Reassessing the flora baseline, impact assessment and management plan of the proposed Gamsberg SE Prospecting to address the revised exploration optimization plan and associated recalculation of biodiversity offset requirements

An addendum report prepared for Black Mountain Mining (Pty) Ltd

M Botha and P Desmet

October 2020

Cover Photo: *A view of the access track to drill site 12 (Old42) across the fine grain quartz patch habitat on the north-eastern Gamsberg plateau. This is one of the most important biodiversity sites at the Gamsberg, and all of Bushmanland, as it contains 90% of the global extent of this habitat type. Conophytum angelicae subsp. rubrohomoterrenum (inset) is a tiny succulent species that occurs only in this habitat type.*

Report Title: Reassessing the flora baseline, impact assessment and management plan of the proposed Gamsberg SE Prospecting to address the revised exploration optimization plan and associated recalculation of biodiversity offset requirements.

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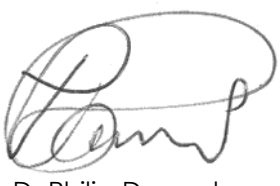
Declaration: We are independent specialist service providers with experience in assessing impacts and designing and negotiating biodiversity offsets for government and corporate clients since 2011. We have no interest in Black Mountain Mining (Pty) Ltd or its agents or operations and declare that we act independently and without influence from any party.

Mark Botha
30 September 2020



Dr Philip Desmet

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1 Summary

This report is an addendum to the original recalculation report submitted to EndemicVision and BMM (Botha & Desmet 2020) and must be read with the methodologies and assumptions provided in that study, as well as the detailed methodology and Assessment Report for this recalculation (see Appendix 1). We provide a brief quantification of the expected residual impact of proposed new prospecting on the Biodiversity Offset set-aside areas on Gamsberg as described in Black Mountain Mine (BMM) proposals of August 2020. The report analyses several iterations of prospecting plans revised as part of the mitigation hierarchy, proposes metrics for considering the nature of the fine-scale receiving environment (whether unrehabilitated, on a trajectory, or effectively rehabilitated), and finally outlines the proposed additional mitigation measures when/if the impacts are realised.

Initial prospecting plans (v1, 2018) indicated a total of 114 prospecting drill sites with a footprint impact of around 17ha, the majority of which would be located in the area set aside on the Gamsberg inselberg. This set aside was required as part of the offset for the original mine development. Subsequent revisions to the prospecting plan (v2) reduced the number and locations of drill sites to 80, contributing around 13ha of additional impact. This layout was submitted on the back of a Basic Assessment Report to the Department of Mineral Resources and Energy (DMRE) for authorisation, but was successfully challenged on appeal. The appeal ruling found *inter* alia that the proposed activities insufficiently followed the mitigation hierarchy.

An outcome of the appeal process was that the existing Biodiversity Offset Agreement (BOA) does not apply to the proposed prospecting activity. The impacts required re-examination and attention be paid to reduce them further, and that any subsequent prospecting plans would require a reappraisal of the Offset agreement between BMM and DENC. Should it be required, it was recommended that BMM augments the current BOA or enters into a new BOA with DENC for the proposed prospecting activity. The offset agreement, if required for this activity, should be entered into before the DMR reconsiders the EA application for Gamsberg SE. To date four properties purchased around the mine have been purchased as part of the Gamsberg Zinc Mine BOA. BMM have to secure an additional three farms by 1 April 2024 to satisfy the original Biodiversity Offset Agreement.

The latest iteration of the prospecting drill plan (v3) proposes a total of 28 drill sites of which 21 are located within the set-aside. Only one site remains located in the highly sensitive fine grain quartz gravel patch habitat on an existing historical drill pad (see

Table 1, see cover photograph). All sites but one are located in previously disturbed sites. The proposed new greenfield site was located to avoid the highly sensitive quartz gravel patch habitat. The total extent of impacts on Gams East and South are around 3.51 ha, including 2.61 ha of Aggeneys Gravel Vygieveld and 0.91 ha of Bushmanland Inselberg Shrubland South African Vegetation Types. The proposed activities have mostly been located within the existing disturbance footprint of previous prospecting or mining activities at the site that are currently recovering towards a natural ecological community. In total 87% (3.07 ha) of the proposed activities are located on previously disturbed sites and 13% (0.46 ha) is considered greenfield.

Impacts and offsets related to the seven drill sites located outside of the set aside within the mining area are not considered here as any offset arising as a result of these has already been considered and met in the properties secured for the BOA.

