**474**	**100**	<5	**67**	**14**	<0.1
	2B	70 m	<5	**90**	<1	<50	<1	**113**	**13**	**27**	<5	**297**	**142**	<5	**62**	**18**	<0.1
Impact Site 3	3A	0 m	<5	**200**	<1	<50	<1	**108**	**12**	**25**	<5	**268**	**188**	<5	**65**	**13**	<0.1
	3B	30 m	<5	**70**	<1	<50	<1	**96**	**5**	**19**	<5	**155**	**66**	<5	**71**	**8**	<0.1
	3C	160 m	<5	<10	<1	<50	<1	**94**	**3**	**9**	<5	**90**	**24**	<5	**49**	**10**	<0.1
Control (average)			<5	<10	<1	<50	<1	**67.0 ± 3.5**	<2	**8.3 ± 0.3**	<5	**76.3 ± 8.2**	**7.3 ± 1.3**	<5	**40.3 ± 0.6**	**10.0 ± 0.7**	<0.1

Notes:
Exceeds the NEPM (2013) site-specific calculated EIL for protection of areas of ecological significance
Exceeds the ANZECC ISQG-Low (Trigger value)
Exceeds the ANZECC ISQG-High (Trigger value)

A notable relationship was observed between several heavy metal concentrations and the site distance from the haul road, specifically barium (Ba), copper (Cu) and nickel (Ni). Barium (Ba) concentrations decreased with increasing distance away from the haul road (Figure 4-26). It should be noted that no specific screening guideline value has been determined for total concentrations of Ba (NEPM, 2013).

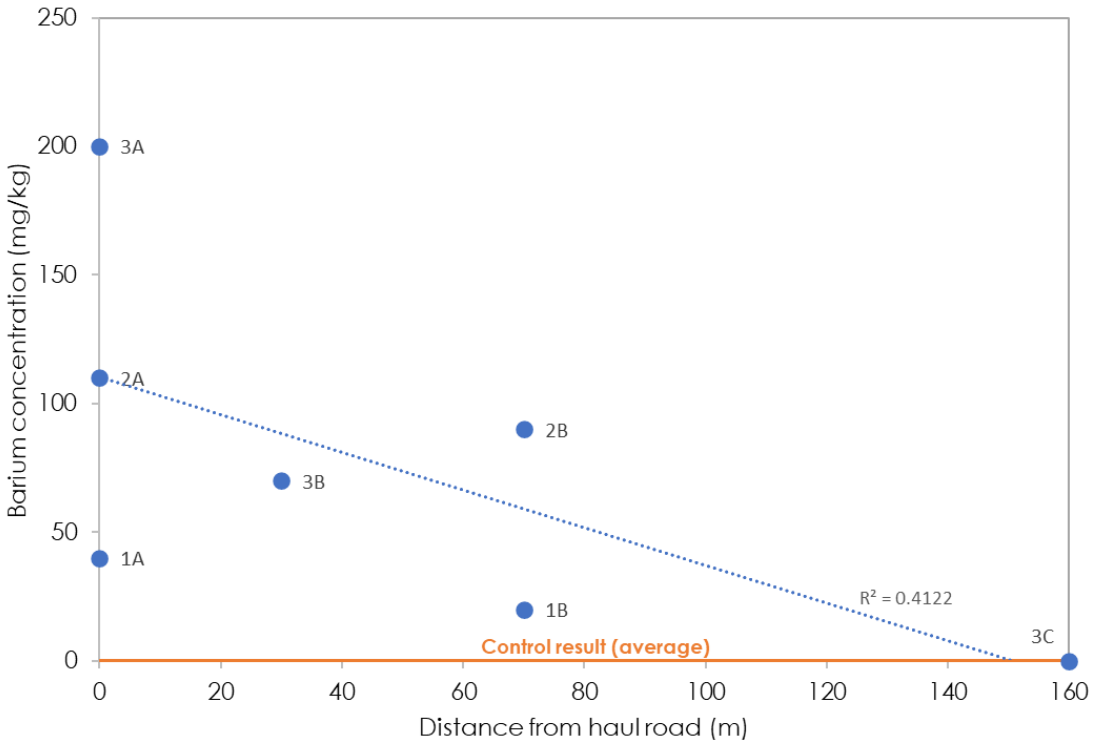
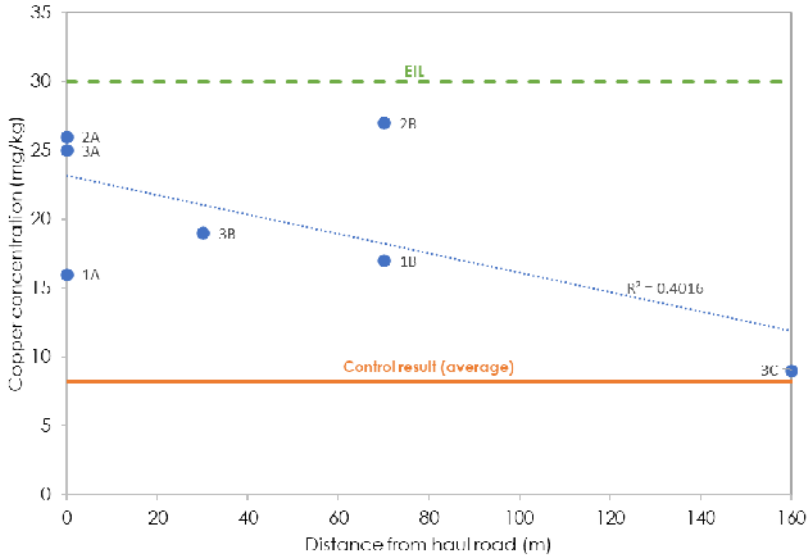


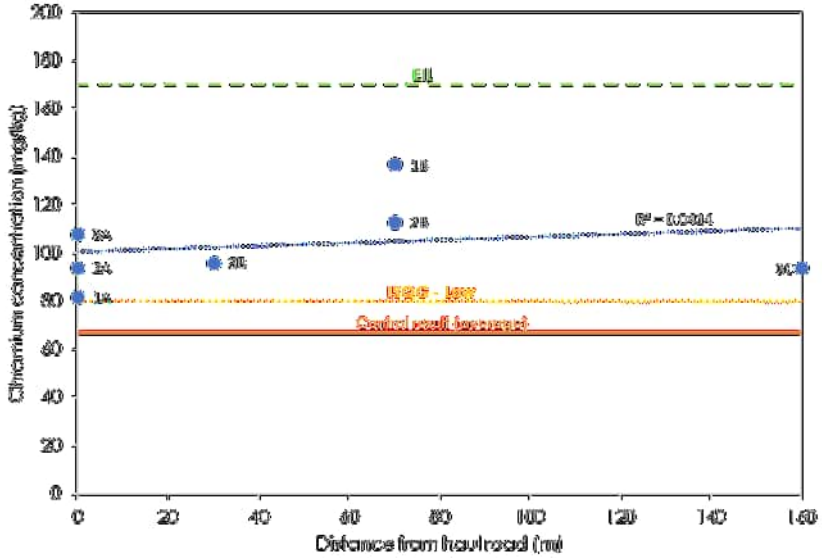
Figure 4-26: Individual and average total barium concentrations (mg/kg) results for the Haul Road Impact and Control sites (R^2 value = relationship between result and distance from Haul Road)

Similarly to barium, total concentrations of copper (Cu) and nickel (Ni) decreased with increasing distance away from the haul road (Figure 4-26). Total concentrations of Cu in Impact sites were greater than that of the Control sites, however did not exceed to relevant screening guideline. Total concentrations of Ni in Impact sites were both greater than that of the Control sites and exceeded the relevant screening guidelines.

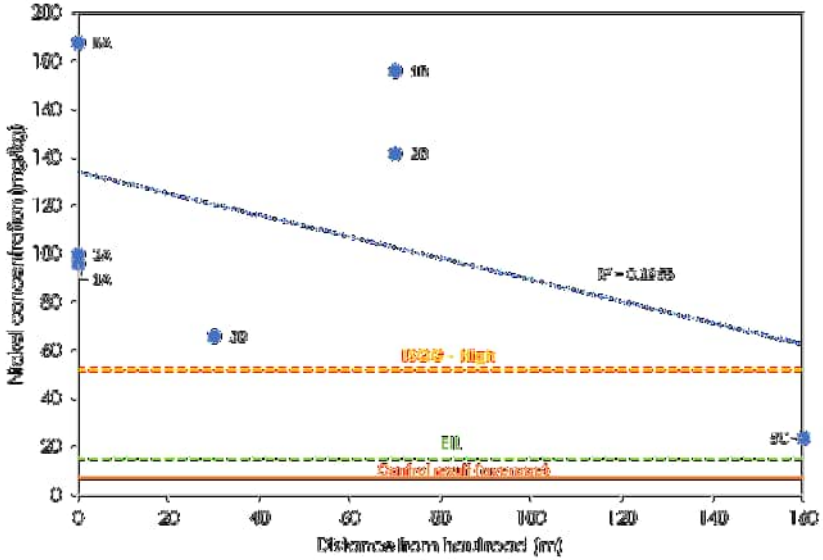
There was no notable relationship between total concentrations of chromium (Cr), zinc (Zn) and the site distance from the haul road (Figure 4-26). Total concentrations of Cr in Impact sites were both greater than that of the Control sites and exceeded the relevant screening guideline. However, total concentrations of Zn in Impact sites were variable and did not exceed the relevant screening guidelines.



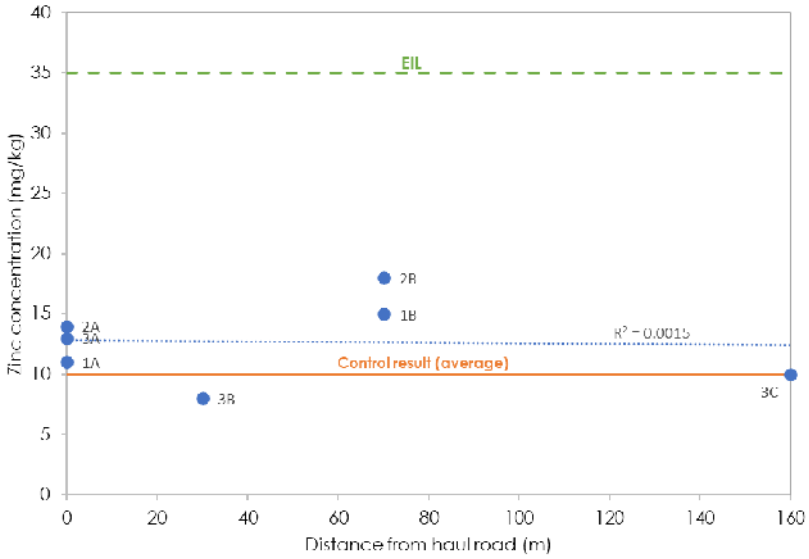
(a) Total copper concentrations



(b) Total chromium concentrations



(c) Total nickel concentrations



(d) Total zinc concentrations

Figure 4-27: Individual and average total copper (a), total chromium (b), total nickel (c) and total zinc (d) concentration (mg/kg) results for the Haul Road Impact and Control sites (R^2 value = relationship between result and distance from Haul Road)

4.3.5 Geochemical Abundance Index (GAI)

The GAI is a screening tool (DER, 2014) which compares elemental concentrations to known crustal abundances and can flag potential issues that warrant additional investigation (see **Appendix I** for methods). Elemental enrichment is, considered to be, common in mineralised areas. The GAI threshold for the analysed elements is 3.

The GAI analysis indicated no potential elemental toxicity in any of the samples analysed from the Impact or Control sites in 2024.

5. Conclusions and recommendations

5.1 Priority flora monitoring

Between November 2023 and November 2024, plant health at the Mt Keith Satellite Priority Flora populations varied, despite the region recording above average annual rainfall in the 12 months prior to monitoring (Section 2).

There were two new deaths in each of the *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) and *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) impact populations, and five new deaths in the *Eremophila* sp. long pedicels (G. Cockerton 1975) control populations, while health at the *Verticordia jamiesonii* impact and control populations remained stable or improved (Table 5-1). The *Pigea* sp. Chloroxantha control population was not monitored in 2024 due to access restrictions.

Deaths in the *Eremophila* sp. long pedicels population can likely be attributed to grazing and cattle tracks that were noted at both control sites in 2024. The disturbance may also have resulted difficultly locating several individuals in 2024. Across all priority flora populations, it is recommended that should the individuals not be located after two monitoring rounds, they be replaced by a new individual in the respective population (Appendix A.1).

Table 5-1: Summary of the Priority flora condition by population between 2023 and 2024. Grey shading indicates a populations that were not monitored in 2024.

Species	Site Type	Location	Summary 2024 results
Pigea sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) (P3)	Impact	South-west of Six Mile Well Pit	• Increase in vegetative individuals • One individual not located
		West of Six Mile Well Pit	• Three individuals not located • One new death
	Control	South of Six Mile Well Pit	• Not monitored in 2024 due to access restrictions
Hibbertia sp. Sherwood Breakaways (R.J. Cranfield 6771) (P2)	Impact	East of haul road	• Increase in declining individuals • Two individuals not located • One new death
		West of haul road	• Increase in vegetative individuals • One new death
	Control	Wanjarri Nature Reserve	• Increase in declining individuals
		Far West of haul road	• Increase in vegetative individuals
Verticordia jamiesonii (P3)	Impact	East of haul road	• Increase in reproducing individuals • Decrease in declining individuals • One individual not located
	Control	Wanjarri Nature Reserve	• Stable plant health
Eremophila sp. long pedicels (G. Cockerton 1975) (P2)	Control	Western edge of Wanjarri Nature Reserve	• Increase in declining individuals • One reproducing individual • Four new deaths
		Northern edge of Wanjarri Nature Reserve	• Increase in vegetative individuals • Two individuals not located • One new death

5.3 EIA Vegetation condition monitoring

In 2024, 35 of the 37 vegetation condition monitoring quadrats were monitored, including 23 impacts sites and 12 control sites (Table 5-2). Two impact sites (MKSEAI 13 and MKSEAI 18) could not be monitored due access restrictions. For the remaining quadrats, vegetation condition ratings ranged from 'excellent' to 'degraded' across impact and control quadrats with condition ratings consistent with previous assessment results, with the exception of two haul road impact quadrats (MKSEIA 35 and MKSEIA 37) that decreased in condition rating due to a reduction of plant cover or deaths of lower storey plants impacting overall vegetation structure.

Plant health ratings of the dominant species within quadrats varied in 2024, however were generally similar to the 2023 assessment. While most sites observed evidence of dust, vegetation was in relatively good condition with little to no evidence of grazing pressure. Most sites were stable with minimal changes in vegetation condition since the previous year monitored. Overall, species richness improved at most sites in 2024, while dominant species cover and health scores varied across sites. Trees and shrubs, particularly of the *Acacia* genera, were consistently the dominating strata across quadrats. Perennial shrub species *Sida ectogama,* was also common amongst quadrats occurring at 12 sites at varying cover. Pastoral activities were considered unlikely to have a notable impact on vegetation condition in 2024, with only historical grazing observed at the control and impact quadrats. No weeds were recorded at any of the quadrats assessed in 2024.

Table 5-2: Summary of vegetation condition in 2024 compared to previous assessment, where green cells indicate an increase in vegetation condition rating, red cells indicate a decrease in vegetation condition rating, grey shading indicates quadrats that were not assessed, and cells not highlighted indicate no change.

Disturbance Category	Monitoring Site Name	Vegetation Condition Rating	Grazing	Weed Cover (%)
Impact – Haul Road	MKSEIA 1	Degraded	Light	Nil
	MKSEIA 2	Good	Light - Historic	Nil
	MKSEIA 3	Degraded	Nil	Nil
	MKSEIA 4	Degraded	Nil	Nil
	MKSEIA 5	Very Good	Light - Historic	Nil
	MKSEIA 6	Excellent	Light	Nil
	MKSEIA 7	Very Good	Light - Historic	Nil
	MKSEIA 8	Very Good	Light	Nil
	MKSEIA 9	Excellent	Nil	Nil
	MKSEIA 23	Excellent	Light - Historic	Nil
	MKSEIA 24	Excellent	Light	Nil
	MKSEIA 25	Excellent	Nil	Nil
	MKSEIA 26	Excellent	Nil	Nil
	MKSEIA 27	Very Good	Nil	Nil
	MKSEIA 35	Degraded	Minor	Nil
	MKSEIA 36	Good	Light - Historic	Nil
	MKSEIA 37	Good	Nil	Nil
Impact - Infrastructure	MKSEIA 10	Good	Light	Nil
	MKSEIA 11	Good	Light - Historic	Nil
	MKSEIA 12	Good	Light	Nil
	MKSEIA 13	Not Assessed	-	-
	MKSEIA 14	Good	Light	Nil
	MKSEIA 15	Very Good	Light - Historic	Nil
	MKSEIA 16	Very Good	Light - Historic	Nil
	MKSEIA 18	Not Assessed	-	-
Control	MKSEIA 19	Excellent	Light	Nil
	MKSEIA 20	Good	Moderate	Nil

Disturbance Category	Monitoring Site Name	Vegetation Condition Rating	Grazing	Weed Cover (%)
	MKSEIA 21	Very Good	Moderate	Nil
	MKSEIA 22	Good	Light - Historic	Nil
	MKSEIA 28	Very Good	Light	Nil
	MKSEIA 29	Very Good	Light	Nil
	MKSEIA 30	Very Good	Historic	Nil
	MKSEIA 31	Very Good	Light - Historic	Nil
	MKSEIA 32	Excellent	Light	Nil
	MKSEIA 33	Good	Light	Nil
	MKSEIA 34	Excellent	Light	Nil
	MKSEIA 38	Very Good	Light - Historic	Nil

5.4 Soil analysis

Overall, the results of the soil analyses suggest that potential impacts from the Mt Keith Satellite Haul Road may be contributing to changes in pH and EC and increased concentrations of several total metals (Ba, Cu, Cr and Ni) in the soil adjacent to, and extending from, the haul road.

All Impact sites reported higher pH values (ranging from 'neutral' to 'moderately alkaline') than that of the Control sites ('moderately acidic'). A strong relationship between increasing distance from the haul road and EC was observed. EC results were higher, and therefore the soils were more saline, in the Impact sites located adjacent to the haul road. EC results decreased as distance from the haul road increased. Soil salinity classifications ranged from 'non-saline' to 'very saline' at the Impact sites, with the Impact site located furthest from the haul road (3C) reporting a similar EC result to the Control sites (all classed as 'non-saline').

It is recommended that the soil assessment around the haul road continues to be conducted annually, to ensure changes in vegetation condition and soil characteristics are identified. The soil assessment provides a more quantitative and robust measure of the severity and extent of potential impacts of the haul road and should continue to be undertaken to observe any changes in soil over time. It is recommended that additional soil sample points be added, bringing the total to three per Impact Site. This will provide more replicates and enhance the reliability of the findings. Furthermore, expanding the number of sample points along the creek line within the designated Impact sites will offer a more accurate representation of the dynamic processes of soil displacement and erosion. Additionally, for comparative purposes, it is suggested that a Control Site be selected near the impacted areas and the material used to construct the haul road is analysed for the same properties as the Impact and Control sites.

6. References

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volume 1. October. Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand.

Beard J.S. (1990). *Plant Life of Western Australia*. Kangaroo Press, Kenthurst, NSW.

BHP Nickel West (2019). *Flora and Vegetation Environmental Management Plan – Mt Keith Satellite Project*. January 2019.

Bureau of Meteorology (BOM) (2025). *Bureau of Meteorology* online. Available online at http://www.bom.gov.au

Cowan, M. (2001). *Murchison 1 (MUR1-East Murchison subregion). In: M. Cowan (ed) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Report published by the Department of Conservation and Land Management, Perth, Western Australia., pp 466-479

Department of Agriculture, Water and the Environment (2012). *Interim Biogeographic Regionalisation for Australia (IBRA) Version 7 – bioregions and subregions*. Available online: https://www.environment.gov.au/land/nrs/science/ibra#ibra

Department of Environmental Regulation (DER) (2014) Contaminated Sites Guidelines – Assessment and Management of Contaminated Sites. December. Department of Environment Regulation.

DPIRD (2022). Measuring soil salinity. Department of Primary Industries and Regional Development. Accessed on August 21 2023, at https://www.agric.wa.gov.au/soil-salinity/measuring-soil-salinity

Hazelton, P., & Murphy, B. (2007) Interpreting Soils Test Resulting. What Do All the Numbers Mean? CSIRO Publishing, Australia.

Hunt, N., & Gilkes, R. (1992). *Farm monitoring handbook: a practical down-to-earth manual for farmers and other land users.* Perth, Western Australia: University of Western Australia.

EPA, Environmental Protection Authority. (2016). *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*. Environmental Protection Authority, Western Australia.

Keighery, B.J. (1994). *Bushland Plant Survey*. A Guide to Plant Community Survey for the Community Wildflower Society of WA (Inc.). Nedlands, Western Australia.

Maslin B.R. and Reid J. (Keighery & Australia)E. (2012). *A taxonomic revision of Mulga (Acacia aneura and its close relatives: Fabaceae) in Western Australia*. Nuytsia: The Journal of the Western Australian Herbarium, Issue 22 (4), pp 129-267. Department of Parks and Wildlife, Western Australia.

Moore, G. (1998). *Soil guide. A handbook for understanding and managing agricultural soils. Bulletin No. 4343.* Perth Western Australia: Agriculture Western Australia.

NEPM (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (amendment No. 1, 2013). Australian Government - Environment.

Pringle H.J.R, Van Vreeswyk A.M.E., and Gillian S.A. (1994). *An Inventory and Condition Survey of Rangelands in the North-Eastern Goldfields, Western Australia*. Technical Bulletin No. 87. Department of Agriculture, Perth.

Stantec (2021). *Mt Keith Satellite 2021 Flora and Vegetation Monitoring Repor*t. Prepared for BHP Nickel West. March 2022.

Western Australian Herbarium (2024). *FloraBase*. Department of Biodiversity, Conservation and Attractions. Available online at https://florabase.dpaw.wa.gov.au

Western Botanical (2017). *Flora and Vegetation Assessment of the Mt Keith Satellite Proposal Study Area*. Prepared for BHP Nickel West. October 2017.

Van Gool, D., Tille, P., & Moore, G. (2005). *Land evaluation standards for land resource mapping. Third Edition. Resource Management Technical Report 298.* Perth, Western Australia: Department of Agriculture.

Appendices

Appendix A EIA Vegetation condition and Priority flora monitoring method limitations

A.1 Priority flora monitoring

The desktop assessment and on-ground verification conducted during the 2020 assessment determined that no impact sites of *Eremophila* sp. long pedicels (G. Cockerton 1975) had been established since there were no plants/extant sites of this taxon within or adjacent to MKS. Without an *Eremophila* sp. long pedicels (G. Cockerton 1975) impact site, the inclusion of this species in the monitoring program cannot contribute to overall conclusions of Priority Flora health within the potential impact area of the MKS project.

The position of the *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) control site was likely too close to the MKS project to provide a reliable comparison of plant health between control and impact sites of that taxa. The control site was approximately 450m downstream of the MKS project and recorded dust deposition as well as lower plant health scores compared to its respective impact sites (located less than 230m from the MKS project).

Certain factors should be considered when assessing change in plant health scores between monitoring rounds. A decline in plant health (or mortality) may occur at either 'impact' or 'control' sites for reasons other than the environmental effects of the MKS project. Non-project related disturbances may include climate factors (e.g., rainfall, wind) which may have localised effects depending on vegetation or soil properties or geology and topography or anthropogenic factors such as pastoral activities (e.g. grazing, weed spreading or dust-generation through track use). Where possible, observable differences related to non-project disturbances, for example recent grazing activity, were recorded during field monitoring.

With the inclusion of both mature and juvenile individuals at each impact and control Priority Flora site it may also be expected that some mature individuals will naturally decline in health and senesce (reach mortality) over multiple years of monitoring across both impact and control sites. When plants reach mortality they are not immediately replaced, but are retained in the dataset. While this tracks the number of dead plants at the location over time, it does not provide an indication of new individuals that may have emerged since December 2018. In the event a dead plant can no longer be visibly located and assessed, sampling intensity can be maintained by including new individuals at the site where feasible.

Stantec continues to use the plant health scale historically used by Western Botanical. It is noted as a qualitative measure of plant health, although the measurable quantitative aspect is lost during the plants reproductive stage. The reproductive stage of an individual may not be an accurate measurement of condition but rather a stage of the lifecycle. An individual may be improving or declining in condition, all while going through its reproductive stages. Additionally, flowering times did not always align with November assessments, resulting in variability in quantity of reproductive plants at Priority Flora sites. Note that the presence of reproductive features does not reflect improvements within the population's health, rather its maturity and evidence of reproduction.

A.2 Vegetation condition assessment

Between December 2018 and March 2020, only descriptive data on vegetation condition was collected quarterly for each quadrat. However, the revised methodology introduced in September 2020 incorporates previously collected descriptive data, listed in Stantec (2021), with quantitative comparisons of vegetation condition, plant cover, and plant health between quadrats. This may limit overall conclusions on whether vegetation condition has been impacted by mining disturbances since the previous data was unstandardized between assessments.

There are limitations associated with the use of plant health scores and vegetation condition ratings in assessing the impact of mining disturbance on vegetation. Primarily, the assignment of vegetation condition ratings can vary based on the assessor, the time of year the assessment was made and the amount of time since the initial disturbance (EPA 2016). It is also partially influenced by the assessor's previous knowledge of what that vegetation looked like historically and how that vegetation type would appear when it is in good condition (EPA 2016).