The field baseline ecological assessment reveals that most sites are on a recovery trajectory towards a natural ecological community, however, this ability is reduced by individual site conditions (e.g. slope) and treatment during and post drilling (e.g. soil compaction, erosion and restoration measures implemented). It is unlikely that most sites will revert fully to a natural state within a 50-year period without further intervention. Some sites are likely to degrade further from their current state due to continued soil erosion.

Table 1: Comparison of the total number of drill sites and impact extent proposed by the three iterations of prospecting plan for Gamsberg: the Original (v1), a revised plan (v2) submitted for authorisation with a Basic Assessment Report, and the current optimised plan (v3) under consideration by this report.

	Original (v1)	As per BAR (v2)	Optimised (v3)
Total Number of Drill Sites	114	80	28
Total Area Impacted (ha)	*17*	*13*	*3.53*

Some species of conservation concern were observed within the proposed footprint area. On the access road to drill site 12 (Old 42) that is located in the fine grain quartz patch habitat on the north-eastern plateau *Conophytum ratum, Conophytum calculus* and *Avonia quinaria* have re-colonised quartz grit drifts that have formed in the "tweespoor". Also, on drill sites where scaffolding was previously used in the 2010 drilling campaign, the species recovery is excellent especially amongst guilds with below ground storage (e.g. various bulb species, *Bulbine striata, Tylecodon suffultus*).

Within the high biodiversity sensitivity context of the Gamsberg all proposed prospecting impacts should be considered as having high significance. However, given the current degraded ecological status of all sites assessed, and provided that the activity management and restoration mitigation measures are implemented as stated, then this impact is likely to be low significance. For sites that are currently on a degradation trajectory the proposed mitigation measures will reverse this trend, therefore, the medium to long term ecological condition of these sites post-prospecting and restoration is likely to be better than their current condition.

Our findings indicate that, with this revised exploration optimisation for Gamsberg SE exploration activities:

- BMM has in our view satisfactorily followed the mitigation hierarchy on Gamsberg South and East;
- The scale and nature of impacts are manageable in the context of the set-aside and the receiving environment given the current degraded ecological state of areas to be impacted due to historic activities and the opportunity for recommended mitigation measures to improve post activity restoration prospects; and
- Appropriate mitigation now appears to be improved site-based management during activity and restoration post activity, a focus on securing the original offset outcomes, and thus not requiring a further increase in offset requirements.

To the best of our knowledge, the approach to the latest prospecting proposal (V3), if augmented by the measures proposed in this report, appears to have sufficiently exhausted the mitigation sequence by:

- Avoiding the most sensitive areas (evidenced by the evolution from v1 to v3);
- Minimising impacts at a micro-site scale (to be supported by the mitigation measures required in the EMP); and
- Restoring those impacts (other historic impacts) that remain (given the modest success from historic restoration efforts).

If this is executed effectively, the residual impacts on Gamsberg are likely to be insufficiently significant to trigger extension to the biodiversity offset and thus will not require renegotiation of the Biodiversity Offset agreement between DENC and BMM. However, this may not apply for the prospecting impacts on Big Syncline which is not currently under review, or other aspects of the implementation of the offset.

This project has highlighted some important over-arching issues limiting the ability to achieve the biodiversity offset agreement goals that need to be addressed within a broader biodiversity plan for the mine and the region as a whole. These include:

- Setting the precedent of further impacting a set-aside (regardless of the scale of this impact and the historical errors which created the circumstances) is problematic. This needs to be addressed in frank discussions between the parties, and properly regulated in provincial and national policy.
- There is a growing risk to the implementation of the original offset (not primarily due to actions or omissions by BMM) that is more cause for concern than the scope and scale of impacts on Gamsberg set aside, and it is unclear if DENC will be able to discharge its obligations to manage the offset.
- The cumulative impacts on the unique biodiversity values of the Bushmanland region from the mine, and all associated infrastructure and developments (let alone the other renewable energy, infrastructure and economic developments) requires serious attention. This is not possible in project level EIAs or disconnected planning or economic development frameworks. As an appropriate legacy, BMM should invest in a regional strategy and implementation plan to secure the biodiversity and ecological processes of Bushmanland. This is currently being addressed by BMM through a broader long-term Biodiversity Strategic Plan.

Ihlenfeldtia excavata observed flowering during the field survey in the crater area of the Gamsberg. This area is not located within the proposed impact area. The leaves of the bulb, *Brunsvigia comptonii*, are also visible in the foreground.