Appendix B EIA Vegetation condition assessment criteria

Table B-1: Observable Plant Condition Scale (BHP Nickel West 2019)

Category	Score	Descriptor	Prevailing Conditions	Observations
Vegetative	**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.
Reproductive	**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.
Declining	**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).
Dead	**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 B-2: Vegetation Condition Scale (Keighery, 1994)

Category	Description
Pristine	Pristine or nearly so. No obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix C Priority Flora plant health score maps November 2024

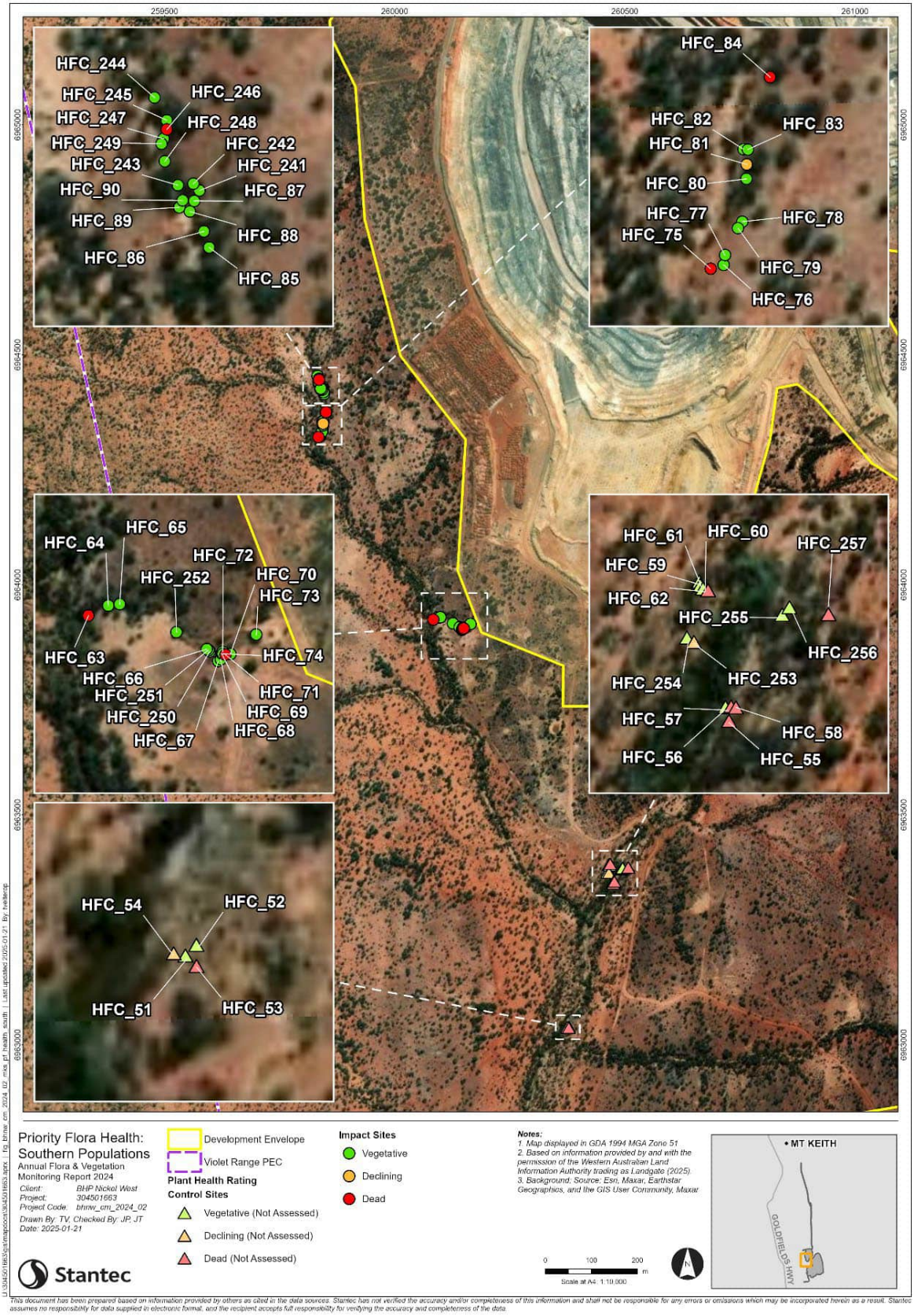


Figure C-1: Visual representation of the plant health scores of all *Pigea* sp. Chloroxantha (E. Bennet & D. Bright EUC 1810) individuals assessed in November 2024

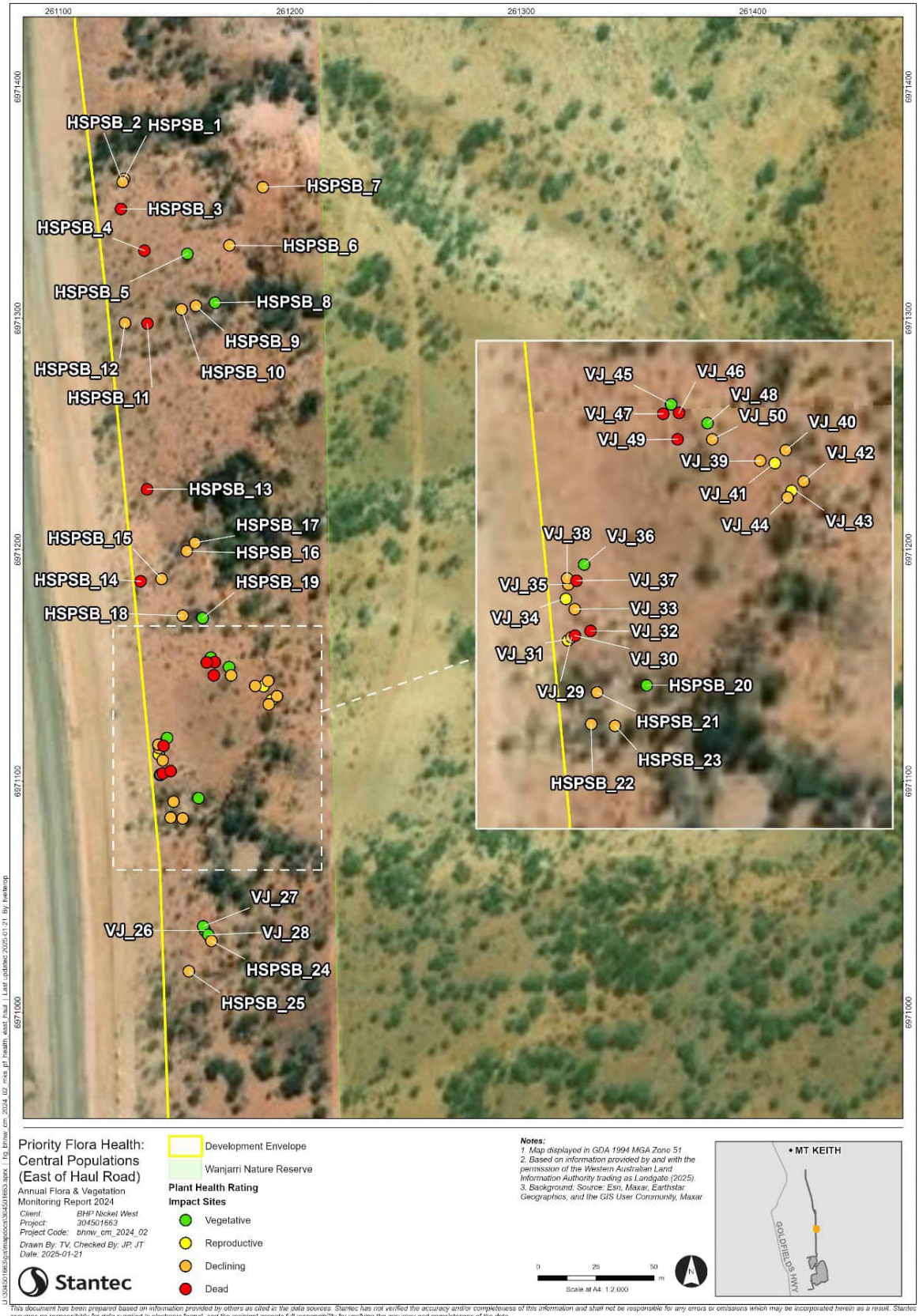


Figure C-2: Visual representation of the plant health scores of Hibbertia sp. Sherwood Breakaways and Verticordia jamiesonii individuals East of the haul road, assessed in November 2024

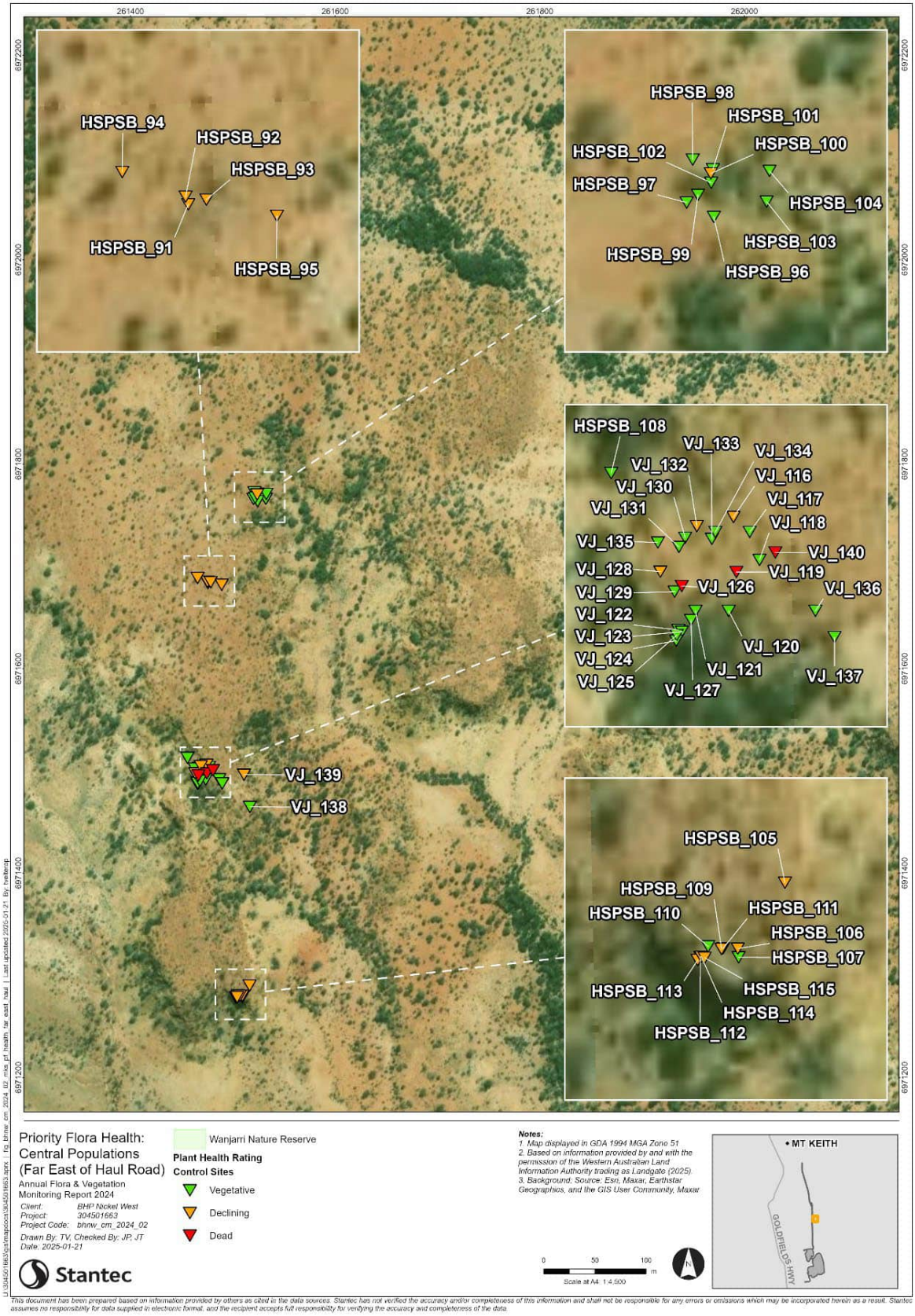


Figure C-3: Visual representation of the plant health scores of Hibbertia sp. Sherwood Breakaways and Verticordia jamiesonii individuals far East of the haul road, assessed in November 2024

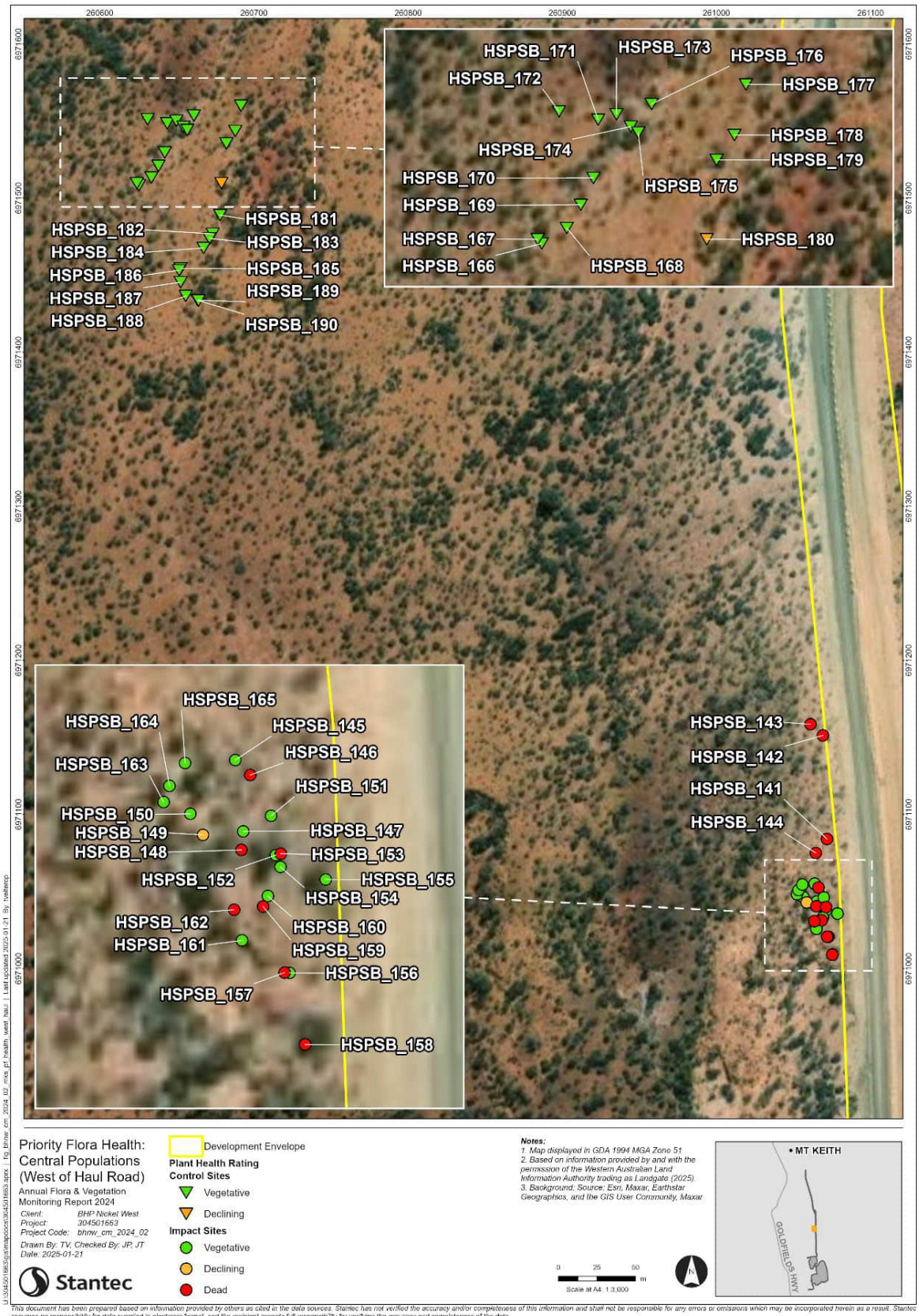


Figure C-4: Visual representation of the plant health scores of Hibbertia sp. Sherwood Breakaways individuals West of the haul road, assessed in November 2024

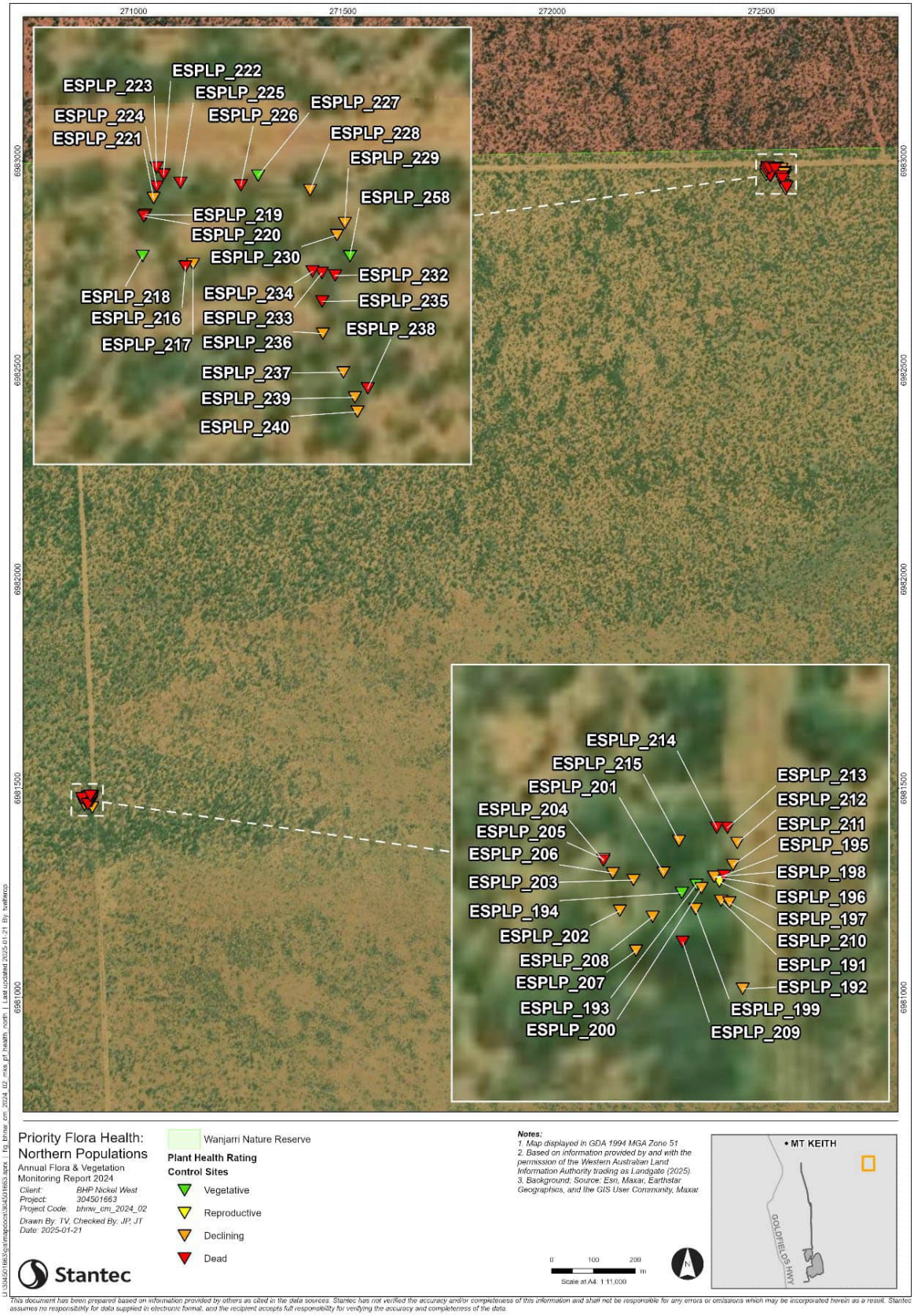


Figure C-5: Visual representation of the plant health scores of Eremophila sp. long pedicels individuals assessed in November 2024

Appendix D Priority Flora individual plant photographs and health ratings in November 2024

D.1 *Pigea* sp. Chloroxantha (E. Bennet & D. Bright EUC 1810)

Table D-1: Photograph and plant health rating of Pigea sp. Chloroxantha (E. Bennet & D. Bright EUC 1810) individuals located at the control site South of Six Mile Well Pit for the November 2023 assessment. Individuals were not monitored in 2024 due to access issues

Site: Control, South of Six Mile Well Pit (Tag ID 51 to 62 and 253 to 257)					
Tag ID	HFC_51	HFC_52	HFC_53	HFC_54	HFC_55
Photo			NA (Not located)		NA (Not located)
Category (score)	NA (Vegetative (7a)	NA (Vegetative (7b)	NA (Dead (1)	NA (Declining (2)	NA (Dead (1)
Tag ID	HFC_56	HFC_57	HFC_58	HFC_59	HFC_60
Photo			NA (Not located)		
Category (score)	NA (Vegetative (7b)	NA (Dead (1)	NA (Dead (1)	NA (Vegetative (7d)	NA (Dead (1)

Site: Control, South of Six Mile Well Pit (Tag ID 51 to 62 and 253 to 257)					
Tag ID	HFC_61	HFC_62	HFC_253	HFC_254	HFC_255
Photo					
Category (score)	NA (Vegetative (7c)	NA (Vegetative (7d)	NA (Declining (2)	NA (Vegetative (7d)	NA (Vegetative (7a)
Tag ID	HFC_256	HFC_257			
Photo					
Category (score)	NA (Vegetative (7a)	NA (Dead (1)			

Table D-2: Photograph and plant health rating of *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) individuals located at the impact site South-west of Six Mile Well Pit for the November 2024 assessment

Site: Impact, South-west of Six Mile Well Pit (Tag ID 63 to 74 and 250 to 252)					
Tag ID	HFC_63	HFC_64	HFC_65	HFC_66	HFC_67
Photo					
Category (score)	Confirmed Dead (1)	Vegetative (7d)	Vegetative (7c)	Vegetative (7c)	Vegetative (7c)
Tag ID	HFC_68	HFC_69	HFC_70	HFC_71	HFC_72
Photo				Could not locate	
Category (score)	Vegetative (7c)	Vegetative (7c)	Vegetative (7d)	NA (Dead (1)	Vegetative (7b)
Tag ID	HFC_73	HFC_74	HFC_250	HFC_251	HFC_252
Photo					
Category (score)	Vegetative (7b)	Vegetative (7c)	Vegetative (7c)	Vegetative (7c)	Vegetative (7c)

Table D-3: Photograph and plant health assessment rating of *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) individuals located at the impact site West of Six Mile Well Pit for the November 2024 assessment

Site: Impact, West of Six Mile Well Pit (Tag ID 75 to 90 and 241 to 249)					
Tag ID	HFC_75	HFC_76	HFC_77	HFC_78	HFC_79
Photo	Confirmed dead (no photo)				
Category (score)	Dead (1)	Vegetative (7b)	Vegetative (7a)	Vegetative (7b)	Vegetative (7c)
Tag ID	HFC_80	HFC_81	HFC_82	HFC_83	HFC_84
Photo		Could not locate			
Category (score)	Vegetative (7a)	NA (Declining (2)	Vegetative (7a)	Vegetative (7a)	Dead (1)
Tag ID	HFC_85	HFC_86	HFC_87	HFC_88	HFC_89
Photo					
Category (score)	Vegetative (7b)	Vegetative (7d)	Vegetative (7a)	Vegetative (7a)	Vegetative (7d)

Tag ID	HFC_90	HFC_241	HFC_242	HFC_243	HFC_244
Photo		Could not locate	Could not locate		
Category (score)	Vegetative (7b)	NA (Vegetative (7a)	NA (Vegetative (7b)	Vegetative (7c)	Vegetative (7a)
Tag ID	HFC_245	HFC_246	HFC_247	HFC_248	HFC_249
Photo					
Category (score)	Vegetative (7a)	Dead (1)	Vegetative (7a)	Vegetative (7a)	Vegetative (7a)

D.2 *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)

Table D-4: Photographs and health ratings for *Hibbertia* sp. Sherwood Breakaways individuals located at the impact site East of the haul road for the November 2024 assessment

Site: Impact, East of Haul Road (Tag ID 1 to 25)					
Tag ID	HSPSB_1	HSPSB_2	HSPSB_3	HSPSB_4	HSPSB_5
Photo			No photo		
Category (score)	Declining (2)	Declining (2)	Dead (1)	Dead (1)	Vegetative (7c)
Tag ID	HSPSB_6	HSPSB_7	HSPSB_8	HSPSB_9	HSPSB_10
Photo	Could not locate				
Category (score)	NA (Declining (2)	Declining (2)	Vegetative (7d)	Declining (2)	Declining (2)

Site: Impact, East of Haul Road (Tag ID 1 to 25)					
Tag ID	HSPSB_11	HSPSB_12	HSPSB_13	HSPSB_14	HSPSB_15
Photo					
Category (score)	Dead (1)	Declining (3a)	Dead (1)	Dead (1)	Declining (2)
Tag ID	HSPSB_16	HSPSB_17	HSPSB_18	HSPSB_19	HSPSB_20
Photo					
Category (score)	Declining (3a)	Declining (2)	Declining (2)	Vegetative (7a)	Vegetative (7c)
Tag ID	HSPSB_21	HSPSB_22	HSPSB_23	HSPSB_24	HSPSB_25
Photo			Could not locate		
Category (score)	Declining (2)	Declining (2)	NA (Declining (2)	Declining (2)	Declining (2)

Table D-5: Photographs and plant health ratings of *Hibbertia* sp. Sherwood Breakaways individuals located at the impact site West of the haul road for the November 2024 assessment

Site: Impact, West of Haul Road (Tag ID 141 to 165)					
Tag ID	HSPSB_141	HSPSB_142	HSPSB_143	HSPSB_144	HSPSB_145
Photo					
Category (score)	Confirmed Dead (1)	Dead (1)	Dead (1)	Confirmed Dead (1)	Vegetative (7b)
Tag ID	HSPSB_146	HSPSB_147	HSPSB_148	HSPSB_149	HSPSB_150
Photo		No photo			
Category (score)	Confirmed Dead (1)	Vegetative (7b)	Confirmed Dead (1)	Declining (2)	Vegetative (7b)
Tag ID	HSPSB_151	HSPSB_152	HSPSB_153	HSPSB_154	HSPSB_155
Photo					
Category (score)	Vegetative (7b)	Vegetative (7b)	Confirmed Dead (1)	Vegetative (7a)	Vegetative (7b)

Tag ID	HSPSB_156	HSPSB_157	HSPSB_158	HSPSB_159	HSPSB_160
Photo					
Category (score)	Vegetative (7b)	Confirmed Dead (1)	Confirmed Dead (1)	Confirmed Dead (1)	Vegetative (7d)
Tag ID	HSPSB_161	HSPSB_162	HSPSB_163	HSPSB_164	HSPSB_165
Photo					
Category (score)	Vegetative (7d)	Dead (1)	Vegetative (7b)	Vegetative (7a)	Vegetative (7d)

Table D-6: Photographs and plant health ratings of *Hibbertia* sp. Sherwood Breakaways individuals located at the control site far West of the haul road for the November 2024 site assessment

Site: Control, Far West of Haul Road (Tag ID 166 to 190)					
Tag ID	HSPSB_166	HSPSB_167	HSPSB_168	HSPSB_169	HSPSB_170
Photo					
Category (score)	Vegetative (7a)	Vegetative (7a)	Vegetative (7d)	Vegetative (7d)	Vegetative (7a)
Tag ID	HSPSB_171	HSPSB_172	HSPSB_173	HSPSB_174	HSPSB_175
Photo					
Category (score)	Vegetative (7a)	Vegetative (7d)	Vegetative (7d)	Vegetative (7c)	Vegetative (7b)
Tag ID	HSPSB_176	HSPSB_177	HSPSB_178	HSPSB_179	HSPSB_180
Photo					
Category (score)	Vegetative (7a)	Vegetative (7b)	Vegetative (7b)	Vegetative (7a)	Declining (2)

Tag ID	HSPSB_181	HSPSB_182	HSPSB_183	HSPSB_184	HSPSB_185
Photo					
Category (score)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)
Tag ID	HSPSB_186	HSPSB_187	HSPSB_188	HSPSB_189	HSPSB_190
Photo					
Category (score)	Vegetative (7d)	Vegetative (7d)	Vegetative (7d)	Vegetative (7a)	Vegetative (7a)

Table D-7: Photographs and plant health ratings of *Hibbertia* sp. Sherwood Breakaways individuals located at the control site in Wanjarri Nature Reserve for the November 2024 assessment

Site: Control, Wanjarri Nature Reserve (Tag ID 91 to 115)					
Tag ID	HSPSB_91	HSPSB_92	HSPSB_93	HSPSB_94	HSPSB_95
Photo					
Category (score)	Declining (2)	Declining (2)	Declining (2)	Declining (2)	Declining (2)
Tag ID	HSPSB_96	HSPSB_97	HSPSB_98	HSPSB_99	HSPSB_100
Photo					
Category (score)	Vegetative (7d)	Vegetative (7b)	Vegetative (7a)	Vegetative (7d)	Declining (3a)
Tag ID	HSPSB_101	HSPSB_102	HSPSB_103	HSPSB_104	HSPSB_105
Photo					

Category (score)	Vegetative (7d)	Vegetative (7c)	Vegetative (7c)	Vegetative (7b)	Declining (3b)
Tag ID	**HSPSB_106**	**HSPSB_107**	**HSPSB_108**	**HSPSB_109**	**HSPSB_110**
Photo				See photo point below	
Category (score)	Declining (2)	Vegetative (7b)	Vegetative (7c)	Declining (2)	Vegetative (7d)
Tag ID	**HSPSB_111**	**HSPSB_112**	**HSPSB_113**	**HSPSB_114**	**HSPSB_115**
Category (score)	Vegetative (7c)	Declining (2)	Declining (3a)	Declining (3a)	Declining (3a)
Photo point **Photo point established in September 2020 due to plant location on edge of breakaway*					

D.3 *Verticordia jamiesonii*

Table D-8: Photographs and plant health ratings of *Verticordia jamiesonii* individuals located at the control site in Wanjarri Nature Reserve for the November 2024 assessment

Site: Control, Wanjarri Nature Reserve (Tag ID 116 to 140)					
Tag ID	VJ_116	VJ_117	VJ_118	VJ_119	VJ_120
Photo					
Category (score)	Declining (2)	Vegetative (7b)	Vegetative (7c)	Dead (1)	Vegetative (7a)
Tag ID	VJ_121	VJ_122	VJ_123	VJ_124	VJ_125
Photo					
Category (score)	Vegetative (7d)	Vegetative (7d)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)

Site: Control, Wanjarri Nature Reserve (Tag ID 116 to 140)

Tag ID	VJ_126	VJ_127	VJ_128	VJ_129	VJ_130
Photo					
Category (score)	Dead (1)	Vegetative (7a)	Declining (3a)	Vegetative (7c)	Vegetative (7a)
Tag ID	VJ_131	VJ_132	VJ_133	VJ_134	VJ_135
Photo					
Category (score)	Vegetative (7a)	Declining (3b)	Vegetative (7b)	Vegetative (7b)	Vegetative (7b)
Tag ID	VJ_136	VJ_137	VJ_138	VJ_139	VJ_140
Photo			Could not located		
Category (score)	Vegetative (7a)	Vegetative (7c)	Vegetative (7b)	Declining (3b)	Dead (1)

Table D-9: Photographs and plant health ratings of *Verticordia jamiesonii* individuals located at the impact site East of the haul road for the November 2024 assessment

Site: Impact, East of Haul Road (Tag ID 26 to 50)					
Tag ID	VJ_26	VJ_27	VJ_28	VJ_29	VJ_30
Photo					No photo
Category (score)	Vegetative (7c)	Vegetative (7b)	Vegetative (7a)	Declining (3b)	Confirmed Dead (1)
Tag ID	VJ_31	VJ_32	VJ_33	VJ_34	VJ_35
Photo					
Category (score)	Reproductive (6)	Dead (1)	Declining (2)	Reproductive (4)	Declining (2)
Tag ID	VJ_36	VJ_37	VJ_38	VJ_39	VJ_40
Photo					
Category (score)	Vegetative (7b)	Dead (1)	Declining (3b)	Declining (2)	Declining (3b)

Tag ID	VJ_41	VJ_42	VJ_43	VJ_44	VJ_45
Photo					
Category (score)	Reproductive (4)	Declining (2)	Reproductive (5)	Declining (2)	Vegetative (7c)
Tag ID	VJ_46	VJ_47	VJ_48	VJ_49	VJ_50
Photo		Could not locate			
Category (score)	Dead (1)	NA (Dead (1)	Vegetative (7c)	Dead (1)	Declining (2)

D.4 *Eremophila* sp. long pedicels (G. Cockerton 1975)

Table D-10: Photographs and plant health ratings of *Eremophila* sp. long pedicels individuals located at the control site on the Western edge of Wanjarri Nature Reserve for the November 2024 assessment

Site: Control, Western edge of Wanjarri Nature Reserve (Tag ID 191 to 215)					
Tag ID	ESPLP_191	ESPLP_192	ESPLP_193	ESPLP_194	ESPLP_195
Photo					
Category (score)	Declining (3a)	Declining (3a)	Vegetative (7a)	Vegetative (7a)	Dead (1)
Tag ID	ESPLP_196	ESPLP_197	ESPLP_198	ESPLP_199	ESPLP_200
Photo					No Photo
Category (score)	Declining (3a)	Reproductive (5)	Declining (3a)	Declining (2)	Declining (2)

Site: Control, Western edge of Wanjarri Nature Reserve (Tag ID 191 to 215)					
Tag ID	ESPLP_201	ESPLP_202	ESPLP_203	ESPLP_204	ESPLP_205
Photo					
Category (score)	Declining (2)	Declining (2)	Declining (3a)	Dead (1)	Declining (2)
Tag ID	ESPLP_206	ESPLP_207	ESPLP_208	ESPLP_209	ESPLP_210
Photo		No photo		No photo	
Category (score)	Declining (2)	Declining (3a)	Declining (3a)	Dead (1)	Declining (2)
Tag ID	ESPLP_211	ESPLP_212	ESPLP_213	ESPLP_214	ESPLP_215
Photo					Could not locate
Category (score)	Declining (2)	Declining (2)	Dead (1)	Dead (1)	NA (Declining (2)

Table D-11: Photographs and plant health ratings of *Eremophila* sp. long pedicels individuals located at the control site on the Northern edge of Wanjarri Nature Reserve for the November 2024 assessment

Site: Control, Northern edge of Wanjarri Nature Reserve (Tag ID 216 to 240; 258)					
Tag ID	ESPLP_216	ESPLP_217	ESPLP_218	ESPLP_219	ESPLP_220
Photo	Could not locate			Could not locate	
Category (score)	Dead (1)	Declining (2)	Vegetative (7a)	Dead (1)	Dead (1)
Tag ID	ESPLP_221	ESPLP_222	ESPLP_223	ESPLP_224	ESPLP_225
Photo		No photo	No photo	No photo	No photo
Category (score)	Declining (2)	Confirmed Dead (1)	Dead (1)	Confirmed Dead (1)	Dead (1)
Tag ID	ESPLP_226	ESPLP_227	ESPLP_228	ESPLP_229	ESPLP_230
Photo	No Photo				
Category (score)	Dead (1)	Vegetative (7a)	Declining (2)	Declining (2)	Declining (2)

Tag ID	ESPLP_232	ESPLP_233	ESPLP_234	ESPLP_235	ESPLP_236
Photo	No Photo	No Photo	No Photo	No Photo	
Category (score)	Dead (1)	Dead (1)	Dead (1)	Dead (1)	Declining (2)
Tag ID	ESPLP_237	ESPLP_238	ESPLP_239	ESPLP_240	ESPLP_258 (ESPLP_231 replacement)
Photo		No Photo			
Category (score)	Declining (2)	Dead (1)	Declining (2)	Declining (2)	Vegetative (7a)

Appendix E Priority Flora monitoring data 2018 to 2024

Table E-1: *Pigea* sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) monitoring data from 2018 to 2024

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Pigea sp. Chloroxantha (E. Bennett & D. Bright EUC 1810) P3	51 to 62 and 253 to 257	Control, south of Six Mile	12	Dec-18	0	0	0	2	2	10	0	0	10	0	0	0	0
			12	Mar-19	0	2	0	1	3	0	9	0	9	0	0	0	0
			12	Jul-19	0	2	0	2	4	8	0	0	8	0	0	0	0
			12	Nov-19	0	2	0	2	4	8	0	0	8	0	0	0	0
			12	Mar-20	0	4	0	0	4	0	0	0	0	0	8	8	0
			17	Jul-20	0	5	1	0	6	0	0	0	0	9	2	11	0
			17	Sep-20	0	5	1	1	7	0	0	1	1	6	3	9	0
			17	Dec-20	0	5	2	3	10	0	0	0	0	4	3	7	0
			17	Mar-21	2	7	0	2	11	0	0	0	0	3	1	4	2
			17	Oct-21	0	2	1	1	4	4	1	2	7	1	1	2	4
			17	Mar-22	0	5	0	2	7	0	0	1	1	3	1	4	5
			17	Dec-22	0	4	1	3	8	0	0	0	0	0	4	4	5
			17	Mar-23	0	4	1	3	8	0	0	0	0	0	4	4	5
			17	Nov-23	3	2	1	3	9	0	0	0	0	0	2	2	6
			17	**Nov-24**	Not monitored due to access issues												
	63 to 74 and 250 to 252	South-west of Six Mile	12	Dec-18	0	0	0	1	1	11	0	0	11	0	0	0	0
			12	Mar-19	0	0	0	0	0	0	12	0	12	0	0	0	0
			12	Jul-19	0	0	0	0	0	12	0	0	12	0	0	0	0
			12	Nov-19	0	0	12	0	12	0	0	0	0	0	0	0	0
			12	Mar-20	0	4	0	0	4	2	4	0	6	0	2	2	0
			15	Jul-20	3	5	4	0	12	0	0	0	0	1	2	3	0
			15	Sep-20	0	3	6	2	11	1	0	0	1	0	3	3	0
			15	Dec-20	2	3	5	2	12	0	0	0	0	1	2	3	0

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			15	Mar-21	0	0	1	1	2	3	7	0	10	1	0	1	2
			15	Oct-21	0	1	0	1	2	2	0	9	11	0	0	0	2
			15	Mar-22	0	2	1	1	4	0	0	4	4	3	2	5	2
			15	Dec-22	0	0	0	5	5	0	0	1	1	0	7	7	2
			15	Mar-23	0	1	1	2	4	0	0	0	0	3	6	9	2
			15	Nov-23	3	1	3	1	8	0	0	0	0	1	4	5	2
			15	**Nov-24**	**0**	**2**	**9**	**2**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**
	75 to 90 and 241 to 249	West of Six Mile	16	Dec-18	0	9	0	0	9	7	0	0	7	0	0	0	0
			16	Mar-19	0	0	0	0	0	0	15	0	15	0	0	0	1
			16	Jul-19	0	0	0	0	0	15	0	0	15	0	0	0	1
			16	Nov-19	0	0	15	0	15	0	0	0	0	0	0	0	1
			16	Mar-20	0	14	1	0	15	0	0	0	0	0	0	0	1
			25	Jul-20	9	11	3	1	24	0	0	0	0	0	0	0	1
			25	Sep-20	1	9	1	12	23	0	0	0	0	1	0	1	1
			25	Dec-20	2	10	5	6	23	0	0	0	0	1	0	1	1
			25	Mar-21	1	4	1	0	6	0	14	2	16	1	1	2	1
			25	Oct-21	0	1	0	4	5	2	0	15	17	1	0	1	2
			25	Mar-22	0	3	6	7	16	0	0	4	4	2	1	3	2
			25	Dec-22	0	3	7	8	18	0	0	3	3	0	2	2	2
			25	Mar-23	0	3	6	12	21	0	0	0	0	0	2	2	2
			25	Nov-23	10	3	4	4	21	0	0	0	0	0	2	2	2
			25	**Nov-24**	**12**	**5**	**2**	**2**	**21**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**

Table E-2: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771) monitoring data from 2018 to 2024

					Number of individual plants in each health category												
					Vegetative					Reproductive			Declining			Dead	
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Hibbertia sp. Sherwood Breakaways (RJ Cranfield 6776) P2	91 to 115	Control, Wanjarri Nature Reserve	24	Dec-18	0	6	2	7	15	9	0	0	9	0	0	0	0
			24	Mar-19	0	4	0	1	5	1	18	0	19	0	0	0	0
			25	Jul-19	0	0	1	24	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	1	0	24	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	14	4	7	25	0	0	0	0	0	0	0	0
			25	Jul-20	0	12	1	7	20	0	0	0	0	4	1	5	0
			25	Sep-20	0	6	2	11	19	0	0	0	0	2	4	6	0
			25	Dec-20	0	5	0	12	**17**	0	0	0	0	3	5	8	0
			25	Mar-21	5	3	1	6	**15**	4	0	0	4	1	5	6	0
			25	Oct-21	0	10	3	2	15	2	0	1	3	2	5	7	0
			25	Mar-22	0	0	0	0	0	8	0	10	18	2	5	7	0
			25	Dec-22	0	1	3	7	11	0	0	0	0	0	14	14	0
			25	Mar-23	0	4	2	4	10	5	0	0	5	0	10	10	0
			25	Nov-23	1	3	3	10	17	0	0	0	0	0	8	8	0
			25	**Nov-24**	**1**	**3**	**4**	**4**	**12**	**0**	**0**	**0**	**0**	**5**	**8**	**13**	**0**
	1 to 25	Impact, East of Haul Road	25	Dec-18	0	9	0	7	16	0	9	0	9	0	0	0	0
			25	Mar-19	0	8	0	3	11	2	12	0	14	0	0	0	0
			25	Jul-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	2	0	23	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	5	0	1	6	0	0	0	0	0	19	19	0
			25	Jul-20	0	3	2	3	8	0	0	0	0	11	6	17	0

					Number of individual plants in each health category												
					Vegetative					Reproductive			Declining			Dead	
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			25	Sep-20	0	2	1	5	8	0	0	0	0	9	8	17	0
			25	Dec-20	0	1	1	6	8	0	0	0	0	9	7	16	1
			25	Mar-21	1	6	4	0	11	2	2	0	4	2	4	6	4
			25	Oct-21	0	0	1	11	12	0	0	0	0	4	5	9	4
			25	Mar-22	0	1	0	1	2	4	0	1	5	6	8	14	4
			25	Dec-22	0	0	1	5	6	0	0	0	0	0	15	15	4
			25	Mar-23	0	1	2	4	7	0	0	0	0	0	13	13	5
			25	Nov-23	1	1	1	4	7	0	1	0	1	0	13	13	4
			25	**Nov-24**	**1**	**0**	**2**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**16**	**16**	**5**
	141 to 165	Impact, West of Haul Road	25	Dec-18	0	0	0	0	0	0	0	0	0	0	0	0	0
			25	Mar-19	0	4	0	8	12	0	13	0	13	0	0	0	0
			25	Jul-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	7	0	0	7	0	0	0	0	0	18	18	0
			25	Jul-20	0	4	0	1	5	0	0	0	0	9	8	17	3
			25	Sep-20	0	4	0	0	4	0	0	0	0	10	8	18	3
			25	Dec-20	0	2	2	0	4	0	0	0	0	3	13	16	5
			25	Mar-21	2	2	1	0	5	0	0	1	1	4	13	17	2
			25	Oct-21	0	1	4	1	6	0	0	0	0	5	10	15	4
			25	Mar-22	0	0	1	3	4	2	0	1	3	3	11	14	4
			25	Dec-22	0	0	0	2	2	0	0	0	0	0	16	16	7
			25	Mar-23	0	0	0	3	3	1	0	0	1	0	12	12	9

					Number of individual plants in each health category												
					Vegetative					Reproductive			Declining			Dead	
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			25	Nov-23	8	0	0	1	9	0	0	0	0	0	6	6	10
			25	**Nov-24**	**2**	**8**	**0**	**3**	**13**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**11**
	166 to 190	Control, Far West of Haul Road	25	Dec-18	Previous results not available at time of reporting												
			25	Mar-19													
			25	Jul-19													
			25	Nov-19													
			25	Mar-20	0	2	2	7	11	0	0	0	0	0	14	14	0
			25	Jul-20	0	0	2	9	11	0	0	0	0	11	3	14	0
			25	Sep-20	0	0	2	7	9	0	0	0	0	10	6	16	0
			25	Dec-20	0	0	2	6	8	0	0	0	0	9	8	17	0
			25	Mar-21	7	2	6	0	15	3	0	0	3	0	7	7	0
			25	Oct-21	1	0	0	11	12	1	0	0	1	8	4	12	0
			25	Mar-22	0	1	2	3	6	0	0	6	6	10	3	13	0
			25	Dec-22	1	0	2	9	12	0	0	0	0	0	13	13	0
			25	Mar-23	0	1	2	10	13	0	0	0	0	4	8	12	0
			25	Nov-23	6	1	0	10	17	0	0	0	0	4	4	8	0
			25	**Nov-24**	**8**	**2**	**1**	**13**	**24**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**

Table E-3: *Verticordia jamiesonii* monitoring data from 2018 to 2024

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Verticordia jamiesonii P3	116 to 140	Wanjarri Nature Reserve	25	Dec-18	-	-	-	-	-	-	-	-	-	-	-	-	-
			25	Mar-19	0	25	0	0	25	0	0	0	0	0	0	0	0
			25	Jul-19	0	13	4	8	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	0	0	25	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	13	9	1	23	0	0	0	0	0	1	1	1
			25	Jul-20	0	7	6	7	20	0	0	0	0	3	1	4	1
			25	Sep-20	0	4	4	5	13	0	0	0	0	7	4	11	1
			25	Dec-20	0	3	2	5	10	0	0	0	0	9	5	14	1
			25	Mar-21	0	6	7	0	13	0	0	0	0	6	3	9	3
			25	Oct-21	1	3	1	2	7	0	9	0	9	2	5	7	2
			25	Mar-22	0	3	2	1	6	0	0	0	0	6	9	15	4
			25	Dec-22	0	1	1	5	7	0	0	7	7	0	9	9	2
			25	Mar-23	0	5	3	6	14	0	0	0	0	0	8	8	3
			25	Nov-23	6	5	3	5	18	0	0	0	0	0	4	4	3
			25	**Nov-24**	**5**	**8**	**3**	**2**	**18**	**0**	**0**	**0**	**0**	**3**	**1**	**4**	**3**
	26 to 50	East of Haul Road	25	Dec-18	0	13	0	3	16	7	0	2	9	0	0	0	0
			25	Mar-19	0	21	0	4	25	0	0	0	0	0	0	0	0
			25	Jul-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Nov-19	0	3	0	22	25	0	0	0	0	0	0	0	0
			25	Mar-20	0	8	0	0	8	0	0	0	0	0	15	15	2
			25	Jul-20	4	0	0	4	8	0	0	0	0	13	1	14	3

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			25	Sep-20	0	3	0	0	3	1	0	0	1	14	4	18	3
			25	Dec-20	0	3	0	0	3	0	0	0	0	11	8	19	3
			25	Mar-21	0	3	0	0	3	0	0	0	0	7	11	18	4
			25	Oct-21	0	0	3	0	3	1	12	0	13	2	2	4	5
			25	Mar-22	0	0	0	1	1	0	0	0	0	8	9	17	7
			25	Dec-22	0	1	2	1	4	0	0	2	2	0	14	14	5
			25	Mar-23	0	4	0	0	4	0	0	0	0	0	16	16	5
			25	Nov-23	2	4	0	3	9	0	0	0	0	4	6	10	6
			25	**Nov-24**	**1**	**2**	**3**	**0**	**6**	**1**	**1**	**2**	**4**	**3**	**6**	**9**	**6**

Table E-4: *Eremophila* sp. long pedicels (G. Cockerton, 1975) monitoring data from 2018 to 2024

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
Eremophila sp. long pedicels (G. Cockerton 1975)	191 to 215	Wanjarri Nature Reserve	0	Dec-18	Previous data was descriptive and therefore no plant health scores were given. In July 2020, 25 individuals were established at each known population and scores were assigned.												
			0	Mar-19													
			0	Jul-19													
			0	Nov-19													
			0	Mar-20													
			25	Jul-20	0	4	14	0	18	0	0	0	0	6	0	6	0
			25	Sep-20	0	4	8	8	20	0	0	0	0	5	0	5	0
			25	Dec-20	0	4	6	10	20	0	0	0	0	4	1	5	0
			25	Mar-21	8	11	1	0	20	0	1	0	1	2	2	4	0
			25	Oct-21	0	9	5	3	17	0	1	1	2	4	2	6	0
			25	Mar-22	0	1	3	16	20	0	0	0	0	3	2	5	0
			25	Dec-22	0	4	7	5	16	0	0	0	0	0	9	9	0
			25	Mar-23	0	5	1	7	13	0	0	0	0	6	6	12	0
			25	Nov-23	0	0	2	1	3	0	5	4	9	2	10	12	1
			25	**Nov-24**	**2**	**0**	**0**	**0**	**2**	**0**	**1**	**0**	**1**	**7**	**10**	**17**	**5**
	216 to 240; 258	Wanjarri Nature Reserve	0	Dec-18	Previous data was descriptive and therefore no plant health scores were given. In July 2020, 25 individuals were established at each known population and scores were assigned.												
			0	Mar-19													
			0	Jul-19													
			0	Nov-19													
			0	Mar-20													
			25	Jul-20	0	1	7	0	8	0	0	0	0	11	6	17	0
			25	Sep-20	0	1	1	6	8	0	0	0	0	7	10	17	0
			25	Dec-20	0	1	2	7	10	0	0	0	0	6	8	14	1

					Number of individual plants in each health category												
					Vegetative					Reproductive				Declining			Dead
	Tag #	Population Type / Location	Count	Date	7a	7b	7c	7d	Total	6	5	4	Total	3	2	Total	1
			25	Mar-21	15	2	1	0	18	0	0	0	0	2	2	4	3
			25	Oct-21	2	8	3	1	14	0	0	0	0	4	4	8	3
			25	Mar-22	0	1	1	1	3	0	0	0	0	12	6	18	4
			25	Dec-22	0	0	0	1	1	0	0	0	0	0	16	16	8
			25	Mar-23	0	0	0	1	1	0	0	0	0	0	6	6	18
			25	Nov-23	0	0	0	0	0	0	0	0	0	0	13	12	12
			25	**Nov-24**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**9**	**10**	**13**

Appendix F EIA Vegetation condition individual quadrat results 2024

F.1 MKS EIA 1 – Haul Road Impact

Site ID: MKS EIA 1	**Co-ordinates: 51 J 261082 6973489**
Location: ~ 40 m west of haul road **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition**: Degraded **Grazing:** Light **Weed cover:** Nil **Photo position:** N	**Comments:** Drainage at this site is from south-east to north-west. Cracked surface from water ponding (low-lying area). Previous plant deaths. Less dust effects than previously seen. Stressed vegetation, particularly *S. ectogama* which has lost most of its foliage. Ants present. Rabbit warrens observed. Vegetation condition rating remains although vegetation looking better than previously seen. Vegetation health decreasing.

Species	Cover (%)	Plant Health Score	Comments
Sclerolaena eurotioides	2	7b	
Sida ectogama	10	2	Covered in dust. Historic deaths but some new growth.
Acacia aneura	30	2	Covered in dust. Historic deaths. Lots of healthy new foliage.
Eremophila fraseri	2	7d	Replaced *Eremophila latrobei* (dead). Healthy individuals.
Sida ectogama	5	7b	

Other species: *Acacia ramulosa var. linophylla, Acacia quadrimarginea, Sclerolaena eurotioides, Ptilotus exaltatus, Salsola australis, Aristida contorta, Atriplex* sp., *Eremophila* sp.