2 Introduction

The original Gamsberg Zinc Mine impacts required a biodiversity offset. Although the offset is in process of being implemented, several impacted habitats have still not had their initial required targets met through the four offset properties secured thus far[1]. The original offset study indicated that the authorised mine impacted on two habitats in particular, Plateau Fine Quartz Gravel and Calcrete Gravel Habitats; these impacts are effectively 'not offsetable'. As a key contribution to the offset, two 'set-asides' were required on areas of the Big Syncline and the Eastern and Southern portions of the Gamsberg to safeguard occurrences of these habitats (among other ecological process considerations).

No new impacts on biodiversity should have been permitted in these set asides (let alone the 'irreplaceable' habitats on them), and their protection and management were to be ensured through the Environmental Management Plan for the mine. BMM's interpretation of this protection was that it still permitted exploration and assessment of the resource underneath the southern and eastern plateau of Gamsberg. Prospecting plans were developed and a service provider engaged to secure the requisite approvals.

From 2017, an iterative process was followed to reduce additional impacts from proposed prospecting. The initial drill plan for Gamsberg incorporated a total of 114 drill pads. The second iteration reduced this number to 80 drill sites with additional substantial new road access, of which 41 were on existing, previous drill pads. Multiple holes would be drilled from each drill pad in order to minimize the total number of drill sites required. Further, 39 new drill pads were proposed - only 2 of which were in the Plateau Fine Quartz Gravel Habitats, but located on existing active roads to reduce their impact as far as feasible. In the second iteration, a total of 11.19km of tracks were proposed, of which 2.051km would be entirely new impact, in the less sensitive habitats predominantly on the set-asides.

For the second iteration of proposed prospecting, the required additional offsets from new Gamsberg impacts would have been 31.9ha of Mountain plateau and 3.9ha of Plains Quartz habitat units of the Aggeneys Gravel Vygieveld. The other impacted habitat types had their targets met by the current offset portfolio and no offset would have been required (although this discounted the set aside impact precedent issue). This version of the listed activities was submitted for authorisation to DMRE in 2018 and the Environmental authorization was approved in February 2019.

A successful appeal against the decision to grant an EA to BMM led to a requirement for reassessment of the prospecting plan to further reduce/avoid impacts especially on sensitive areas or areas requiring an offset; more attentively follow the mitigation sequence; resubmit Search, Rescue and Protection Plan; and, the Amend Offset Agreement or go into new agreement if required. From late 2019 to mid-2020, BMM revised the proposed prospecting plan for Gamsberg, using new tools and techniques, and pushing the limits of what drill technology exists to reduce these impacts further. Multiple holes (in some cases up to 18) could possibly be drilled from a single drill collar, although this introduces a level of risk in terms of accuracy of determination of the ore body. BMM have indicated that they are willing to accept this risk. The objective of the revised and optimised exploration plan was to decrease the impacts on the environment and to avoid sensitive areas (especially sensitive features, vegetation/habitats and threatened species).

A final drill plan (version 3) was optimised for assessment in-field and to determine whether this layout would incur sufficiently significant impacts to trigger a redesign of the offset requirements (and implementation agreement) for Gamsberg. The full terms of reference are set out in section 3).

This document outlines the approach, context and assessments of the v3 prospecting plan for the additional biodiversity offset implications for Gamsberg. It does not provide a comprehensive picture of

[1] Information correct as at 19 September 2020.

the mine impacts, offset policy, or progress with implementation of the original 2014 Offset Agreement. This addendum should be read and interpreted with the following reports and documents:

- Offset Recalculation report (Botha and Desmet V4 February 2020);
- Original Gamsberg Offset Report (Botha, Desmet and Brownlie 2013);
- Finalised implementation agreement between BMM and DENC (October 2014);
- Review of the Black Mountain Mine Biodiversity Management and Monitoring (ERM 2017); and,
- Independent audit of the offset implementation progress (Smuts, 2020).

The proposed offset implications presented here are based on extensive expert site study, the specialist reports conducted for the BAR, and perspectives / observations gathered from field trips. The field work (EndemicVision 2018b, Desmet 2013b, Desmet 2019, and Appendix 1. Baseline Biodiversity Assessment and Calculation of Area Impacted) aimed to verify site-specific impacts based on a worst-case scenario for the prospecting scope of works provided to the consultants as well to guide a revised Gamsberg optimisation exploration plan. This report provides a brief quantification of the expected residual impact of the initial, revised and final prospecting plans, proposes appropriate metrics for the offset, and finally outlines the proposed additional mitigation measures should potential impacts be realised.

A detailed estimation of the additional costs of any additional offsets and compensation for the non-offsetable impacts is only possible once the original offset has been substantially complied with; a further suite of mitigation measures, in particular for the ecological restoration of historic and proposed prospecting impacts is finalised; and, a regional intervention for securing biodiversity targets arrived at. We do not have the necessary information to cost the restoration and impact minimisation measures for drill rig and process adaptation.