2021

2022

2022

2023

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.2 MKS EIA 2 - Haul Road Impact

Site ID: MKS EIA 2	Co-ordinates: 51 J 261089 6972365
Location: ~ 40 m west of MKS haul road	**Comments:** Water stressed vegetation. Vegetation is overall healthy/improving in the upper storey. Historical deaths of shrubbery and trees. Heavy dust cover over plants, having obvious impact. Kangaroo scats and termite mounds present. Internal drainage in Grove. Site was not accessible in 2022 but re-monitored in 2023.
Veg. Type: Groved Mulga shrubland	
Veg. Condition: Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	60	7c	New growth and juveniles present.
Eucalyptus lucasii	2	7b	Mostly outside quadrat.
Acacia tetragonophylla	2	2	Post-flowering. Partially dead canopy. Foliage doing well.
Sida ectogama	2	7c	Dusty but vegetative.
Eremophila latrobei	2	7c	Dusty. Yellowing. New growth and juveniles.

Other species: *Eragrostis eriopoda, Psydrax latifolia, Eremophila pungens* (P4), *Enchylaena tomentosa, Ptilotus exaltatus, Aristida contorta, Sclerolaena* sp.

2020

2021

2023

2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.3 MKS EIA 3 – Haul Road Impact

Site ID: MKS EIA 3			**Co-ordinates: 51 J 261117 6971563**
Location: ~ 9 m west of haul road	**Comments:** Soil surface 95% gravely stones, 5% silty sand and clay. All plants are water stressed. Some dead shrubs present, including all upper storey shrubs and trees. Track runs through the quadrat. Widening of haul road since 2021 is bordering the quadrat. Dust affects minimal due to closure of haul road.		
Veg. Type: Groved Mulga shrubland / Archaean granite geology			
Veg. Condition: Degraded			
Grazing: Nil			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Eremophila galeata	3	7d	Partially dead canopy.
Acacia pruinocarpa	<2	7b	Good condition.
Sclerolaena sp.	<2	3	Juvenile.
Senna glaucifolia	<2	3	Declining.
Ptilotus schwartzii	<2	3	
Other species: *Sclerolaena* sp.			

2020

2021

2022

2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.4 MKS EIA 4 – Haul Road Impact

Site ID: MKS EIA 4			**Co-ordinates: 51 J 261049 6971565**
Location: ~ 75 m west of haul road **Veg. Type:** Groved Mulga shrubland/ Stony ironstone Mulga shrubland **Veg. Condition:** Degraded **Grazing:** Nil **Weed cover:** Nil **Photo position:** N	**Comments:** Cleared road and soil bund. This area gets a lot of dust from vehicular traffic, and this is clearly visible on *Mulga*, *Senna* and *Eremophila* species. Drainage is west to southwest so it is expected that the haul road may have minimal impact on sheet flow. No cryptograms. Historical Acacia deaths. Directly adjacent to haul road. Soil surface has high dust coverage which was grey in colour indicating it was transported from the haul road. Decline in vegetation condition ratings was due to decline in lower storey vegetation health and cover.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	15	7b	Dust affected. Looking healthier with new growth.
Eremophila fraseri	<2	2	Very stressed.
***Maireana* sp.**	<2	3	
Salsola australis	<2	2	
***Sclerolaena* sp.**	<2	2	
Other species:			

2021

2022

2023

2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.5 MKS EIA 5 – Haul Road Impact

Site ID: MKS EIA 5			**Co-ordinates: 51 J 261204 6970774**
Location: ~ 80 m east of haul road **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition:** Very Good **Grazing:** Light, historic **Weed cover:** Nil **Photo position:** N	**Comments:** Site lies 100m downstream from the MKS haul road and about 15m west of the WNR track. Minor drainage line drains from southern end of the breakaway in a south-east direct into the Wanjarri Nature Reserve. The haul road interrupts that drainage path. Cryptograms on soil surface. Litter present under trees. Pedestalling erosion present. Vegetation is water stressed and dust affected. Historical *Acacia* deaths recorded. Termite mounds and kangaroo scats observed.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia caesaneura	15	7b	Good condition.
Acacia tetragonophylla	10	7b	
Sida ectogama	10	2	Dry, foliage loss observed.
***Eremophila pungens* (P4)**	<2	4	Good condition.
Eremophila forrestii	2	7a	Dry, foliage loss observed.
Other species: *Acacia craspedocarpa, Eremophila jucunda* subsp. *jucunda* (seeding), *Psydrax latifolia, Sclerolaena eurotioides, Eremophila latrobei, Dodonaea petiolaris, Senna* sp. Meekatharra, *Ptilotus obovatus, Senna artemisioides* subsp. *Filifolia, Ptilotus exaltatus, Enneapogon caerulescens, Sclerolaena lanicuspis, Salsola australis*			

2020

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.6 MKS EIA 6 – Haul Road Impact

Site ID: MKS EIA 6	**Co-ordinates: 51 J 261139 6971172**
Location: ~13 m east of haul road	**Comments:** Post has WB 30 on it and all four posts are installed. All vegetation is in good condition considering dry seasonal conditions. Minimal dust impact. Area protected by large bund along the edge of the haul road, in previous assessment but was not observed in 2021 or 2022. Site was not accessible in 2022 due to proximity to haul road.
Veg. Type: Archaean granite geology	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Callitris columellaris	<2	7b	
Thryptomene decussata	10	7b	
Acacia pruinocarpa	2	7b	Stressed.
Acacia quadrimarginea	5	7b	
Acacia rhodophloia	5	7d	

Other species: *Acacia rhodophloia, Acacia aneura, Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)*, Hakea leucoptera subsp. sericipes, Acacia tetragonophylla, Dodonaea petiolaris, Verticordia jamiesonii, Poaceae* sp.*, Calytrix uncinata, Eremophila eriocalyx*

2020

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Not assessed in 2022 and 2023 due to access

2022/2023

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.7 MKS EIA 7 – Haul Road Impact

Site ID: MKS EIA 7	**Co-ordinates: 51 J 261216 6970204**
Location: ~ 90 m east of haul road	**Comments:** Drainage from the west, interrupted by haul road. Two posts installed. Termite mounds were present. Litter present under large *Acacia* shrubs. Half of quadrat dominated by vegetation, but other half is almost bare. Historic shrub deaths to the west of the quadrat. Upper storey healthy while lower storey was good. Area was less affected by dust.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: N	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	30	7d	Lower branches have reduced foliage. Previously grazed.
Eremophila compacta	2	7d	Adult beneath Mulgas.
Sida ectogama	20	4	Dusty and stressed. Some foliage loss.
Eremophila granitica	<2	3	Dusty and stressed. Some foliage loss.
Acacia thomae	20	7d	Slight reduction in foliar cover.

Other species: *Ptilotus obovatus, Eremophila galeata, Eremophila jucunda* sp. *jucunda, Senna* sp. Meekatharra, *Solanum horridum, Sclerolaena lanicuspis, Enneapogon caerulescens, Ptilotus exaltatus, Aristida* sp.

2020

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F.8 MKS EIA 8 – Haul Road Impact

Site ID: MKS EIA 8	**Co-ordinates: 51 J 261231 6969060**
Location: ~ 60 m east of haul road	**Comments:** This site may dependent on sheet flow from the west. Site is covered in stony ferruginous rocks and boulders. No annuals at time of assessment. Evidence of grazing, possibly historic. Dust present on vegetation. Termite mounds and rabbit warrens present. Dead grasses and shrubs observed. Litter present under Acacias.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Very Good	
Grazing: Light	
Weed cover: Nil	
Photo position: N	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	20	7b	Healthy adult individuals.
Psydrax suaveolens	<2	5	
Eremophila spectabilis	10	7d	Dry, but full canopy. Dusty.
Eremophila latrobei	<2	7b	
Senna glaucifolia	<2	2	Very low canopy cover.

Other species: *Ptilotus schwartzii, Eriachne helmsii, Eremophila jucunda* subsp. *jucunda, Eragrostis eriopoda, Sida* sp.

2020

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F.9 MKS EIA 9 – Haul Road Impact

Site ID: MKS EIA 9	**Co-ordinates: 51 J 261218 6969942**
Location: ~95 m east of haul road	**Comments:** Soil surface is 95% quartz, ironstone rocks and gravel with 5% silty sand. Site is on a low rise, higher than surrounding landscape and unlikely to be affected by interruption to drainage due to the haul road. Many young *Hakea leucoptera* observed. Many *Maireana* individuals stressed. No annuals. This may also be associated with the vegetation type given it was different to most other impact quadrats.
Veg. Type: Weathered basalt, *Hakea leucoptera* subsp. *sericipes*/ *Eremophila pantonii* shrubland	
Veg. Condition: Excellent	
Grazing: Nil	
Weed cover: Nil	
Photo position: N	

Species	Cover (%)	Plant Health Score	Comments
Hakea leucoptera* subsp. *sericipes	10	5	Healthy. Seeding. Juveniles.
Ptilotus exaltatus	2	5	
***Senna* sp. Meekatharra**	6	7a	Healthy.
Eremophila pantonii	5	7a	Healthy.

Other species: *Atriplex semilunaris, Ptilotus obovatus, Maireana georgei, Sclerolaena* sp.

2020

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F.10 MKS EIA 10 – Infrastructure Impact

Site ID: MKS EIA 10	**Co-ordinates: 51 J 260553 6966093**
Location: ~ 320 m north of Run-of-mine	**Comments:** Topsoil stockpile in the background of photo. Note east peg is 8m from centre peg (closer than standard 10m distance). Drainage comes from the west, the Run-of-mine is north of the quadrat so drainage may not be interrupted. Very bare quadrat. Low cover of cryptograms present. Some understorey shrub death. Litter present under Acacias.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Good	
Grazing: Light	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	10	7b	Some dust, full canopy.
Ptilotus schwartzii	<2	5	Actively flowering.
Eremophila latrobei	<2	7a	
Eremophila spectabilis	<2	4	Very dry. Dusty.
Ptilotus obovatus	<2	2	Declining

Other species: *Eremophila latrobei, Psydrax suaveolens, Acacia pruinocarpa, Salsola australis, Maireana* sp., *Eremophila forrestii, Sida* sp.

2020

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F.11 MKS EIA 11 – Infrastructure Impact

Site ID: MKS EIA 11			**Co-ordinates: 51 J 260029 6965525**
Location: ~ 250 m east of Run-of-mine	**Comments:** Six mile well pit and run-of-mine in background. 100% rocky laterite with quartz stones and gravel. Lichens present on rocks. Moderate dust layer visible on rocks. Dust was grey in colour and covered the half of the quadrat closes to mine infrastructure. Dry vegetation, with sparse cover. Many dead dry plants, particularly *P. schwartzii.* Likely affected by extended dry seasonal conditions. Note: This site is positioned perpendicular to the MKS clearing edge and transversely across the slope.		
Veg. Type: Stony ironstone low/Mulga shrubland			
Veg. Condition: Good			
Grazing: Light, historic			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	2	2	Looks almost dead.
Acacia quadrimarginea	<2	7b	Small amount of foliage hanging on but looks healthy.
Thryptomene decussata	<2	7b	
Eremophila latrobei	<2	7c	
Ptilotus schwartzii	<2	5	

Other species: *Sida calyxhymenia, Sida sp. Excedentifolia (J.L. Egan 1925), Aristida* sp.*, Salsola australis, Maireana tomentosa*

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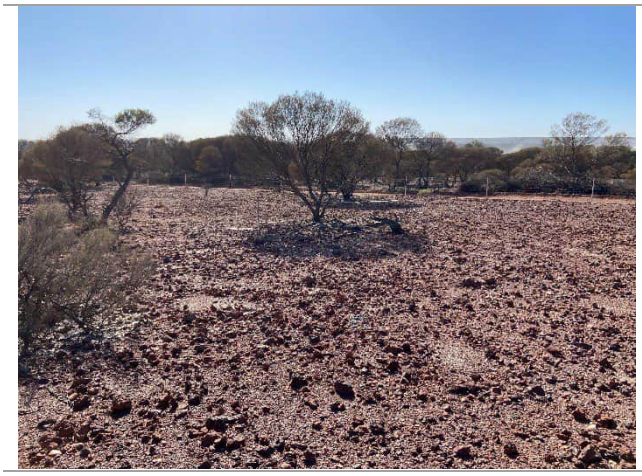

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F.12 MKS EIA 12 – Infrastructure Impact

Site ID: MKS EIA 12	**Co-ordinates: 51 J 259909 6964937**
Location: ~ 150 m east of Six Mile Well pit	**Comments:** All *Maireana* sp. plants stressed, likely reflecting extended dry seasonal conditions. High dust load present on foliage. Dust was grey and heavier on the side closest to Six Mile Well. No annuals. No cryptograms present. Very good vegetation condition, lots of juveniles present. Burrows observed in the area.
Veg. Type: Weathered basalt, *Hakea leucoptera* subsp. *sericipes*/ *Eremophila pantonii* shrubland	
Veg. Condition: Good	
Grazing: Light	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Eremophila pantonii	8	3	Budding.
***Acacia aneura* sens. lat.**	15	7b	
Maireana triptera	<2	7b	Dry juveniles present.
Sclerolaena eurotioides	<2	7b	
***Grevillea inconspicua* (P4)**	2	5	Flowering.

Other species: *Sclerolaena eurotioides, Eremophila fraseri, Leichhardtia australis, Prostanthera althoferi subsp. althoferi, Enneapogon caerulescens, Salsola australis*

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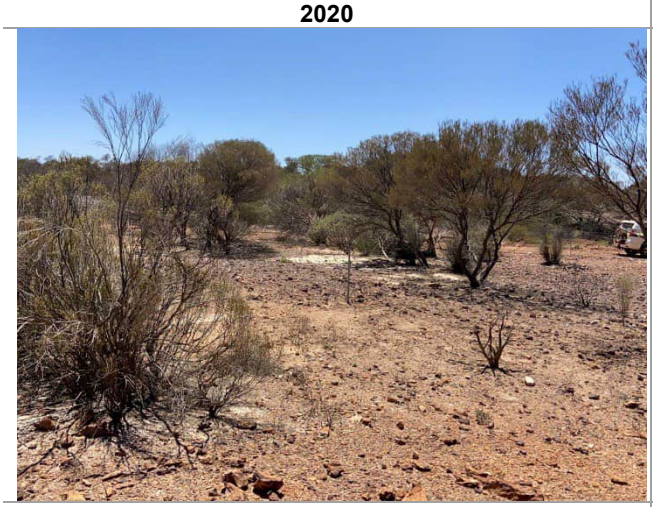

2022

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F.13 MKS EIA 13 – Infrastructure Impact

Site ID: MKS EIA 13	**Co-ordinates: 51 J 260866 6964098**
Location: ~ 80 m from Six Mile Well pit	**Comments**: Creek bed at the site is normal with healthy fringing grasses and a sandy creek bed. On western bank of Jones Creek. Creek banks composed of silty sand overlaying polymictic rocks including weather sandstone and concreted Wiluna hardpan. All vegetation in good condition, most are vegetative. *Eucalyptus camaldulensis* in healthy condition. Some historic shrub death. Heavy dust deposition on vegetation and soil surface. Ants present. Only middle post present.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: NA (Very Good)	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia caesaneura	NA (10)	NA (7c)	
Acacia burtikii	NA (15)	NA (7b)	
Themeda triandra	NA (15)	NA (4)	Declining but post-seeding.
Dodonaea viscosa	NA (5)	NA (7d)	
***Dodonaea rigida* (EIA_13_012)**	NA (5)	NA (4)	Post-flowering.

Other species: *Ptilotus obovatus, Duperreya sericea, Grevillea inconspicua, Santalum spicatum, Eucalyptus camaldulensis* subsp. *obtusa, Eremophila granitica, Hemigenia exilis, Eremophila pantonii, Eremophila oldfieldii* subsp. *angustifolia, Pigea sp.* Chloroxantha (E. Bennett & D. Bright EUC 1810)*, Teucrium teucriiflorum*

2020

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Not assessed in 2023 due to access

2023

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F.14 MKS EIA 14 – Infrastructure Impact

Site ID: MKS EIA 14			**Co-ordinates: 51 J 263217 6963155**
Location: ~ 400 m south-east of WRL	**Comments:** Eastern side of MKS, outside clearing margin. Track runs through quadrat. Previous Acacia deaths observed as well as recent plant deaths. Vegetation is dry. Post missing. Lots of ants present. Near road, very bare. Still has potential to regenerate. Area surrounding is much healthier.		
Veg. Type: Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland			
Veg. Condition: Good			
Grazing: Light			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia caesaneura	10	7b	
Acacia ramulosa* var. *linophylla	5	7b	
Triodia basedowii	2	7c	
Eremophila spectabilis	2	7c	

Other species: *Acacia incurvaneura, Eragrostis eriopoda*

2020

2021

Not assessed in 2022 and 2023 due to access

2022/2023

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F.15 MKS EIA 15 – Infrastructure Impact

Site ID: MKS EIA 15			**Co-ordinates: 51 J 260412 6961163**
Location: ~ 2.2 km southwest of WRL, ~ 450 m from Jones Creek track	**Comments:** Historical Acacia deaths. Kangaroo scats present. This site is a minor drainage line within a stony plain. Drainage here is from the east, from the south-western corner of the MKS development envelope.		
Veg. Type: Mulga over *Maireana triptera* shrubland/ Drainage line Mulga shrubland			
Veg. Condition: Very Good			
Grazing: Light, historic			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Ptilotus obovatus	<2	5	Some foliage loss but flowering.
Acacia aneura	40	4	Historic browsing lines. Vegetative.
Eremophila fraseri	5	7b	
Aristida jerichoensis	25	7d	Dried out and drying, but reproductive.
Enchylaena tomentosa	<2	7a	
Other species: *Ptilotus schwartzii, Senna* sp., *Ptilotus exaltatus, Sida ectogama*			

2020

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F.16 MKS EIA 16 – Infrastructure Impact

Site ID: MKS EIA 16	**Co-ordinates: 51 J 260261 6961683**
Location: ~ 1.8 km southwest of WRL, ~ 250 m from Jones Creek track	**Comments:** All vegetation in good condition. Cryptograms are present but dry. *Acacia tetragonophylla* present. Stream channel showing clayey sand on banks and stony stream bed. This site lies downslope of the MKS development with a large proportion of its catchment interrupted by MKS. Lots of seedlings present.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Sida ectogama	7	5	Healthy.
Eremophila granitica	5	4	Post reproductive.
Eremophila fraseri	5	7d	Seedlings present.
Acacia caesaneura	20	7b	
Acacia aptaneura	70	7a	

Other species: *Eriachne helmsii, Solanum lasiophyllum, Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Cheilanthes* sp., *Ptilotus exaltatus, Senna* sp., *Euphorbia* sp., *Enneapogon caerulescens*

2020

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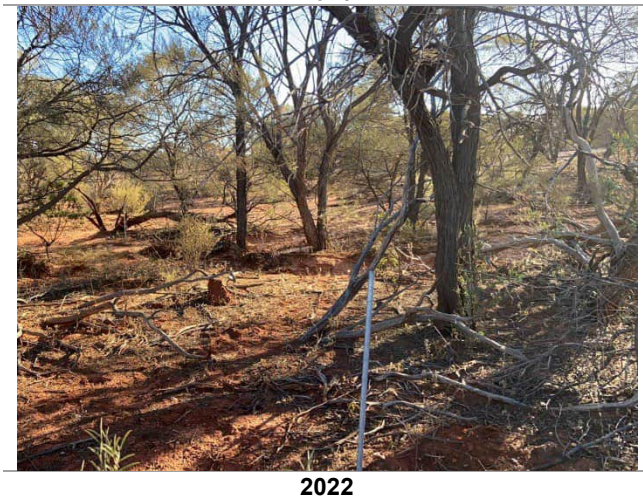
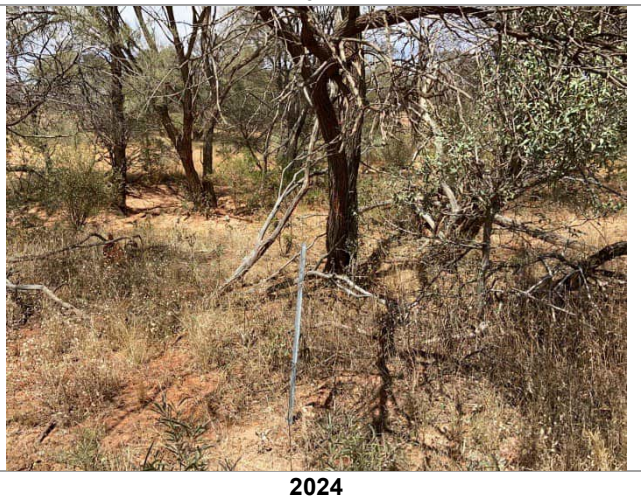


2022



2024

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F.17 MKS EIA 18 – Infrastructure Impact

Site ID: MKS EIA 18	**Co-ordinates: 51 J 261285 6964460**
Location: ~ 195 m south east of Run-of-Mine/ Six Mile Well	**Comments:** Jones Creek, upstream of bridge crossing on the eastern bank. Grasses on edge of the creek are stressed, dusty and grazed. *Eucalyptus camaldulensis* are healthy. Heavy dust load on most shrubs and grasses. Soil surface also covered in dust. Ants present.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: NA (Very Good)	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	NA (25)	NA (7b)	
Santalum spicatum	NA (20)	NA (7c)	
Aristida jerichoensis	NA (8)	NA (5)	
Acacia burkittii	NA (10)	NA (7d)	
Themeda triandra	NA (5)	NA (7c)	

Other species: *Santalum lanceolatum, Acacia aneura, Eucalyptus camaldulensis* subsp. *obtusa, Eragrostis eriopoda, Eremophila gilesii, Sida ectogama, Ptilotus obovatus, Eremophila latrobei, Teucrium teucriiflorum, Rhagodia drummondii*

2020

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Not assessed in 2023 due to access

2023

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F.18 MKS EIA 23 – Haul Road Impact

Site ID: MKS EIA 23	**Co-ordinates: 51 J 261137 6971361**
Location: ~ 25 m east of haul road	**Comments:** Previously cleared by haul road, need to move quadrat. Grey dust deposition on soil surface likely transported from haul road via drainage line. Minimal dust was on the vegetation itself.
Veg. Type: Granitic Mulga shrubland on Archaean geology	
Veg. Condition: Excellent	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia quadrimarginea	10	7b	
Callitris columellaris	5	7b	
Thryptomene decussata	8	7d	
Ptilotus obovatus	2	2	Post-flowering.
Dodonaea petiolaris	2	3	

Other species: *Eriachne helmsii, Acacia aneura, Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)*, Calytrix uncinata, Eremophila latrobei*

2020

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F.19 MKS EIA 24 – Haul Road Impact

Site ID: MKS EIA 24	**Co-ordinates: 51 J 261187 6971273**
Location: ~ 10 m west from haul road	**Comments:** Looking southwards parallel to the haul road. No annuals. Most shrubs are vegetative, but dry. *Thryptomene decussata* regaining new foliage. Minimal dust load on vegetation. Hibbertia dying/dead. Quadrat re-established due to quadrat being too close to haul road.
Veg. Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Thryptomene decussata	15	7a	
Dodonaea petiolaris	<2	7d	Yellowing and foliage loss.
Eriachne mucronata	<2	2	Post seeding.
Calytrix uncinata	2	4	Post-flowering.
Verticordia jamiesonii	2	7d	

Other species: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771), Poaceae sp.

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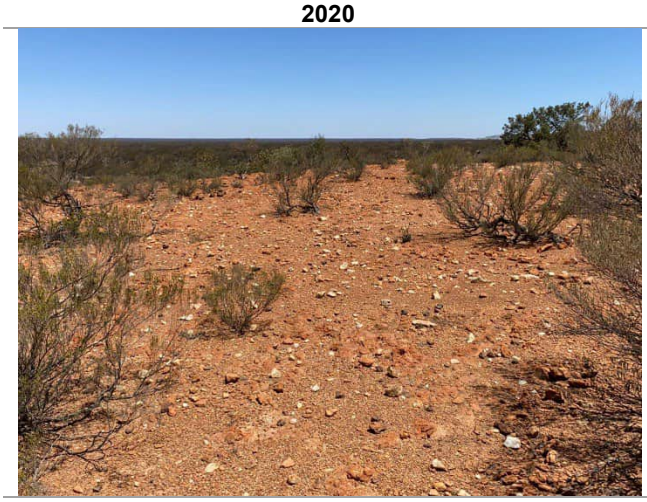

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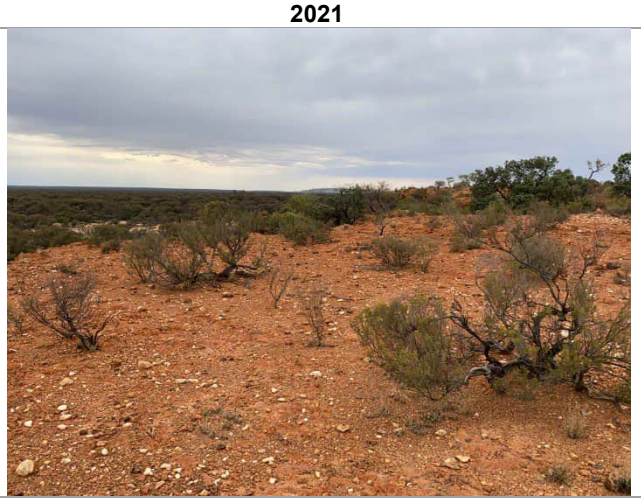

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F.20 MKS EIA 25 – Haul Road Impact

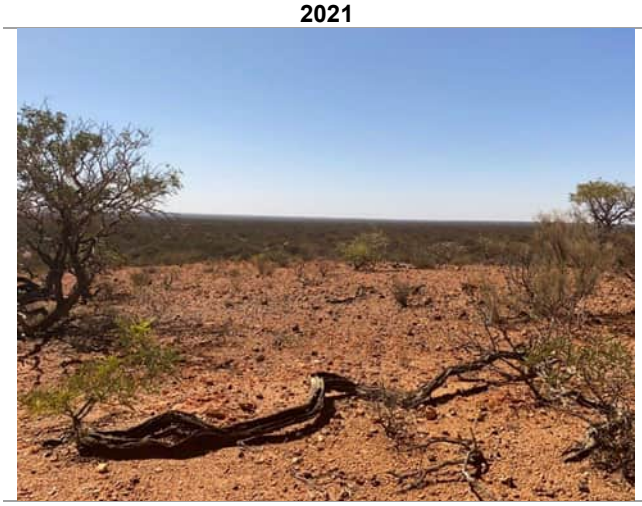
Site ID: MKS EIA 25	**Co-ordinates: 51 J 261174 6971135**
Location: ~ 2 m east of haul road	**Comments:** Looking south, haul road to right. Quadrat moved away from haul road downslope from the MKS haul road. All vegetation in good condition. Light dust impact. No cryptograms. Minimal impact from haul road.
Veg. Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Excellent	
Grazing: Nil	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia pruinocarpa	5	7b	Good condition.
Acacia rhodophloia	2	7b	Good condition.
Acacia aneura	2	7d	
Calytrix uncinata	5	4	Good condition.
Thryptomene decussata	<2	7b	Replaced *Dodonaea petiolaris.*

Other species: *Ptilotus obovatus, Dodonaea petiolaris, Ptilotus schwartzii, Solanum cleistogamum, Solanum lasiophyllum, Dysphania rhadinostachya*

2021

2022



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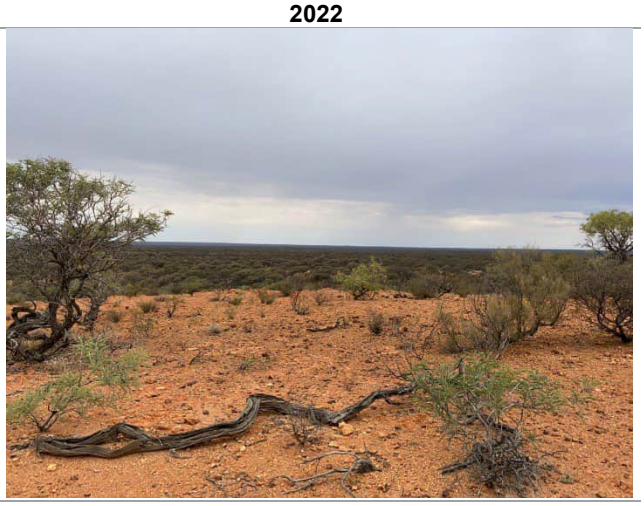

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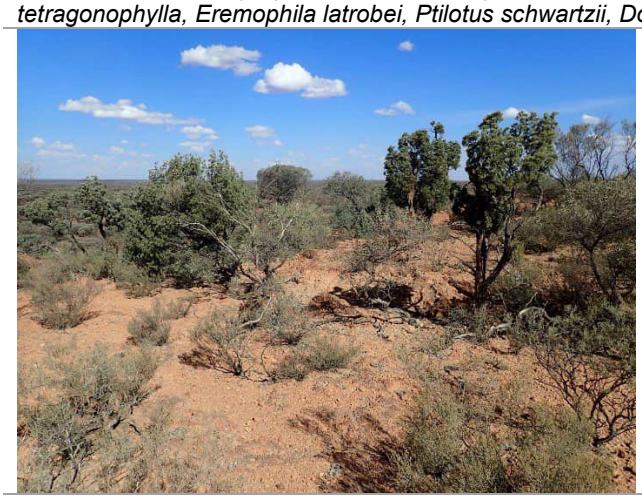
F.21 MKS EIA 26 – Haul Road Impact

Site ID: MKS EIA 26			**Co-ordinates: 51 J 261162 6971094**
Location: ~ 7 m east of haul road	**Comments:** Moved quadrat away from haul road. Most plants are vegetative, but smaller lower storey shrubs are losing foliage. Grey dust load originating from haul road. Notably higher vegetation condition considering distance from haul road.		
Veg. Type: Granitic Mulga shrubland on Archaean geology.			
Veg. Condition: Excellent			
Grazing: Nil			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Callitris columellaris	15	7b	
Thryptomene decussata	<2	7b	
Dodonaea petiolaris	<2	7b	
Acacia pruinocarpa	2	7d	Discoloured.
Acacia quadrimarginea	10	7a	

Other species: *Acacia incurvaneura, Hakea leucoptera* subsp. *sericipes, Verticordia jamiesonii, Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771), *Ptilotus obovatus, Eriachne mucronata, Calytrix uncinata, Acacia tetragonophylla, Eremophila latrobei, Ptilotus schwartzii, Dodonaea petiolaris*



2020

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2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.22 MKS EIA 27 – Haul Road Impact

Site ID: MKS EIA 27	**Co-ordinates: 51 J 261177 6970972**
Location: ~ 4 m west of haul road	**Comments:** Southern edge of Breakaway landform. Haul interrupts surface drainage from west to east. Mid slope from MKS haul road. Lichens present. Little under trees. Light dust load. Dry but vegetative shrubs. Some washout from the haul road.
Vegetation Type: Granitic Mulga shrubland on Archaean geology.	
Veg. Condition: Very Good	
Grazing: Nil	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Acacia aneura	40	7b	
Dodonaea petiolaris	3	7b	Declining but seeding.
Scaevola spinescens	2	7b	
Sida ectogama	<2	7b	Foliage loss.
Verticordia helmsii	<2	7b	

Other species: Thryptomene decussata*, Ptilotus schwartzii, Eragrostis eriopoda, Ptilotus exaltatus, Solanum* sp.

2020

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.23 MKS EIA 35 – Haul Road Impact

Site ID: MKS EIA 35	**Co-ordinates: 51 J 261071 6971248**
Location: ~ 3 m west of haul road	**Comments:** Half quadrat on haul road boundary, moved 10m west from haul road. Sparse vegetation present. Dust on rocks and soil surface. Cryptograms present but covered in dust and dry. Overall the area is dusty although there is evidence of fresh plant growth. Very dusty.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Degraded	
Grazing: Minor	
Weed cover: Nil	
Photo position: W	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
***Senna* sp. Meekatharra**	<2	7b	Replaced *Eremophila latrobei* (dead).
Acacia aneura	<2	2	Dusty.
Ptilotus obovatus	5	2	Healthy. Some grazing.
Maireana triptera	<2	7b	
Acacia rhodophloia	5	7a	

Other species: *Maireana triptera, Eremophila jucunda* subsp. *jucunda, Acacia pruinocarpa, Maireana georgei, Dodonaea microzyga, Rhagodia drummondii, Senna artemisioides subsp. Filifolia, Sclerolaena cuneata, Atriplex* sp., Maireana sp.

2021

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.24 MKS EIA 36 – Haul Road Impact

Site ID: MKS EIA 36	**Co-ordinates: 51 J 261071 6971159**
Location: ~ 52 m west of haul road	**Comments:** Dust impacts on flora and vegetation. Grey in colour hence likely transported from haul road. Soil is firm silty with abundant discontinuous lag gravel of angular quartz and subangular ironstone. Site slope towards the haul road, which intercepts drainage from the easterly direction. Shrubs in good condition, except for some *Thryptomene decussata* deaths. Light browsing present. Some cryptograms and ants present. Very dry.
Veg. Type: Stony ironstone Mulga shrubland	
Veg. Condition: Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: N	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aptaneura	<2	7c	Grazing lines, flowering.
Acacia rhodophloia	10	7b	Grazing line.
Thryptomene decussata	5	4	Improved, flowering.
***Sclerolaena* sp.**	<2	7c	Large adult outside quadrat, but juvenile within.
Dodonaea petiolaris	<2	7a	Healthy.

Other species: *Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771), *Sclerolaena* sp.

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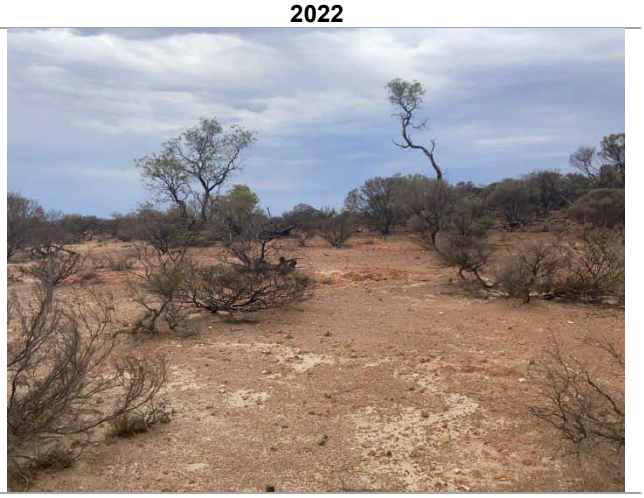

2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

MKS EIA 37 – Haul Road Impact

Site ID: MKS EIA 37	**Co-ordinates: 51 J 261077 6971050**
Location: ~ 48 m west of the haul road	**Comments:** Dust impacts likely on flora and vegetation, with grey dust covering soil surface. Site has shallow silty sand over extensive outcropping and sub cropping weather granite. Area subject to dust from vehicular movement on MKS haul road. Historic shrubs death observed. Acacia in good condition considering extended dry seasonal conditions and proximity to haul road. Scats, termite mounds and lichen present. Priority Flora specifically in poor health with loss of foliar cover evident and plant deaths. Lots of dust.
Vegetation Type: Stoney ironstone low shrubland	
Veg. Condition: Good	
Grazing: Nil	
Weed cover: Nil	
Photo position: N	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia pruinocarpa	5	7b	
Acacia quadrimarginea	10	7b	
Dodonaea petiolaris	<2	7b	Dust present.
***Hibbertia* sp. Sherwood Breakaways (R.J. Cranfield 6771)**	<2	7b	Replaced *Eremophila jucunda* subsp. *Jucunda* as higher cover %.
***Thryptomene* sp.**	2	7b	

Other species: *Acacia aneura, Acacia rhodophloia, Psydrax latifolia*

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.25 MKS EIA 19 – Control

Site ID: MKS EIA 19			**Co-ordinates: 51 J 270893 6981469**
Location: ~12 km from haul road in Wanjarri Nature Reserve **Veg. Type:** Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland **Veg. Condition:** Excellent **Grazing:** Light **Weed cover:** Nil **Photo position:** NW	**Comments:** Along fence line of Wanjarri Nature Reserve. Grazing impacting individual species including *Eremophila* sp. long pedicels (P2). Other shrubs are in good health. Dry habitat. Cattle and kangaroo scat in the area. Ant nests present. Triodia individuals looking healthy. Some upper storey thinning. Mid storey in good condition. Eremophila's dying.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
***Eremophila* sp. long pedicels (G. Cockerton 1975)**	5	3	Replaced *Triodia basedowii* (dead). Very poor health.
Acacia aneura	35	7b	
Acacia burkittii	5	7b	
Hakea preissii	10	7b	
Acacia caesaneura	5	7b	
Other species: *Eremophila spectabilis, Eragrostis eriopoda*, *Triodia wiseana, Calandrinia* sp.			

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.26 MKS EIA 20 – Control

Site ID: MKS EIA 20			**Co-ordinates: 51 J 272524 6982988**
Location: ~15 km from haul road in Wanjarri Nature Reserve	**Comments:** *Eremophila* sp. long pedicels occurring in patches under Mulga with older seed pods present. Cryptograms present but dry. Grasses are dry. No impacts from MKS, but nearby WNR track. Cattle scat present. Grazing observed. Many rabbit burrows. Very dry and lots of dead mulga in the area.		
Veg. Type: Sandplain Mulga spinifex shrubland/ Hardpan Mulga shrubland			
Veg. Condition: Good			
Grazing: Moderate			
Weed cover: Nil			
Photo position: N			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Eragrostis eriopoda	10	4	Dry.
Triodia basedowii	2	3	
Acacia incurvaneura	20	7b	
Grevillea deflexa	2	7a	
Eremophila sp. long pedicels (G. Cockerton 1975)	2	2	Very stressed.
Other species: *Acacia caesaneura, Ptilotus obovatus*			

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.27 MKS EIA 21 – Control

Site ID: MKS EIA 21	**Co-ordinates: 51 J 261186 6973491**
Location: ~ 60m from haul road, within WNR	**Comments:** Old 4WD track nearby. No posts established at quadrat. Almost all plants are vegetative, but some dry. Soil is a red silty sand with abundant but discontinuous ferruginous pizolitic gravel. Inappropriate control as it is too close to impact zone. Track through quadrat. Minor historical grazing.
Vegetation Type: Hardpan Mulga shrubland with *Acacia thoma* co- dominant	
Veg. Condition: Very Good	
Grazing: Moderate	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia thomae	30	7a	Healthy.
Acacia incurvaneura	15	7a	Healthy.
Eremophila jucunda* subsp. *jucunda	2	7b	Very healthy shrub on track.
Eremophila spectabilis	5	4	Declining, maybe senescence.
Eragrostis eriopoda	<2	7d	Senescence due to warmer months.

Other species: *Solanum lasiophyllum, Eriachne mucronata, Ptilotus schwartzii, Eremophila latrobei, Ptilotus obovatus, Sida* sp., Poaceae sp.

2020

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F.28 MKS EIA 22 – Control

Site ID: MKS EIA 22			**Co-ordinates: 51 J 261218 6972404**
Location: ~ 87 m from haul road, within WNR	**Comments:** Some plants are water stressed. Control quadrat is close to MKS haul road and receives dust from the road. 10 m away from the WNR track. Historical *Acacia* deaths observed.		
Vegetation Type: Groved Mulga woodland			
Veg. Condition: Good			
Grazing: Light, historic			
Weed cover: Nil			
Photo position: N			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia incurvaneura	10	7d	Seeding.
Sida ectogama	<2	2	Declining. Dusty.
Aristida jerichoensis	<2	1	Dead, seasonal.
Eremophila latrobei	<2	7d	Juvenile outside of quadrat.
Acacia tetragonophylla	2	7b	Seeding.
Other species: *Acacia thomae, Calocephalus knappii, Sida* sp., *Solanum* sp., *Sclerolaena* sp.			

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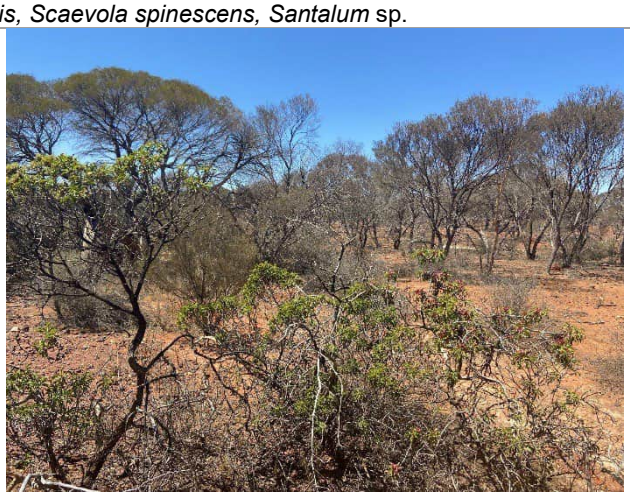
F.29 MKS EIA 28 – Control

Site ID: MK SEIS 28			**Co-ordinates: 51 J 261239 6970770**
Location: ~ 110 m east of haul road, within WNR	**Comments:** Site lies 100m downstream of the newly constructed road. The WNR fence line track is nearby with a high bund east of the track. Ants and termite mounds were present. Cryptograms on soil surface. Light dust load. At base of drainage line, depression in landscape.		
Veg. Type: Drainage line Mulga shrubland			
Veg. Condition: Very Good			
Grazing: Light			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Sida ectogama	20	2	Declining.
Eremophila fraseri	5	5	Flowering.
Acacia aptaneura	25	7b	Old pods present.
Acacia quadrimarginea	20	7b	
Eremophila jucunda* subsp. *jucunda	<2	7b	
Other species: *Senna glaucifolia, Eremophila granitica, Dodonaea petiolaris, Senna* sp. Meekatharra, *Eremophila shonae* subsp. *shonae, Senna artemisioides* subsp. × *sturtii, Enneapogon caerulescens, Sclerolaena lanicuspis, Ptilotus exaltatus, Solanum lasiophyllum, Leichhardtia australis, Scaevola spinescens, Santalum* sp.			

2020



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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.30 MKS EIA 29 – Control

Site ID: MKS EIA 29			**Co-ordinates: 51 J 261255 6970160**
Location: ~ 100 m east of haul road, within WNR	**Comments:** Monitoring peg is approximately 15 m east of the WNR track in a minor drainage. Vegetation in good condition, but dry. Centre post installed. Minor pedestalling western side of quadrat. Lower dust load than the other quadrats. Historic *Acacia* deaths. Ants present. Annuals dying off.		
Veg. Type: Drainage line Mulga shrubland			
Veg. Condition: Very Good			
Grazing: Light			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia quadrimarginea	20	7b	Browsing lines across lower branches.
Sida ectogama	2	3	
Acacia aptaneura	15	7b	
Eremophila jucunda* subsp. *jucunda	<2	7a	
Other species: *Acacia caesaneura, Eremophila forrestii,* Poaceae sp.*, Ptilotus obovatus, Eremophila fraseri, Enneapogon caerulescens*			

2020

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F.31 MKS EIA 30 – Control

Site ID: MKS EIA 30	**Co-ordinates: 51 J 261261 6969699**
Location: ~ 125 m east of haul road, within WNR	**Comments:** Monitoring peg is approximately 15m east of the WNR track a minor drainage line. Annual groundcover dying off. Lots of mid-storey historical deaths. Tree damage from historical heavy grazing.
Veg. Type: Drainage line Mulga shrubland	
Veg. Condition: Very good	
Grazing: Historic	
Weed cover: Nil	
Photo position: NW	

Species	Cover (%)	Plant Health Score	Comments
Sida ectogama	5	4	
Acacia caesaneura	30	7b	
Eremophila fraseri	<2	7b	
Acacia incurvaneura	<2	7b	

Other species: *Ptilotus obovatus, Eremophila compacta, Psydrax latifolia, Acacia macraneura, Acacia aneura, Dodonaea petiolaris, Eragrostis dielsii, Solanum horridum, Eragrostis eriopoda, Enneapogon caerulescens*

2020

2021

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.32 MKS EIA 31 – Control

Site ID: MKS EIA 31			**Co-ordinates: 51 J 261263 6969421**
Location: ~ 114 m east of haul road, within WNR **Veg. Type:** Drainage line Mulga shrubland **Veg. Condition**: Very Good **Grazing:** Light, historic **Weed cover:** Nil **Photo position:** NW	**Comments:** Monitoring peg is approximately 10m east of the WNR track in a minor drainage line. Soil surface is intact with a clay. All vegetation in good condition. Insect galls on vegetation. Only middle post installed. Some dust present on vegetation and soil surface likely from haul road runoff. Historical grazing observed with browsing lines across Acacia shrubs/trees.		
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Sida ectogama	10	2	Stressed, some dead.
Eremophila latrobei	<2	5	Thinning but alive individuals look healthy.
Acacia aneura	40	7d	
Acacia caesaneura	20	7d	
Eriachne helmsii	<2	3)	Dry, end of seeding.

Other species: *Eremophila jucunda* subsp. *jucunda, Psydrax suaveolens, Scaevola spinescens, Maireana* sp.

2020

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.33 MKS EIA 32 – Control

Site ID: MKS EIA 32			**Co-ordinates: 51 J 261277 6968983**
Location: ~ 110 m east of haul road, within WNR	**Comments:** Site is 100% covered in stony ferruginous rocks and boulders. No annuals at time of assessment. Only middle post installed. Leaf litter present under Acacias. Vegetation in good condition.		
Veg. Type: Stony ironstone Mulga shrubland			
Veg. Condition: Excellent			
Grazing: Light			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
Acacia aneura	15	7b	
Acacia thomae	5	7b	
Eremophila spectabilis	<2	4	
Eremophila latrobei	<2	4	Insect damage.
Eremophila jucunda	3	7a	
Other species: *Eriachne mucronata, Eremophila jucunda* subsp. *jucunda, Ptilotus schwartzii, Enneapogon caerulescens, Eragrostis eriopoda*			

2020

2021

2022

2024

Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.34 MKS EIA 33 – Control

Site ID: MKS EIA 33			**Co-ordinates: 51 J 261280 6968863**
Location: ~ 114 m east of haul road, within WNR	**Comments:** Site is very bare. Multiple dead *Maireana* sp. individuals. Only middle post present. Cryptograms on soil surface. Some pedestalling erosion present. Dry vegetation with further lower storey shrub deaths.		
Veg. Type: Stony ironstone Mulga shrubland			
Veg. Condition: Good			
Grazing: Light			
Weed cover: Nil			
Photo position: NW			
Species	**Cover (%)**	**Plant Health Score**	**Comments**
***Senna* sp. Meekatharra**	15	7a	Very healthy.
***Acacia aneura* sens. lat.**	15	7b	Some insect galls.
Acacia craspedocarpa	15	7b	Thin lower half from historic grazing.
Ptilotus obovatus	<2	2	Stressed but alive.
Other species: *Acacia quadrimarginea, Hibiscus* sp., *Aristida* sp., *Psydrax suaveolens, Sclerolaena* sp., *Acacia tetragonophylla*			

2020

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.35 MKS EIA 34 – Control

Site ID: MKS EIA 34	**Co-ordinates: 51 J 261298 6968771**
Location: ~ 114 m east of haul road, within WNR	**Comments:** Quadrat situated on a rocky outcrop next to WNR track. Dominated by *Thryptomene decussata*. Lichens present on rocks. Some vegetation affected by extended dry seasonal conditions (*P. schwartzii, D. rigida*).
Veg. Type: Stony ironstone low shrubland	
Veg. Condition: Excellent	
Grazing: Light	
Weed cover: Nil	
Photo position: E	

Species	Cover (%)	Plant Health Score	Comments
Thryptomene decussata	20	7b	Budding. Vegetative.
Acacia pruinocarpa	5	7a	Few adolescent trees.
Dodonaea petiolaris	<2	7b	Post flowering.
Acacia quadrimarginea	5	7c	

Other species: *Hibiscus* sp., *Aristida* sp., *Scaevola spinescens, Hakea preissii, Ptilotus obovatus*

2020

2021

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

F.36 MKS EIA 38 – Control

Site ID: MKS EIA 38	**Co-ordinates: 51 J 261304 6967527**
Location: ~ 130 m east of haul road	**Comments:** Dust impacts and flora and vegetation. Ants and multiple rabbit warrens. Litter under trees. Old cattle scats and grazing lines present.
Veg. Type: Stony ironstone low shrubland.	
Veg. Condition: Very Good	
Grazing: Light, historic	
Weed cover: Nil	
Photo position: NW	

Species	**Cover (%)**	**Plant Health Score**	**Comments**
Maireana triptera	5	3	Few dead individuals.
Acacia burkittii	15	7b	Insect galls.
Acacia aptaneura	15	7b	Browsing line.
Eremophila oldfieldii	8	7b	
Acacia incurvaneura	5	7b	

Other species: *Acacia aneura, Eremophila granitica, Enneapogon caerulescens, Sclerolaena eurotioides, Ptilotus obovatus, Santalum spicatum, Senna* sp. Meekatharra (E. Bailey 1-26), *Eremophila fraseri*, *Martensia australis, Aristida* sp., *Grevillea* sp., *Hakea* sp.

2020

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Cell shading is indicative of change in vegetation condition, plant health rating or cover. Green is indicative of improvement since previous assessment and red is indicative of decline since previous assessment. Clear cells indicate no change.

Appendix G EIA Vegetation condition rating maps 2024

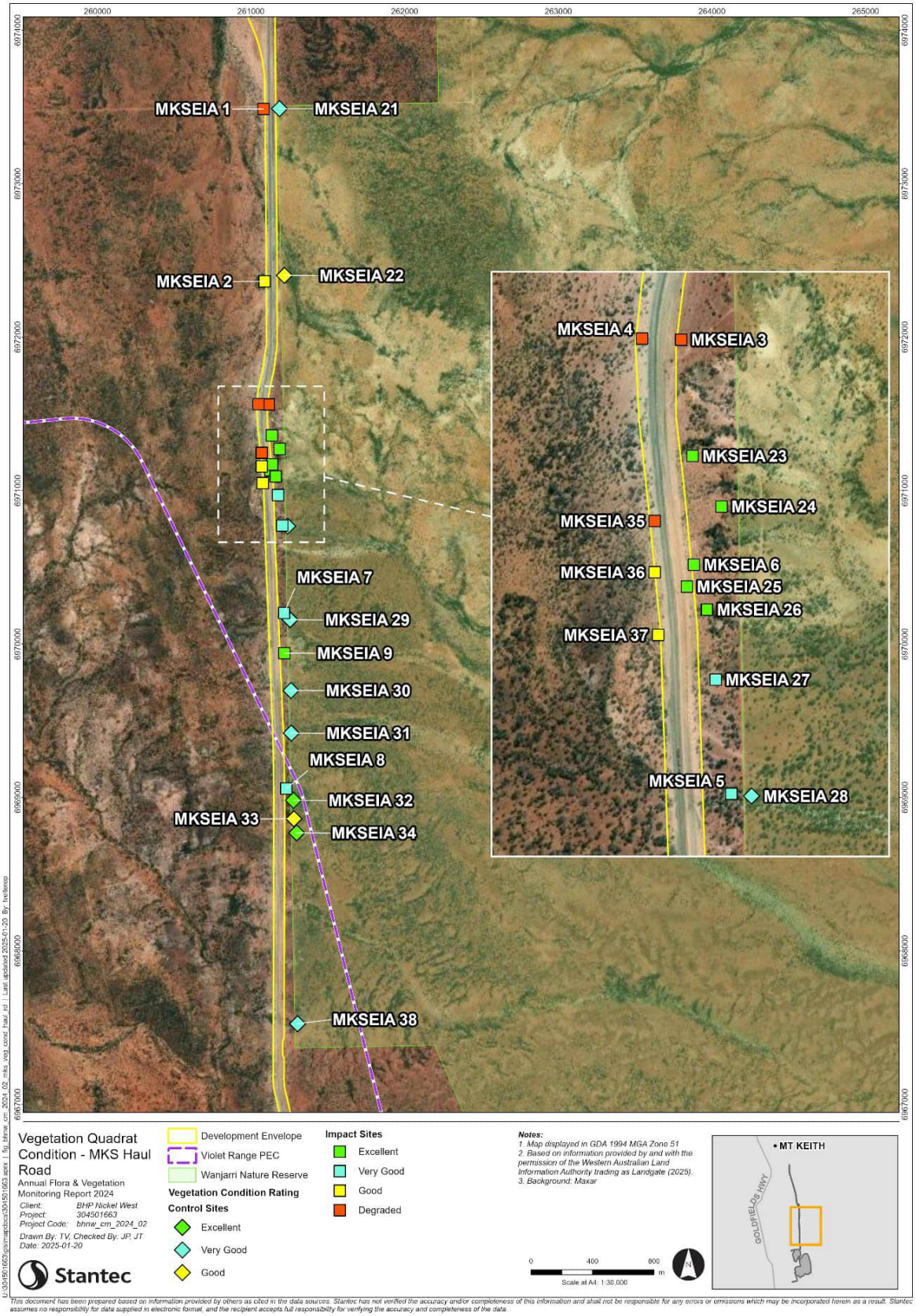

Figure G-1: Visual representation of the vegetation condition ratings for vegetation quadrats situated along the MKS haul road, assessed in November 2024

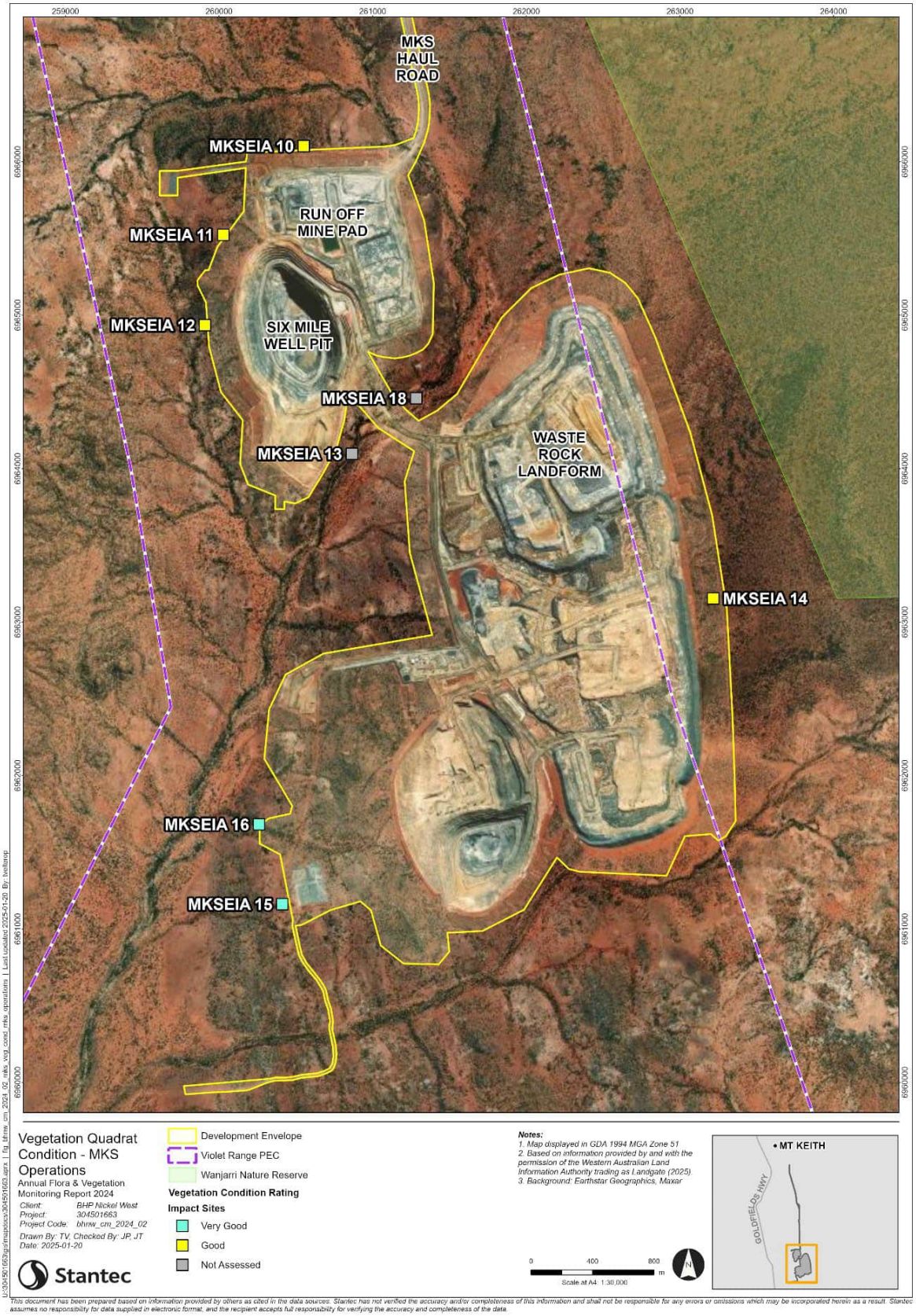

Figure G-2: Visual representation of the vegetation condition ratings for vegetation quadrats situated at MKS operations, assessed in November 2024

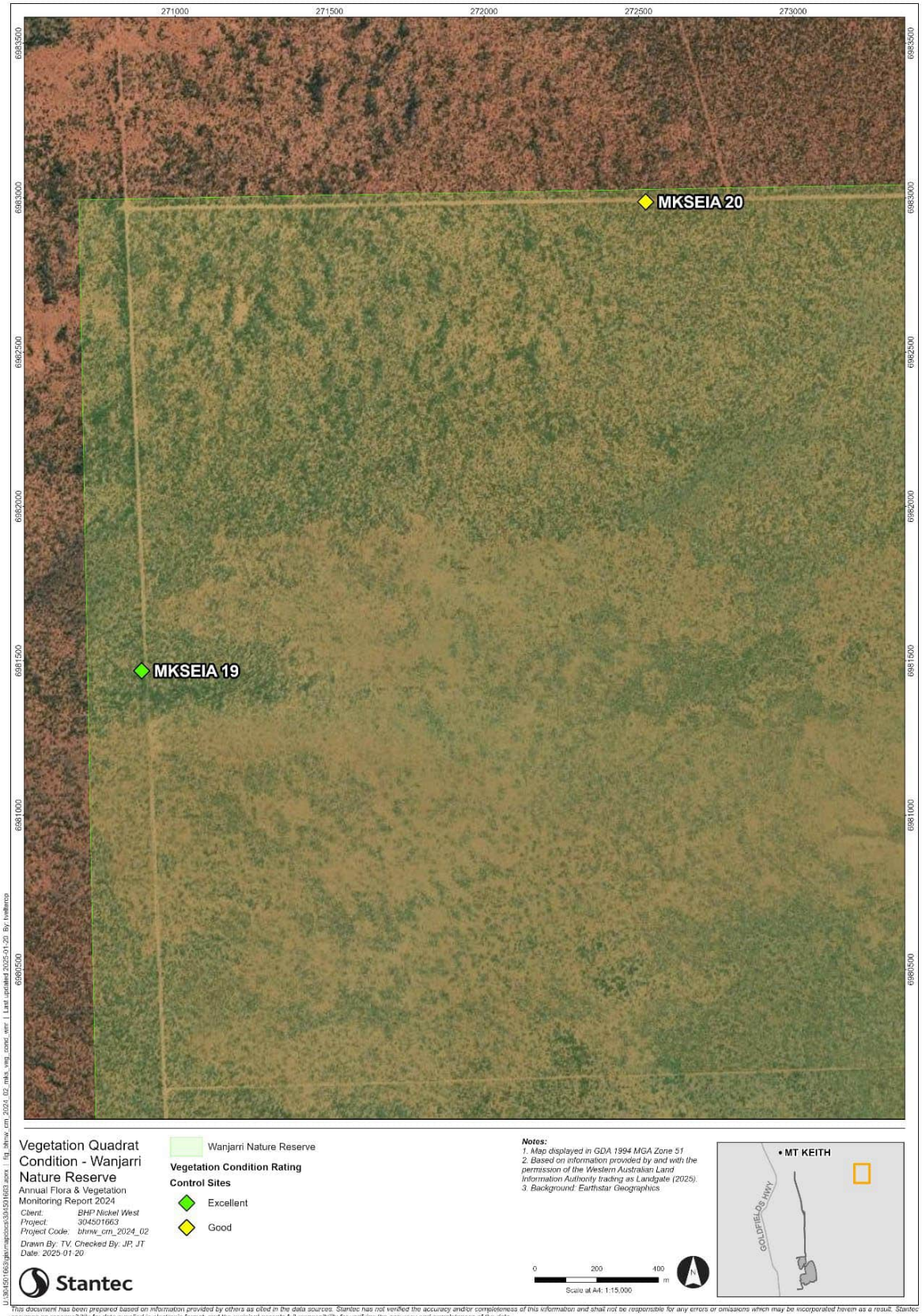

Figure G-3: Visual representation of the vegetation condition ratings for vegetation quadrats situated on the Northern edge of the Wanjarri Nature Reserve, assessed in November 2024

Appendix H EIA Vegetation condition species diversity data from 2020 to 2024

Table I-1: Species diversity data from 2020 to 2024 for the EIA quadrats monitored in 2024. Green shading indicates increases in species diversity since the previous year monitored, orange shading indicates decreases in diversity since the previous year. Clear cells indicate no change, and "-" indicates years where transects were not monitored.

		Monitoring Year				
Category	**Quadrat**	**2020**	**2021**	**2022**	**2023**	**2024**
Impact – Haul Road	MKS EIA 1	7	11	9	10	13
	MKS EIA 2	6	9	9	10	12
	MKS EIA 3	7	8	7	-	6
	MKS EIA 4	6	6	5	4	5
	MKS EIA 5	12	19	16	-	18
	MKS EIA 6	11	14	14	-	15
	MKS EIA 7	9	13	10	-	14
	MKS EIA 8	10	10	10	-	10
	MKS EIA 9	7	7	7	-	8
	MKSEIA 23	-	13	13	-	10
	MKS EIA 24	4	7	7	-	7
	MKS EIA 25	6	9	9	8	11
	MKS EIA 26	10	12	12	-	16
	MKS EIA 27	7	10	10	-	10
	MKS EIA 35	11	13	13	13	15
	MKS EIA 36	8	8	8	8	7
	MKS EIA 37	7	9	9	10	8
Impact – Infrastructure	MKSEIA 10	9	10	8	-	12
	MKSEIA 11	8	8	6	-	10
	MKSEIA 12	10	10	7	-	11
	MKSEIA 13	15	16	16	-	-
	MKSEIA 14	5	5	5	-	6

		Monitoring Year				
Category	**Quadrat**	**2020**	**2021**	**2022**	**2023**	**2024**
	MKSEIA 15	7	9	9	-	9
	MKSEIA 16	9	15	14	-	14
	MKSEIA 18	13	17	15	-	-
Control	MKS EIA 19	8	8	8	11	9
	MKS EIA 20	7	8	8	8	7
	MKSEIA 21	7	8	8	-	12
	MKSEIA 22	5	6	7	-	10
	MKSEIA 28	11	16	12	-	18
	MKSEIA 29	9	13	8	-	10
	MKSEIA 30	9	10	8	-	14
	MKSEIA 31	8	6	6	-	9
	MKSEIA 32	9	10	9	-	10
	MKSEIA 33	5	9	8	-	10
	MKSEIA 34	5	8	8	-	9
	MKSEIA 38	10	13	13	-	16

Appendix I Soil methodolgy and results

I.1 Method descriptions

Soil pH provides a measure of the activity of hydrogen ions in a soil solution made from a 1:5 soil to liquid suspension. Ratings are assigned from very strongly acidic to strongly alkaline based on the recorded pH measured in deionised water (pH_W) and other solutions (Van Gool, Tille, and Moore, 2005) (Table I-1). The ideal pH range for growth of most agricultural plant species is considered to be between 5.0 and 7.5 (Moore, 1998). Outside this range, the plant-availability of some nutrients can be affected, while various metal toxicities (e.g., aluminium and manganese) can become limiting to plant growth at low pH. For native species, which may be tolerant of wider ranges in soil pH, preferred pH ranges are best inferred from the natural, undisturbed soil in which they are observed to occur.

Soil salinity, or electrical conductivity (EC, measured as deciSiemens/metre (dS/m)), is a measure of the amount of readily-soluble salts in soil and soil pore water (Moore, 1998). The salinity is measured from a suspension of soil in deionised water (1:5, soil to water). Soil salinity classes are rated from non-saline to extremely saline based on the measured EC and the soil texture (Table I-2). The classes used for rating are equivalent to those commonly used by the United States Department of Agriculture (USDA) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Appendix I). Soil salinity can limit plant growth and impact soil structural stability. The measured salinity of a soil is influenced by natural processes of landscape evolution, hydrological processes, and rainfall (Hunt and Gilkes, 1992), and may also be affected by anthropogenic processes such as water application for dust suppression, leaching and seepage from water bodies and infrastructure. Care needs to be taken in ensuring that stated units of electrical conductivity are consistent with those used in published salinity classifications, or if necessary that the units are converted.

Table I-1: Soil surface assessment standards for pH (based on standard USDA and CSIRO categories)

pH test method	Very strongly acidic (Vsac)	Strongly acidic (Sac)	Moderately acidic (Mac)	Slightly acidic (Slac)	Neutral (N)	Moderately alkaline (Malk)	Strongly alkaline (Salk)
pH_{water}	< 5.3	5.3 – 5.6	5.6 – 6.0	6.0 – 6.5	6.5 – 8.0	8.0 – 9.0	> 9.0
pH_{CaCl_2}	< 4.2	4.2 – 4.5	4.5 – 5.0	5.0 – 5.5	5.5 – 7.0	7.0 – 8.0	> 8.0

Table I-2: Soil surface assessment standards for salinity using electrical conductivity (1:5) (dS/m) (based on standard USDA and CSIRO categories, from DPIRD 2022)

Salinity class	EC 1:5 (dS/m)					
	Sand	Sandy loam	Loam	Clay loam	Light/medium clay	Heavy clay
Non-saline	< 0.13	< 0.17	< 0.20	< 0.22	< 0.25	< 0.33
Slightly saline	0.13-0.26	0.17-0.33	0.20-0.40	0.22-0.44	0.25-0.50	0.33-0.67
Moderately saline	0.26-0.52	0.33-0.67	0.40-0.80	0.44-0.89	0.50-1.00	0.67-1.33
Very saline	0.52-1.06	0.67-1.33	0.80-1.60	0.89-1.78	1.00-2.00	1.33-2.67
Extremely saline	> 1.06	> 1.33	> 1.60	> 1.78	> 2.00	> 2.67

I.1.1 Analysis of total elemental concentrations

The availability of metals (micronutrients) in soils play a significant role in many biological functions. The majority of metals occur in inert forms in soils and rocks and only become available to plants and animals if they are chemically altered during oxidation reactions, or if severe weathering events occur (Hazelton and Murphy 2007). Although some metals are essential to support plant growth, high concentrations can be toxic to flora and fauna. The exact sensitivity of different plant types and animal species in the semi-arid region of Australia has not been studied extensively. Assessment of potential toxicology is made through comparison of metal concentrations to site-specific soil and rock elemental concentrations (where available), as well as published guideline criteria. It is noted that this represents a conservative estimate as local soil and groundwater in mineralised areas is likely to contain more naturally elevated concentrations of metals and salts compared to guideline criteria.

To assess the potential for elemental enrichment, waste materials are generally tested for total metal concentration. In accordance with the GARD Guide, the results are then compared to standard median soil abundance values (Bowen 1979) to evaluate the extent of elemental enrichment. The result is reported as a geochemical abundance index (GAI). In

general, a GAI of 3 or greater is considered indicative of enrichment that may require additional examination to assess potential environmental concerns.

In addition to GAI, the total concentration of elements of potential environmental concern are assessed in accordance with the DER Contaminated Sites Guidelines (DER 2014). For the purposes of this assessment, total elemental concentrations were determined via acid-digest. As a conservative approach, the materials have been assessed as both soil material, which may enter the ecosystem via dust or bulk movement of material, and sediment material which may enter the ecosystem via water-driven erosion and transport. The latter is considered to represent the more bioavailable form of the metal. In the absence of site-specific screening criteria, criteria for assessment of potential impacts as soil have been developed using the National Environment Protection Measure (NEPM) (NEPM, 2013) EIL that applies to 99% protection of areas of ecological significance. It is noted that this represents a conservative approach to screening. Criteria for assessment of potential impacts as sediment has been developed using Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) (ANZECC 2000) interim sediment quality guidelines (ISQG) low and high probable effects values. It is noted that for the purposes of this study, an exceedance of a trigger value under the guideline does not indicate a concentration of environment significance, but rather as an indication of potential contamination or migration with respect to that element. A summary of assessment criteria for the elements assessed as part of this study is provided in Table I-3.

Table I-3: Assessment criteria for multi-elements in soil materials

Element	EIL[1]	ISQG-Low[2] (mg/kg)	ISQG – High[3] (mg/kg)
Arsenic	40	20	70
Barium	ND	ND	ND
Beryllium	ND	ND	ND
Boron	ND	ND	ND
Cadmium	ND	1.5	10
Chromium[4]	170	80	370
Cobalt	ND	ND	ND
Copper[5]	30	65	270
Lead	480	50	220
Manganese	ND	ND	ND
Mercury	ND	0.15	1
Nickel[6]	15	21	52
Selenium	ND	ND	ND
Vanadium	ND	ND	ND
Zinc[7]	35	200	410

Notes:
[1] NEPM EIL for 99% protection of areas of ecological significance derived from ACL where appropriate
[2] ISQG – Low: sediment concentrations above which biological effects rarely occur
[3] ISQG – High: sediment concentrations above which biological effects would possible occur
[4] Assumed all Chromium is present as Cr III (conservative approach based on mineralogy). EIL value adopted based on average clay content for each material type (based on results presented in Appendix I)
[5] EIL value adopted based on average CEC and pH for each material type (based on results presented in Appendix I)
[6] EIL value adopted based on average CEC for each material type (based on results presented in Appendix I)
[7] EIL value adopted based on average CEC and pH for each material type (based on results presented in Appendix I)
ND = No trigger value data is published

I.2 Analytical results

Table I-4: Limit of reporting (LOR) of each soil parameter as analysed by ALS Laboratories

Soil Parameter	Units	LOR
pH (H_2O)	-	0.1
Soil Moisture	%	1
Electrical Conductivity (EC)	dS/m	0.001
Arsenic	mg/kg	5
Barium	mg/kg	10
Beryllium	mg/kg	1
Boron	mg/kg	50
Cadmium	mg/kg	1
Chromium	mg/kg	2
Cobalt	mg/kg	2
Copper	mg/kg	5
Lead	mg/kg	5
Manganese	mg/kg	5
Mercury	mg/kg	0.1
Nickel	mg/kg	2
Selenium	mg/kg	5
Vanadium	mg/kg	5
Zinc	mg/kg	5

Table I-5: Raw soil chemistry data for sampling sites assessed in November 2024

Site	Sample point	Approx. distance from haul road (m)	Nov-24		
			pH (LOR pH 0.1)	Soil Moisture (%) (LOR 1%)	Salinity (dS/m) (LOR 0.001 dS/m)
Impact site 1	1A	0	6.7	<1	0.487
	1B	70	8.3	<1	0.085
Impact site 2	2A	0	7.7	<1	0.703
	2B	70	8.0	1.2	0.163
Impact site 3	3A	0	7.5	1.4	1.310
	3B	30	8.0	3.9	0.055
	3C	160	7.3	<1	0.024
Control	C-A	NA	5.8	<1	0.025
	C-B	NA	5.8	<1	0.027
	C-C	NA	5.8	<1	0.029
	C-D	NA	5.9	<1	0.020

Table I-6: Raw total metal concentration data for sampling sites assessed in November 2024

Site	Sample point	Approx. distance from haul road (m)	Analyte (mg/kg)														
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury
Impact site 1	1A	0	<5	40	<1	<50	<1	82	6	16	<5	111	96	<5	58	11	<0.1
	1B	70	<5	20	<1	<50	<1	137	10	17	<5	140	176	<5	80	15	<0.1
Impact site 2	2A	0	<5	110	<1	<50	<1	94	14	26	5	474	100	<5	67	14	<0.1
	2B	70	<5	90	<1	<50	<1	113	13	27	<5	297	142	<5	62	18	<0.1
Impact site 3	3A	0	<5	200	<1	<50	<1	108	12	25	<5	268	188	<5	65	13	<0.1
	3B	30	<5	70	<1	<50	<1	96	5	19	<5	155	66	<5	71	8	<0.1
	3C	160	<5	<10	<1	<50	<1	94	3	9	<5	90	24	<5	49	10	<0.1
Control	C-A	NA	<5	<10	<1	<50	<1	62	<2	8	5	60	6	<5	40	9	<0.1
	C-B	NA	<5	<10	<1	<50	<1	67	<2	9	5	74	6	<5	42	10	<0.1
	C-C	NA	<5	<10	<1	<50	<1	77	<2	8	5	72	6	<5	40	9	<0.1
	C-D	NA	<5	<10	<1	<50	<1	62	<2	8	5	99	11	<5	39	12	<0.1

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stantec.com/au

Appendix 5 – Astron (2025) Mt Keith Vegetation Remote Sensing Analysis 2025

2 May 2025

Our Reference: 2400-003-24-EOLR-1Rev0_250812

Matthew Quinn
Principal Environment - Biodiversity
BHP Nickel West
125 St Georges Terrace
Perth WA 6000

Dear Matthew,

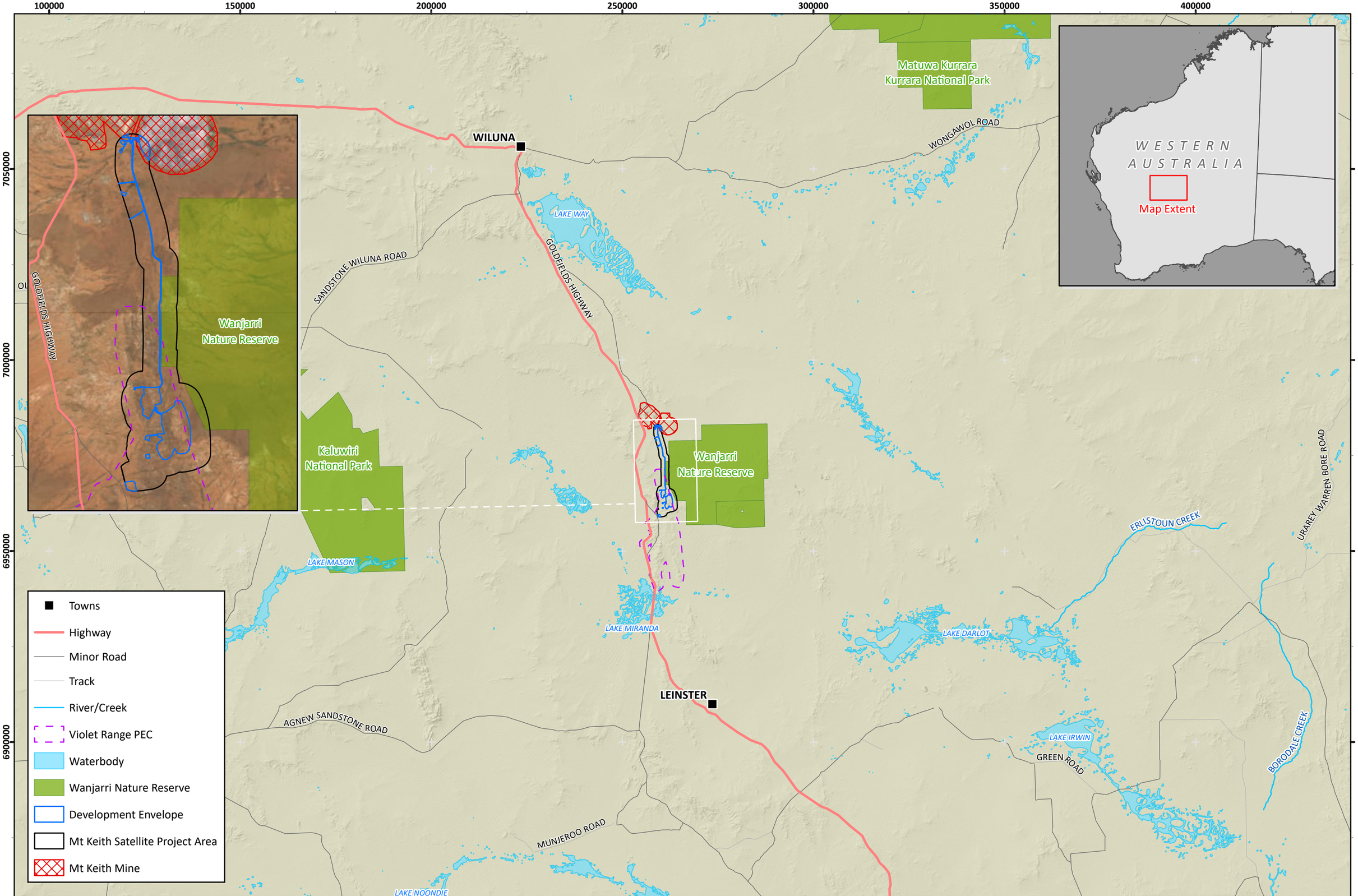
Re: Mt Keith Satellite Project - Vegetation Remote Sensing Analysis, May 2025

1 Introduction

BHP Nickel West (BHP NiW) requested Astron Environmental Services (Astron) undertake a remote sensing analysis of the vegetation condition encompassing the Mt Keith Satellite Project development envelope and surrounding area (the project area), approximately 18 km south of the Mt Keith mine operations. The project area is 109 km^2 and includes 30 km^2 of the Violet Range (Perseverance Greenstone Belt), vegetation complexes (banded ironstone formation) and Priority Ecological Community (the Violet Range PEC) (Figure 1). The project area also includes 7.4 km^2 of the Wanjarri Nature Reserve, occurring on the eastern border of the development envelope (Figure 1). The Wanjarri Nature Reserve supports conservation significant flora and is the only A Class Reserve in the northern part of Eastern Goldfields (CALM 1996).

Astron has conducted annual remote sensing analyses since 2020 to assess change since baseline (2017) and annual change in the vegetation condition (Astron Environmental Services 2020, 2021, 2022, 2023, 2024). In these analyses, WorldView-2/3 or Pléiades Neo imagery is used to assess change in the vegetation condition within the project area to fulfil compliance obligations outlined in the Mt Keith Satellite Project Flora and Vegetation Environmental Management Plan (FVEMP) (BHP Nickel West 2018). In 2024, additional analyses were undertaken to explore how vegetation condition varies relative to infrastructure and the riparian corridor in the southeast of the site. Further comparisons were also made to assess whether vegetation condition changes within the riparian corridor, as well as within the Violet Range PEC, differed from those observed across the remainder of the study area.

This report presents findings on vegetation condition changes within the Mt Keith Satellite Project, including baseline trends from 2017 to 2024 and annual variations from 2023 to 2024. It also details the influence of infrastructure and the riparian corridor on vegetation condition, as well as comparative assessments of vegetation condition changes within the riparian corridor and the Violet Range PEC in relation to the remainder of the study site.



BHP Nickel West

Mt Keith Satellite Project - Vegetation Remote Sensing Analysis

Figure 1: Project area location

Scale: 1:900,000 at A3

Coordinate System: GDA 1994 MGA Zone 51

0 10 20 30 40 50 Kilometres

N

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an ecocene company

Author: H. Koh | Drawn: H. Koh | Date: 01-04-2025 | Figure Ref: 2400-003-23-EODR-1RevA_010425_Fig01_Locn

2 Methods

2.1 Imagery Acquisition

For the annual monitoring comparison, vegetation condition within the Mt Keith project area was analysed using high-resolution satellite imagery from Pléiades Neo and WorldView-2 sensors. WorldView-2, launched by Maxar in 2009, and Pléiades Neo, launched by Airbus in 2021, both capture reflectance data across multispectral bands within the electromagnetic spectrum, including visible and near-infrared (NIR) wavelengths. The 6-band Pléiades Neo imagery, supplied by satellite imagery provider Geoimage Pty Ltd (Geoimage), was used for the 2023 and 2024 analyses and was supplied at a spatial resolution of 1.2 m (Table 1). For the baseline analysis in 2017, 4-band WorldView-2 imagery supplied by Geoimage was used and supplied at a spatial resolution of 1.6 m (Table 1; DigitalGlobe 2013).

Table 1: Imagery acquired for the vegetation assessment.

Sensor	Image Acquisition Date
WorldView-2	September 2017
Pléiades Neo	September to November 2023 November 2024

2.2 Image Pre-processing

Image pre-processing is used to control common sources of error known to occur in imagery. While no pre-processing or correction algorithm can remove all distortions from an image, correction methods have been developed and applied to minimise the impact of the distortions or errors. In the case where temporal comparison or time series analyses are required, the pre-processing is even more critical. Without this, there is no way to reliably know if an observed change is the result of errors and distortions within the input datasets or from true environmental change.

Atmospheric correction is the broad term used to describe methods of correcting remotely sensed datasets for the effects of the atmosphere on both incoming and reflected solar radiation. Common effects of the atmosphere on electromagnetic radiation include scattering and absorption. Both effects can alter the amount and type of radiation detected by a sensor. Atmospheric correction allows for minimisation of these effects, and therefore improved comparability of images from different dates. Geoimage performed a limited atmospheric correction to surface reflectance for the 2023 and 2024 imagery and Maxar used their proprietary atmospheric compensation method to correct surface reflectance in 2017 data (Pacifici et al. 2012, Pacifici 2016).

Astron did not need to co-register the 2024 imagery as it was found to align with the 2023 imagery. Cloud masking applied to the 2023 imagery resulted in the exclusion of approximately 13% of the total study area in the southeast for the annual change analysis.

2.3 Vegetation Detection

A combination of a red-band mask and a Modified Soil Adjusted Vegetation Index (MSAVI; Equation 1) mask was used to detect vegetation across the entire project area. The efficacy of the red-band mask stemmed from differences in distinctive reflectance properties of soil and vegetation. The soil exhibited a high red reflectance, while the vegetation displayed a lower one, which facilitated the masking of non-vegetation. MSAVI exploits the reflectance properties of live vegetation (low red range, high near infrared range reflectance) to measure vegetation health. Higher values returned by

the index indicate healthy vegetation while lower values indicate dry vegetation or cover other than vegetation (Qi et al. 1994), thus the MSAVI mask aided the digitisation of infrastructure. To ensure consistency, a combined 2017, 2023, and 2024 infrastructure digitisation mask was used to exclude these areas from the change analysis. For the 2024 additional analyses, only the 2024 infrastructure digitisation was used. A combined mask was created from the red-band mask and the MSAVI mask and converted into a binary layer (i.e., 1 for vegetation and 0 for soil). The total vegetation cover was quantified as a percentage of the entire site area derived from the binary layer, which is the percentage of ones in the binary mask. Changes in vegetation cover were then computed by comparing the percentage differences between 2024 and 2023 for the annual variation analysis, and 2024 and 2017 for the baseline trend analysis.

$$MSAVI = \frac{2 * NIR + 1 - \sqrt{(2 * NIR + 1)^2 - 8 * (NIR - R)}}{2}$$

Equation 1: Modified Soil-Adjusted Vegetation Index (MSAVI) formula. R represents the red spectral band, and NIR the near-infrared band.

2.4 Vegetation Condition Assessment

The vegetation condition was assessed for the entire landscape and for pixels corresponding to vegetation only using MSAVI (Equation 1) (Qi et al. 1994). For both change analyses, the MSAVI layer was calculated for the relevant years and statistics of MSAVI derived for the whole landscape and for the vegetation cover only using the union of the two years' binary vegetation cover layer. For the annual variation analysis, an MSAVI change layer was generated by subtracting the MSAVI values of 2023 from those of 2024. Similarly, for the baseline trend analysis, the 2017 MSAVI values were subtracted from those of 2024. The combined 2017, 2023 and 2024 infrastructure digitisation layer was excluded for both change analyses, while areas where clouds appeared in 2023 were excluded for the annual variation analysis.

The MSAVI change values do not represent percent change. Values greater than 0 indicate a linear increase in MSAVI values between dates (for example, 0.1 is a small increase and >0.3 is a large increase), values less than 0 indicate a decrease in MSAVI (for example, -0.1 is a small decrease and <-0.3 is a large decrease), while 0 indicates no change. To test for statistically significant MSAVI change, a cluster analysis was used, which is discussed in Section 2.5.

2.5 Clustering Analysis

To identify hotspots of positive and negative vegetation change, a geospatial cluster analysis was performed, which involved analysing change values for each pixel relative to the values of neighbouring pixels. The Getis-Ord statistic (Getis and Ord 1992) was calculated to separate aggregations of pixels with similar change values from areas of random change. For instance, positive clusters indicate aggregations of pixels with positive change and differing from the general trend across the scene. It is important to note that in the case of a uniform trend between pixels (decrease, no change or increase), no clusters will be returned. Therefore, the cluster results should be viewed along with the change layers.

The Getis-Ord statistic assigns a Z-score to each cluster and the statistical significance of the Z-score is measured based on a Monte-Carlo approach. A kernel density calculation is then performed based on significant Z-scores to produce raster layers of MSAVI clusters. For statistically significant positive Z-scores, the larger the Z-score is, the more intense the clustering of high values is (e.g. positive change). For statistically significant negative Z-scores, the smaller the Z-score is, the more intense the clustering of low values is (e.g. negative change).

2.6 2024 Additional Analysis

2.6.1 Proximity to Infrastructure

Using the 2024 infrastructure digitisation created from the MSAVI mask, a series of 25 m incremental buffer zones up to 1000 m was applied. These buffers zones were used to define distance bands from infrastructure. Vegetation cover and condition for both landscape and vegetation only were then quantified for each band and were statistically compared between each other to identify if any relationship was observable.

2.6.2 Proximity to Riparian Corridor

The riparian corridor was extracted from the imagery though the use of existing hydrological datasets. A series of 25 m incremental buffer zones up to 500 m was applied to the corridor to define distance bands from the corridor. Vegetation cover and condition (landscape and vegetation only) was compared between bands. Additionally, a larger buffer of 100 m was created to represent the general extent of the riparian corridor. Analysis was then undertaken to determine whether observed overall condition and cover within the corridor were different to those observed outside of the corridor. The magnitude of change was also assessed between the corridor and the larger study site. This analysis indicated whether potential decline observed in the 2023 analysis was greater than across other areas.

2.6.3 Violet Ranges PEC

Comparison was undertaken to compare vegetation cover and condition (both for landscape and vegetation only) within the Violet Ranges PEC relative to the remainder of the study site. Infrastructure was excluded from the analysis. This comparison was calculated for the 2024 data, as well as for the baseline variation and annual change analysis.

2.7 Auxiliary Data

To understand natural influences on vegetation condition within the project area, data on rainfall and fire history were collected and analysed.

Rainfall data interpolated for the project location (120.55°E, -27.40°S) were sourced from the Scientific Information for Land Owners (SILO) database (Queensland Government 2023, 2024). The SILO database sources climate data from the Bureau of Meteorology and interpolates data between weather stations to provide a complete dataset for any location. Annual rainfall (from 1 October 2023 to 31 September 2024), long-term annual average rainfall (from 1890 to 2024), and monthly rainfall for 2023 to 2024 were calculated. In addition, rainfall was categorised using the decile method, based on long-term average rainfall where data were allocated into five bins, each containing 20% of the data range obtained from the long-term time series. Annual values were then categorised into the respective category in which they fall as described in Table 2.

Table 2: Rainfall decile categories

Category	Decile bins
Much below normal	Lowest 20%
Below normal	Within lowest 20 - 40%
About normal	Within 20% of normal
Above normal	Within highest 20 - 40%
Much above normal	Highest 20%

Fire scar data were sourced from the North Australia and Rangelands Fire Information (NAFI) database (NAFI 2024). This database provides annual updates on fire history by way of access to fire boundary shapefiles containing attributes such as location and fire extent.

Fire scar maps are derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) sensor on the Terra and Aqua satellites, and from Sentinel-2 satellites using algorithms such as the Normalised Burn Ratio (Wagtendonk 2004), or similar indexes, which use the differences in reflectance properties of the spectral bands to highlight the presence of recently burnt vegetation. The MODIS algorithm (MODIS 2022) also uses active fire detection or hotspot information, derived from thermal infrared bands, to identify areas where fire scars are likely to occur after the fire has passed, as these algorithms can sometimes generate false positive detection of fire scars.

2.8 Limitations

When interpreting the results or using it for any further analysis, it is important to note that the two images for the baseline variation analysis were captured by different sensors with different atmospheric correction methods applied. Pléiades Neo corrects for the gaseous component of the atmosphere, often called Rayleigh-only correction (Pléiades 2021). This does not try to compensate for different levels of atmospheric aerosol, water vapour or ozone. Maxar satellite data atmospheric correction reports to perform a more rigorous process where these other atmospheric constituents are considered (Maxar 2025). Whilst both images were corrected to surface reflectance by the image provider, as the correction methods applied are different, there is a possibility of differences in MSAVI values due to differences in the correction applied.

The observational geometry, which is the angle between the Sun and the surface at the time of satellite overpass, and the direction that the satellite views the surface at the time of overpass can also create differences in surface reflectance. If there are large discrepancies between the day of the year that multi-year data are captured, this can cause differences in surface reflectance and indices, such as MSAVI, which may not be indicative of relative changes in vegetation condition. Differences between the specification of the two sensors, such as wavelength and band width, may also introduce inaccuracies.

3 Results and Discussion

3.1 Rainfall

Annual rainfall in 2024 was 329 mm, which was higher than both the long-term average of 228 mm (from 1890 to 2024) and the 2023 annual rainfall of 142 mm (Queensland Government 2024) (Figure 2). Within the 12 months prior to the 2024 remote sensing analysis, rainfall was well above the long-

term average in March, April, June, November, and December 2024 and January 2025 (Figure 3). However, rainfall was well below the long-term monthly average in February, May, July, August, September and October 2024 (Figure 3).

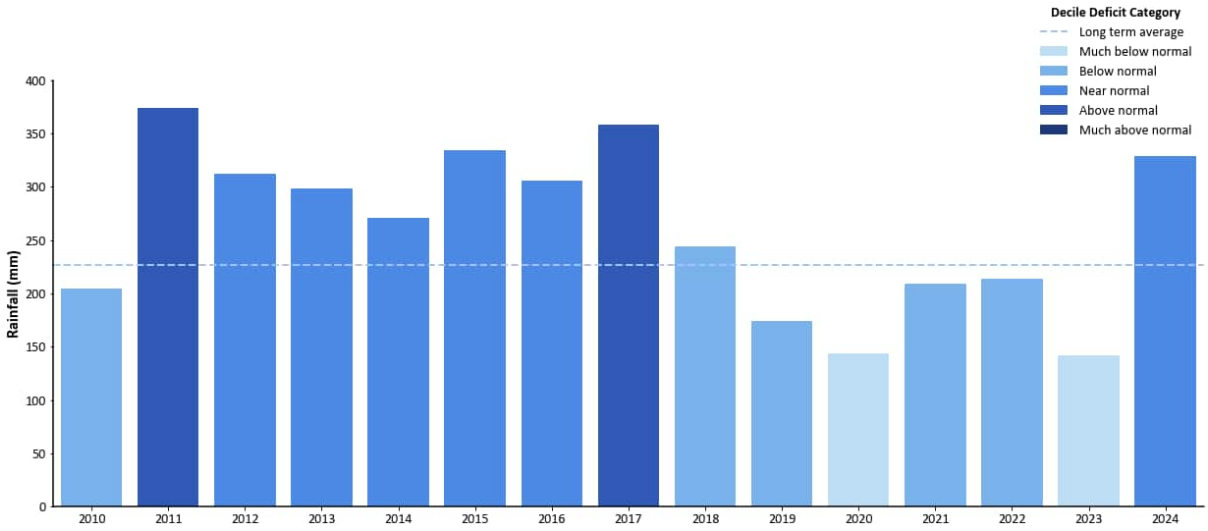

Figure 2: Rainfall total for 12-month periods (1 October to 30 September) from 2010 to 2024 for the project area (data from the Scientific Information for Land Owners (SILO) database, at 120.55°E, -27.40°S (Queensland Government 2025)). The dashed line represents the long-term average for the period 1890 to 2024.

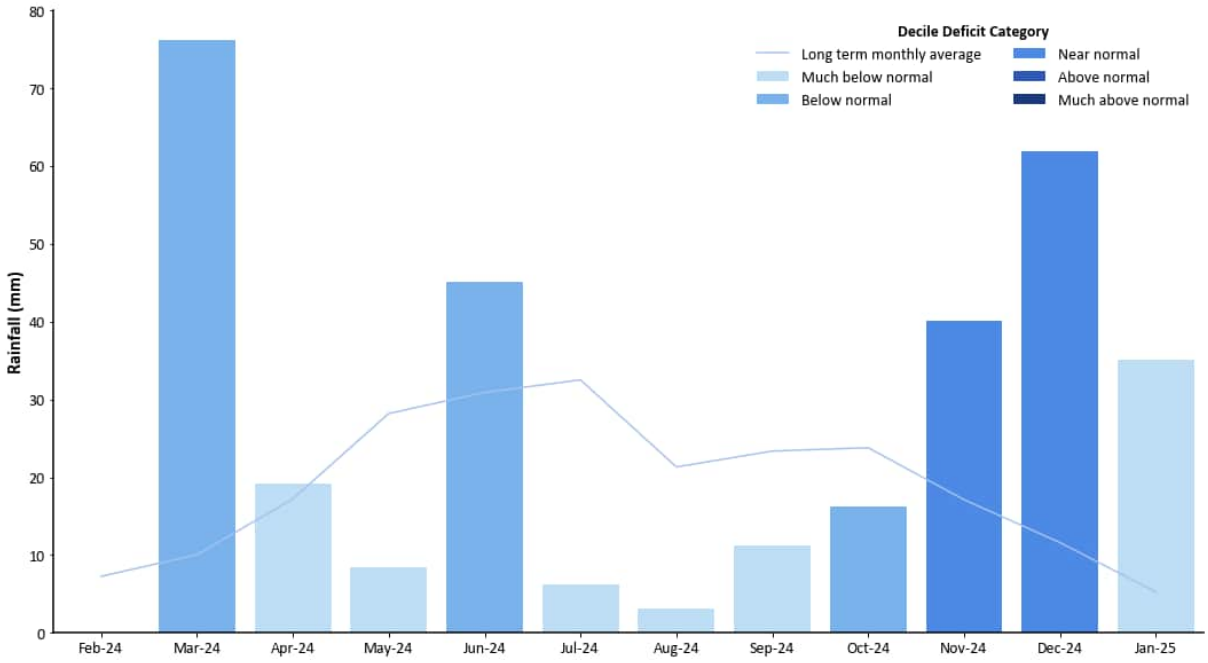

Figure 3: Monthly rainfall total for February 2024 to January 2025 (data from the Scientific Information for Land Owners (SILO) database, at 120.55°E, -27.40°S (Queensland Government 2025)). The plotted line represents long-term monthly average (1890 to 2024).

3.2 Fire History

Since January 2017, fire activity has only been recorded in 2019 in the north-eastern section of the project area, near the tailings storage facility (TSF) (NAFI 2023). While fire scars were evident over the TSF and nearby mining operations in 2019, these areas support little, if any, vegetation, so it is very likely that these detections may be false positives. For the 2024 analysis, no fire activity was detected.

3.3 Annual Comparison Analysis (2023 to 2024)

3.3.1 Vegetation Detection and Condition Assessment

The MSAVI statistics for the entire landscape (vegetated and non-vegetated) recorded a slight increase from 2023 to 2024 (Table 3). This slight increase may indicate there had been vegetation growth since 2023. The results for vegetation only MSAVI values recorded similar increases within these statistics, most notably with an increase in MSAVI values within the 95th percentile, although values were slightly higher when compared to the entire landscape (Table 3). Total vegetation cover over the landform (derived from MSAVI values) increased by 6.22% between 2023 and 2024. It is likely that the wetter-than-average annual conditions resulted in overall greener vegetation with more photosynthetic activity, thus resulting in an increase in detectable vegetation.

The mean MSAVI change between 2023 and 2024 showed a slight increase in mean MSAVI for vegetation only, with an increase of 0.01 (Table 3). This is illustrated spatially as the MSAVI change map (Figure 4), where the majority of the project area fell into two MSAVI change categories: negligible change (-0.05 to +0.05) over some areas, and a slight increase (+0.05 to +0.15) over larger areas for both the entire landscape and the vegetation only mask. However, increases shown on the map were observed mostly at the lower end of the change category (+0.05 to +0.15) when considering the mean changes in Table 3. Nonetheless, there were small areas of negative change (-0.05 to -0.15) which may be a result of mine operation expansion or clearing of land (Figure 4). There were also small areas of larger positive change (0.15 to 0.3) around the riparian zone (Figure 4), which may be the result of increased rainfall in 2024 leading up to the satellite data capture.

Table 3: Modified Soil-Adjusted Vegetation Index (MSAVI) and vegetation cover statistics. The statistics displayed in the landscape columns include the entire project area as shown in Figure 1. The statistics displayed in the vegetation segments columns are confined to the vegetation only and the minimum extent between the 2023 and 2024 images.

Statistics	Landscape (vegetation and non-vegetation)		Vegetation Only	
	2023	2024	2023	2024
5th percentile MSAVI	0.08	0.09	0.09	0.10
Mean MSAVI	0.12	0.13	0.14	0.15
95th percentile MSAVI	0.16	0.20	0.13	0.21
Standard deviation MSAVI	0.03	0.03	0.04	0.04
Vegetation cover (%)	19.13	25.35	-	-

MSAVI Change Landscape

MSAVI Change Vegetation Segments (Union)

Development Envelope

Violet Range PEC

Mt Keith Satellite Project Area

MSAVI Change (2023 to 2024)

> 0.3

0.15 to 0.3

0.05 to 0.15

-0.05 to 0.05

-0.15 to -0.05

-0.3 to -0.15

< -0.3

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Mt Keith Satellite Project - Vegetation Remote Sensing Analysis

Figure 4: Modified Soil-Adjusted Vegetation Index change November 2023 to November 2024 from Pleiades Imagery

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Author: H. Koh	Date: 01-04-2025	Scale: 1:85,000 at A3 Coordinate System: GDA 1994 MGA Zone 51 Kilometres 0 1 2 3 4 5 N
Drawn: H. Koh	Figure Ref: 2400-003-23-EODR-1RevB_010425_Fig04_dMSAVI_23-24	

3.3.2 Cluster Analysis

The results of the cluster analysis derived from the 2023 to 2024 MSAVI change layers highlight areas of statistically significant change (Figure 5). Clusters identified were variable across the entire project area. The areas of the most positive change were around the digitised infrastructure, in particular around the mining operations in the south of the development envelope, which may be a result of run off from the mining operations. The areas with the most negative change were seen in the north and southeast of the development. A majority of the negative clusters occurred where there were positive clusters from 2023 (Astron Environmental Services 2023), indicating that there a moderate decline was observed in these areas compared to 2023.

260000

270000

6980000

6970000

6960000

Mt Keith Satellite Project Area

Development Envelope

Violet Range PEC

Cluster Analysis

Positive

Negative

BHP Nickel West

Mt Keith Satellite Project - Vegetation Remote Sensing Analysis

Figure 5: Cluster analysis November 2023 to November 2024 from Pleiades Imagery

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Author: H. Koh	Date: 01-04-2025	Scale: 1:75,000 at A3 Coordinate System: GDA 1994 MGA Zone 51
Drawn: H. Koh	Figure Ref: 2400-003-23-EODR-1RevB_010425_Fig05_Cluster_23-24	0 1 2 3 4 5 Kilometres N

3.4 Baseline Variation Analysis (2017-2024)

3.4.1 Vegetation Detection and Condition Assessment

MSAVI statistics for the entire landscape (vegetated and non-vegetated) recorded an increase from 2017 to 2024 (Table 4). This indicated that there had been vegetation growth since 2017. The results for vegetation only MSAVI values recorded similar increases within these statistics, most notably with an increase in mean MSAVI values from 0.09 in 2017 to 0.15 in 2024 (Table 4). Total vegetation cover over the landform (derived from MSAVI values) increased by 10.84% between 2017 and 2024.

The increase in MSAVI for vegetation only is illustrated spatially as the MSAVI change map (Figure 6), where the majority of the project area recorded a slight increase (+0.05 to +0.15) for both the entire landscape and the vegetation segments. However, increases in MSAVI shown on the map are mostly at the lower end of the change category (+0.05 to +0.15) when considering the mean changes in Table 4. Nonetheless, there were small areas of negative change (-0.05 to -0.15) which may be the result of mine operation expansion or clearing of land rather than negative effects from changes to natural water flows within the riparian zone (Figure 6). There were also small areas of positive change (0.15 to 0.3) around the riparian zone (Figure 6), which may be due to an increase from normal rainfall in 2024.

Table 4: Modified Soil-Adjusted Vegetation Index (MSAVI) and vegetation cover statistics. The statistics displayed in the landscape columns include the entire project area as shown in Figure 1. The statistics displayed in the vegetation segments columns are confined to the vegetation only and the minimum extent between the 2017 and 2024 images.

Statistics	Landscape (vegetation and non-vegetation)		Vegetation Only	
	2017	2024	2017	2024
5th percentile MSAVI	0.04	0.09	0.04	0.11
Mean MSAVI	0.08	0.13	0.09	0.15
95th percentile MSAVI	0.13	0.17	0.17	0.22
Standard deviation MSAVI	0.03	0.03	0.04	0.04
Vegetation cover (%)	13.29	24.13	-	-

MSAVI Change Landscape

MSAVI Change Vegetation Segments (Union)

Development Envelope

Violet Range PEC

Mt Keith Satellite Project Area

MSAVI Change (2017 to 2024)

> 0.3

0.15 to 0.3

0.05 to 0.15

-0.05 to 0.05

-0.15 to -0.05

-0.3 to -0.15

< -0.3

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Mt Keith Satellite Project - Vegetation Remote Sensing Analysis

Figure 6: Modified Soil-Adjusted Vegetation Index change September 2017 to November 2024 from WorldView and Pleiades Imagery

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Author: H. Koh	Date: 09-04-2025	Scale: 1:85,000 at A3 Coordinate System: GDA 1994 MGA Zone 51
Drawn: H. Koh	Figure Ref: 2400-003-23-EODR-1RevB_250331_Fig06_dMSAVI_17-24	0 1 2 3 4 5 Kilometres N

3.4.2 Cluster Analysis

The results of the cluster analysis derived from the 2017 to 2024 MSAVI change layers highlight areas of statistically significant change (Figure 7). Clusters identified were variable across the entire project area. The areas of the most positive change were around the digitised infrastructure particularly around the mining operations in the south of the development envelope. The areas with the most negative change were seen in the north and may be associated with mining operations. It is also possible that the clusters analysis is impacted due to differences in site illumination between captures, as solar conditions are variable between September and November, and due to differences between Worldview-2 and Pléiades Neo sensors.

260000

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Mt Keith Satellite Project Area

Development Envelope

Violet Range PEC

Cluster Analysis

Positive

Negative

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Mt Keith Satellite Project - Vegetation Remote Sensing Analysis

Figure 7: Cluster analysis September 2017 to November 2024 from WorldView and Pleiades Imagery

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an ecocene company

Author: H. Koh	Date: 11-04-2025	Scale: 1:75,000 at A3 Coordinate System: GDA 1994 MGA Zone 51
Drawn: H. Koh	Figure Ref: 2400-003-23-EODR-1RevB_250331_Fig07_Cluster_17-24	0 1 2 3 4 5 Kilometres N

3.5 2025 Additional Analysis

3.5.1 Proximity to Infrastructure Analysis

Figure 8 shows a plot of the relationship between proximity from infrastructure and landscape vegetation health calculated by MSAVI. The logarithmic trend line fitted to the data suggests that as the distance from infrastructure increases, MSAVI also increases, but at a decreasing rate. The coefficient of determination (R^2 = 0.84) indicates that the model explains approximately 84% of the variability in MSAVI, suggesting a strong fit.

Figure 9 shows the relationship between proximity from infrastructure and vegetation health calculated by MSAVI. The initial value at 25 m is 0.1480, slightly higher than the immediate surrounding values in the next few buffer zones, which show a minor dip before gradually increasing again. Near the middle of the buffer zones (approximately 300 –500 m), there is a slight but noticeable upward trend, with values peaking at approximately 0.1512, suggesting that vegetation health tends to improve slightly as distance from infrastructure increases. However, the pattern is not as consistent when considering MSAVI values from the entire project area. MSAVI values are lower for bare soil, dry vegetation and some understory ground cover and these items are excluded in the vegetation only analysis. Average values for MSAVI increase as a result of this exclusion, most noticeably closest to the infrastructure. While there are small fluctuations throughout, the strength of the association is weaker than landscape health and proximity to infrastructure.

Figure 10 shows a plot of vegetation cover fraction and distance from infrastructure. The logarithmic trend line fitted to the data shows less agreement to the data than observed for the analysis of MSAVI, indicating that as the distance from infrastructure increases, so too does the vegetation cover, but at a decreasing rate. The coefficient of determination (R^2 = 0.54) shows that the model explains about 54% of the variation in vegetation cover. The model demonstrates a moderate relationship implying that other factors, beyond just the distance from infrastructure, may play a significant role in determining vegetation cover.

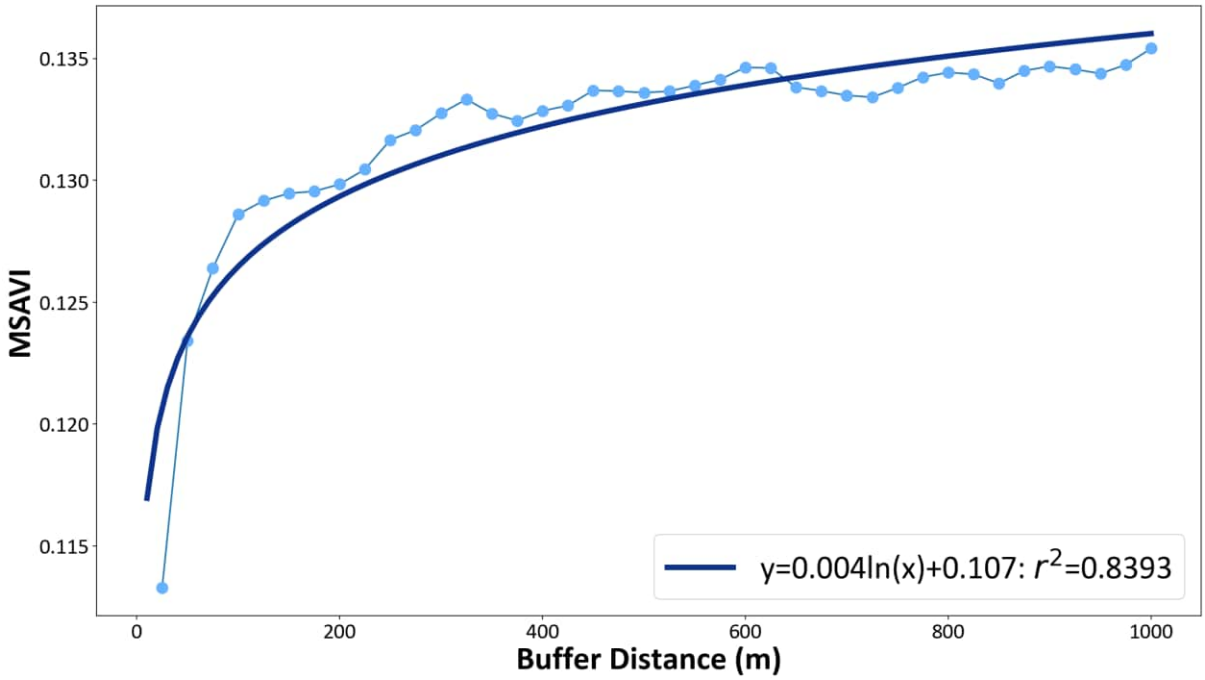

Figure 8: The relationship between distance from infrastructure and 2024 mean vegetation health (MSAVI) for landscape wide.

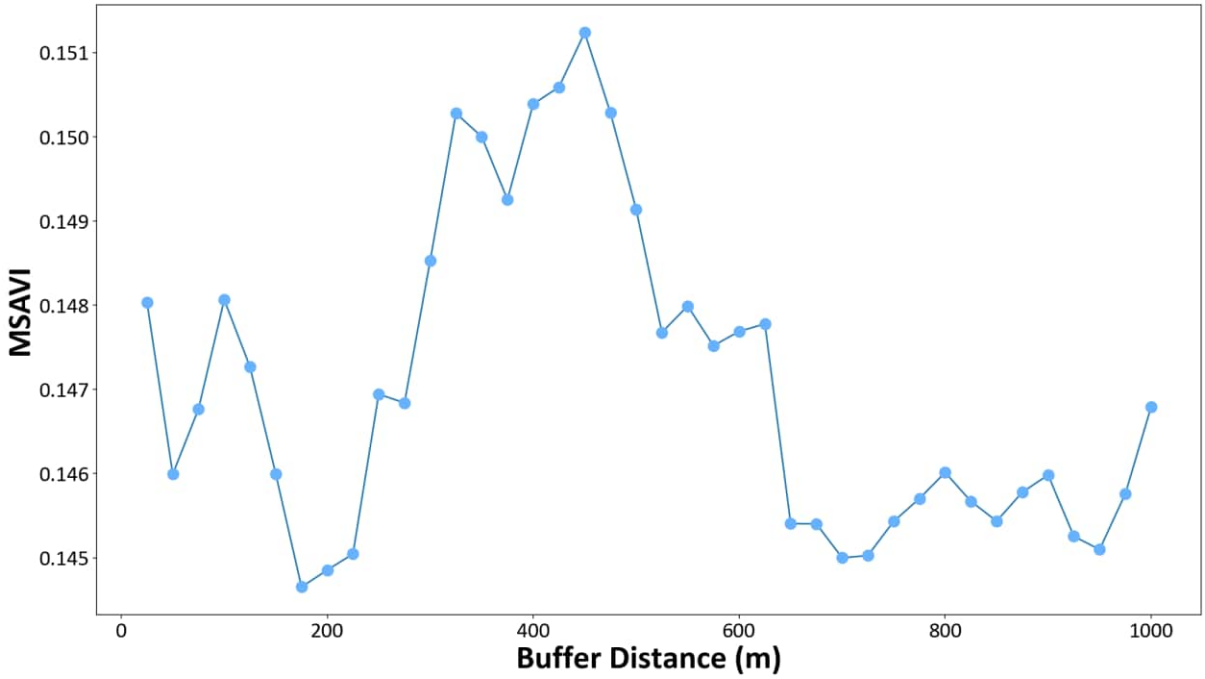

Figure 9: The relationship between distance from infrastructure and 2024 mean vegetation health (MSAVI) for vegetation only.

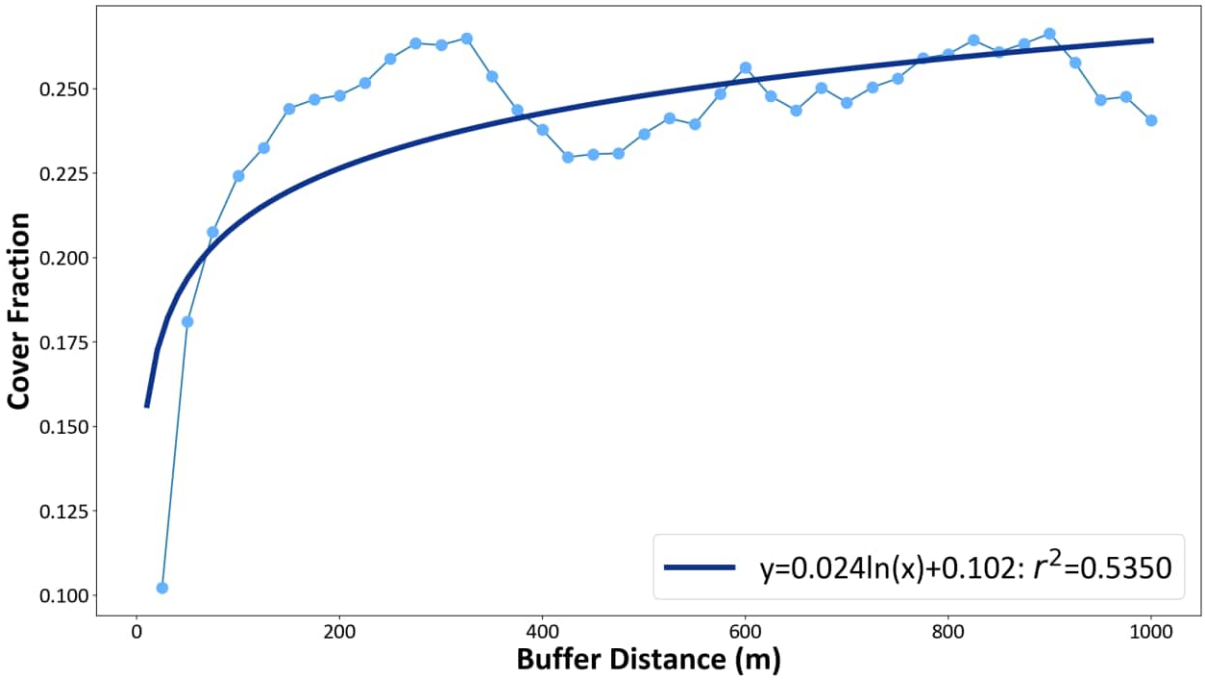

Figure 10: The relationship between distance from infrastructure and 2024 mean vegetation cover.

3.5.2 Proximity to Riparian Corridor Analysis

Figure 11 shows the non-linear relationship between distance from the riparian corridor and landscape vegetation health calculated by MSAVI. The highest MSAVI values occur at 25 m (0.149), and then drop rapidly over the first 100–125 m, reaching a minimum of 0.123 at 150m. This suggests a sharp decline in vegetation condition just beyond the riparian zone. Beyond this minimum, values stabilise and then gradually increase, reaching 0.130 by 500 m from the riparian corridor.

Figure 12 shows a non-linear relationship between mean vegetation (vegetation only) MSAVI with increasing distance from the riparian corridor. At 25 m, mean MSAVI is at its peak (0.172), indicating dense and/or healthy vegetation near the corridor. However, there is a noticeable decline in vegetation health over the next 50–75 m, reaching a low of approximately 0.137 by 125 m (Figure 12). This suggests that while vegetation adjacent to the riparian zone benefits from proximity to water and soil moisture, a transitional zone exists. Beyond the transition zone, MSAVI values decrease, potentially due to reduced water access, substrate changes, or disturbance. Beyond 125 m, vegetation health gradually improves with distance, rising to 0.148 by 500 m from the riparian corridor. This increasing trend may reflect a shift to more stable or favourable conditions for vegetation growth further from the corridor.

Figure 13 shows the relationship between vegetation cover with increasing distance from the riparian corridor. Starting at an MSAVI value of 0.356 at 25 m, vegetation cover drops sharply to a minimum of 0.174 at 100m, indicating a zone of reduced vegetation density immediately beyond the riparian edge. Beyond this point, vegetation cover gradually recovers in an overall upward trend, rising to 0.228 by 500 m. Despite some fluctuations, the overall pattern suggests that the immediate buffer beyond riparian areas may experience reduced vegetation density, followed by a gradual recovery with distance.

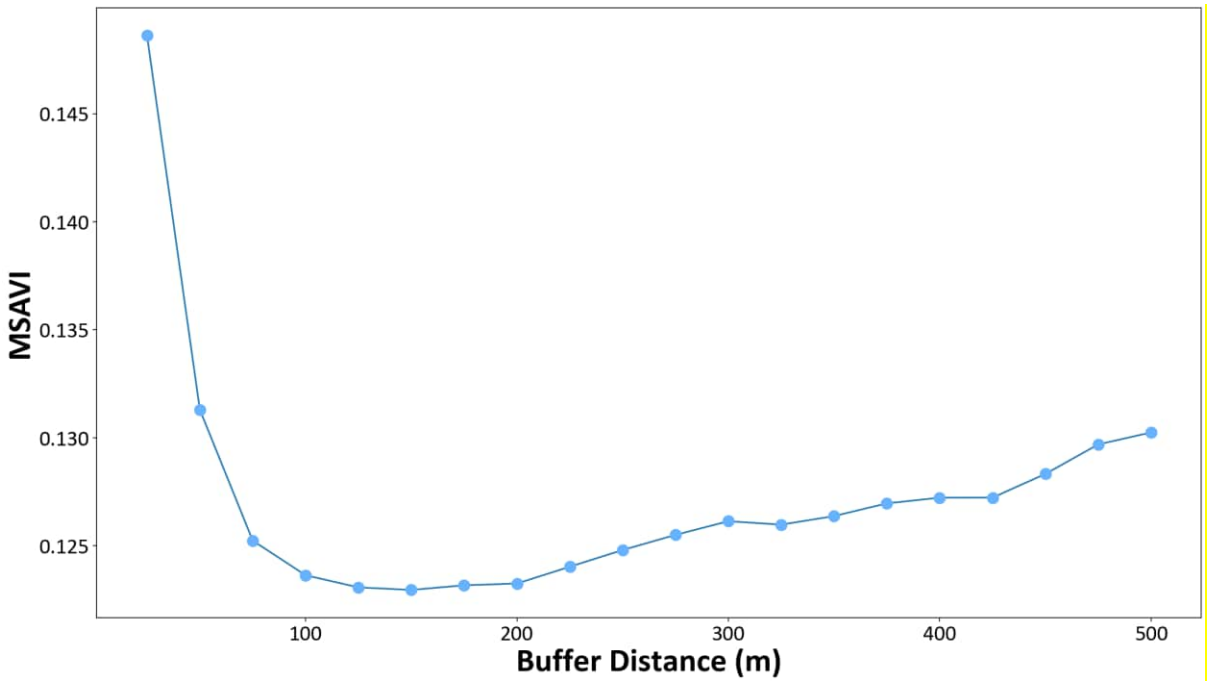

Figure 11: The relationship between distance from the riparian corridor and 2024 mean vegetation health (MSAVI) for landscape wide.

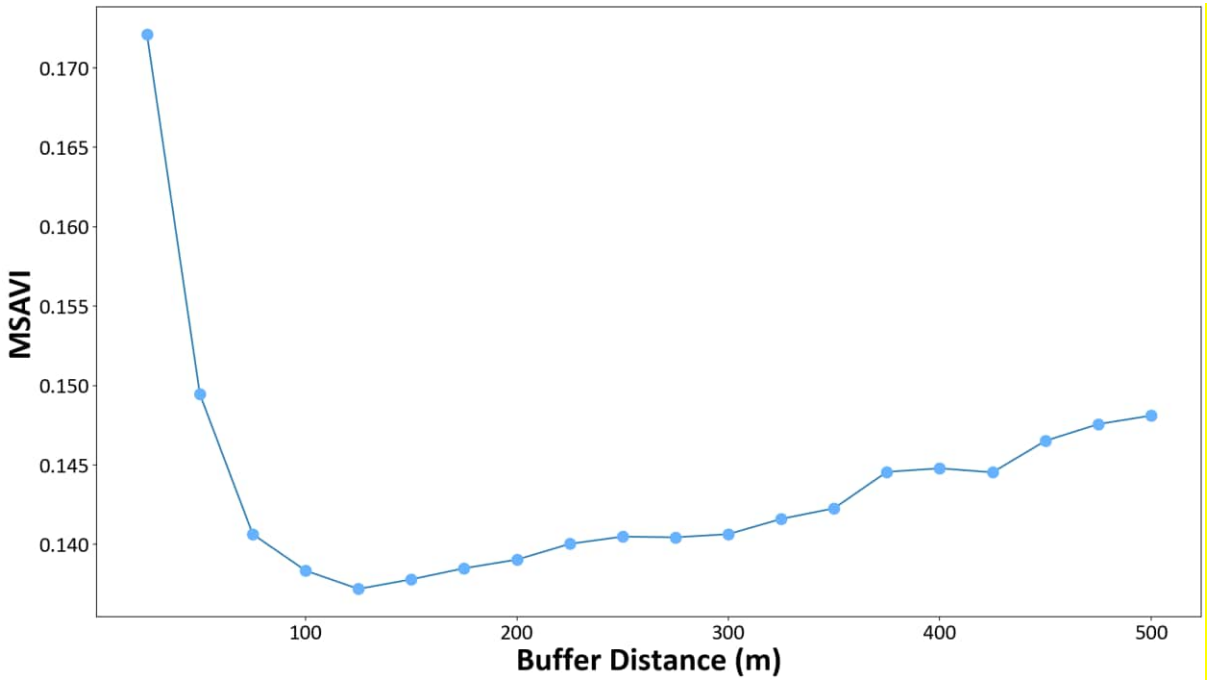

Figure 12: The relationship between distance from the riparian corridor and 2024 mean vegetation health (MSAVI) for vegetation only.

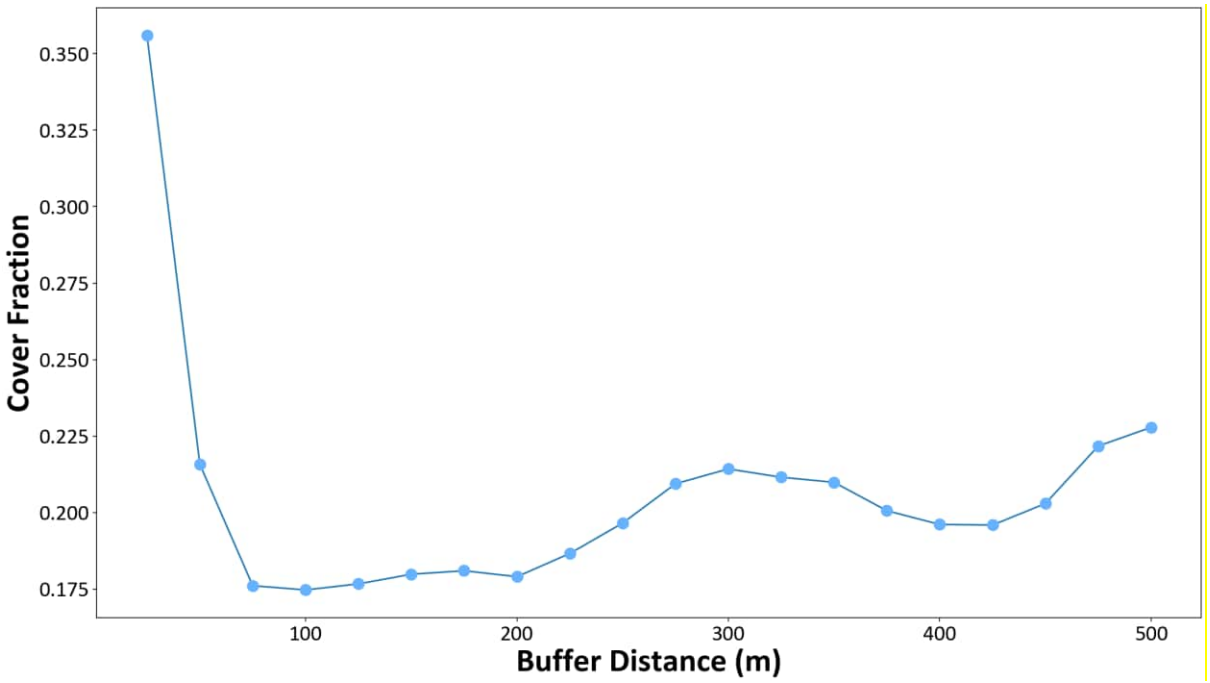

Figure 13: The relationship between distance from the riparian corridor and 2024 mean vegetation cover.

A comparison between the riparian corridor with a 100 m buffer and the remainder of the study site in 2024 revealed similar vegetation characteristics. Mean vegetation cover was slightly lower within the riparian corridor (23.31%), compared to the rest of the site (23.99%; Table 5). Mean vegetation condition for both landscape wide and vegetation only were identical between the riparian corridor and remainder of the study site (0.13 and 0.15, respectively; Table 5). These results suggest that, at a broad scale, vegetation health is relatively uniform across the landscape, with little distinction between riparian and non-riparian zones in 2024.

Table 5: 2024 Vegetation condition statistics comparing the riparian corridor 100 m buffer area with the remainder of the study site.

Statistics	Riparian Corridor	Remainder of study site
2024 Mean Vegetation Cover (%)	23.31	23.99
2024 Mean Vegetation Condition (Landscape wide)	0.13	0.13
2024 Mean Vegetation Condition (Vegetation only)	0.15	0.15

3.5.3 Violet Ranges PEC Analysis

Table 6 compares vegetation condition within the Violet Ranges PEC relative to the remainder of the study site. In 2024, mean vegetation cover was notably lower in the PEC (15.67%) compared to the rest of the site (24.66%), indicating a sparser vegetation presence within the PEC area. Mean vegetation condition across the landscape was also lower in the PEC (0.13) than in the remainder (0.16), suggesting slightly reduced vegetation health in this area. However, when considering vegetation only, vegetation condition was consistent between the two zones at 0.15, indicating that where vegetation is present, its condition is similar across the landscape.

Between 2023 and 2024, the PEC saw a mean increase in vegetation cover of 3.34%, while the remainder of the site experienced an increase of 5.65%. Vegetation condition improved slightly in

both areas over the same period, with the PEC showing a 0.02 increase at both the landscape and vegetation only scales, compared to a 0.01 increase in the remainder of the site.

When 2024 was compared to baseline (2017), both zones experienced gains in vegetation cover and condition. The PEC showed a 6.13% increase in vegetation cover, while the remainder of the study site recorded an increase of 11.77%. Vegetation condition at the landscape scale improved equally in both areas (+0.05), while the vegetation only condition increased slightly more in the PEC (+0.07) than in the remainder of the site (+0.06), suggesting slightly greater gains in vegetated areas within the PEC over this longer timespan.

Table 6: Vegetation condition statistics comparing the Violet Ranges PEC area with the remainder of the study site.

Statistics	Violet Ranges PEC	Remainder of study site
2024 Mean Vegetation Cover (%)	15.67	24.66
2024 Mean Vegetation Condition (Landscape wide)	0.13	0.16
2024 Mean Vegetation Condition (Vegetation only)	0.15	0.15
2023 – 2024 Mean change in Vegetation Cover (%)	3.34	5.65
2023 – 2024 Mean change in Vegetation Condition (Landscape wide)	0.02	0.01
2023 – 2024 Mean change in Vegetation Condition (Vegetation only)	0.02	0.01
2017 - 2024 Mean change in Vegetation Cover (%)	6.13	11.77
2017 – 2024 Mean change in Vegetation Condition (Landscape wide)	0.05	0.05
2017 – 2024 Mean change in Vegetation Condition (Vegetation only)	0.07	0.06

4 Conclusions

Overall, vegetation health across the study area showed a slight but consistent improvement from 2023 to 2024, with increases in both MSAVI values and vegetation cover likely due to wetter-than-average conditions. The longer-term trend from 2017 to 2024 also showed increases, particularly in vegetation only areas. Spatial analysis revealed that vegetation health generally improves with distance from infrastructure, even though the cluster analysis demonstrated that areas close to the infrastructure have shown a greater relative improvement compared to the surrounding areas. Areas close to riparian corridors show a large MSAVI, but MSAVI drops sharply within 100–125 m before gradually recovering. Although the Violet Ranges PEC has lower vegetation cover than the rest of the site, there were increases in vegetation condition since 2017 which suggest some improvement is occurring.

Further remote sensing analyses of the area are recommended during years with more typical rainfall patterns to better understand the impacts of mining operations on the surrounding vegetation without the potentially confounding effect of unseasonal rainfall.

This report was prepared by Hannah Koh (Remote Sensing Analyst) and reviewed by Dr Mark Broomhall (Principal Remote Sensing Analyst) and Dr Paul Drake (Principal Environmental Scientist).

Yours sincerely
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References

Astron Environmental Services. 2020. Mt Keith Remote Sensing Desktop Assessment - Stage 1. Unpublished report prepared for BHP Nickel West.

Astron Environmental Services. 2021. Mt Keith Vegetation Remote Sensing Analysis, March 2021. Unpublished report prepared for BHP Nickel West.

Astron Environmental Services. 2022. Mt Keith Vegetation Remote Sensing Analysis, March 2022. Unpublished report prepared for BHP Nickel West.

Astron Environmental Services. 2023. Mt Keith Vegetation Remote Sensing Analysis, March 2023. Unpublished report prepared for BHP Nickel West.

BHP Nickel West. 2018. Flora and Vegetation Environmental Management Plan - Mt Keith Satellite Project.

CALM. 1996. Wanjarri Nature Reserve Management Plan 1996 - 2006.

DigitalGlobe. 2013. WorldView-3.

Getis, A., and J. K. Ord. 1992. The Analysis of Spatial Association by Use of Distance Statistics. Geographical Analysis 24:189–206.

NAFI. 2023. Northern Australian Fire Information. https://www.firenorth.org.au/nafi3/.

Pacifici, F. 2016. Validation of the DigitalGlobe surface reflectance product. IEEE International Geoscience and Remote Sensing Symposium (IGARSS):1973–1975.

Pacifici, F., N. Longbotham, and W. J. Emery. 2012. Multi-temporal and multi-angular analysis of very high spatial resolution images. Pages 1996–1999 2012 IEEE International Geoscience and Remote Sensing Symposium.

Qi, J., A. Chehbouni, A. Huete, Y. Kerr, and S. Sorooshian. 1994. A Modified Soil Adjusted Vegetation Index. Remote Sensing of Environment 42:119–126.

Queensland Government. 2023. SILO climate database: https://www.longpaddock.qld.gov.au/silo/.

Queensland Government. 2024. SILO climate database: https://www.longpaddock.qld.gov.au/silo/.

Appendix 6 – Location Map – Disturbance Outside of Development Envelope