3 Project Brief

"*The following scope of work was requested:*

i. *To revise and assess the baseline information regarding the flora/biodiversity from a landscape, vegetation type, habitat and species point of view for each of the proposed exploration optimization drill pads and associated access tracks/roads. This should include drone imagery and plant health;*
ii. *Fine-scale mapping and sensitivity of each of the proposed exploration drill pads and associated access tracks/roads as well as the proposal of alternative sites in the event of high sensitivity;*
iii. *Basic assessment of additional 23 proposed sites, some of which fall outside set-aside areas, to determine which may trigger no additional offset (for inclusion in BAR);*
iv. *To verify the restoration/disturbance status of each of the proposed exploration drill pads and associated access tracks/road according to a well-defined, systematic, repeatable and defensible methodology and threshold. Aspects to consider, but not limited includes presence/removal of waste, erosion, topsoil, rock packing, re-seeding, natural succession, species presence/absence, indicators such as hotspots, etc.;*
v. *To determine the presence and status of any features contributing to a Critical Biodiversity Area (based on publication by DENC) and to what extent the proposed exploration drilling will impact on it and/or how this will be compromised and if, what the offset requirements will be if not reversible;*
vi. *Each drill site should be demarcated (by means of pegs or painted rocks), delineating the approximate boundary between previously disturbed area and "virgin" undisturbed ground. Each site's layout should be discussed with site geologist and compared to the minimum-possible footprint used during drilling operations;*

vii. *Disturbed footprint should also be marked on drone images for future reference;*

viii. *Once the above are assessed and available, revise and update the Biodiversity Offset Calculation Report for the proposed Gamsberg SE exploration activities, taking the results of the revised exploration optimization drilling plan and associated access tracks/roads, restoration/rehabilitation status each proposed exportation drilling pad and access track/road into consideration;"*

4 Approach to Reassessing the impacts and Implications

4.1 Assumptions, Limitations, Uncertainties and Risks

The following assumptions have been made for the quantification of the 2020 v3 Gamsberg prospecting offset requirements.

- The study must assume that all proposed and required mitigation will be undertaken by BMM, and these requirements have been assessed and/or approved by the relevant regulatory authorities (DMRE in the EMPr, and DENC under the Biodiversity Offset Agreement). In particular, that the habitats set aside and conserved on BMM owned land will need to be protected through a more effective means and managed for biodiversity for at least the duration of the impacts of all mining activities;
- It is assumed that any future mining under Gamsberg will not adversely affect the biota and ecosystem functioning on the surface, through water table draw down, dust or additional surface infrastructure development;
- Offset design must cater for worst case scenarios, applying a risk-averse and cautious approach in accordance with the requirements of NEMA's environmental management principles. The areas used for footprint impact analysis are quite fine scale, and it may be that the final footprint impact is larger than anticipated due to dust, edge, unintentional and unforeseen impacts. We are not aware if dust impact monitoring and evaluation of the affected habitats and species is sufficient, and whether the assumptions made in the 2013 Offset study are accurate;
- With the exception of the sandy plain habitats, no impacted area has the potential to be restored to or near their original condition within the life of the mine and its closure phase, as the required ecological timeframes are greater than the span of the closure plans. The physical and biophysical environmental qualities (including the specific particle size, soil structure and organism dynamics such as lichens, fungi and organic crusts) that determine these habitats cannot be perfectly recreated. However, initial observations indicate that some recovery of natural ecosystems is occurring on Gamsberg;
- The effectiveness of proposed mitigation actions around drill rigs is unclear. The restoration assessment (EndemicVision 2018b) noted that residual impacts still affect recovery potential, including drill sludge residue, soil structure impacts from erosion, inverted soil profiles, and irreversible compaction (not possible to mechanically address in the quartz habitats). Rock packing can be replicated after drilling, but quartz layering cannot be recreated. Additional mitigation measures (elevated perforated staging or platforms) are suggested to contribute to further minimising impacts;
- The micro scale processes and ecological drivers on Gamsberg make it unique. Normally ecological drivers (like grazing) can be used to assist restoration, but this may not be possible on Gamsberg. Also, Impacts from mining operations, for example dust, may disrupt other ecological processes we are currently unaware of. All attempts to avoid or reduce these impacts should be pursued;
- Ecological Impacts of current disturbed area, such as fragmentation by existing roads or degradation due to erosion, are unclear;

- Best mitigation remains footprint reduction and avoidance. This study must assume that footprint impacts will not be any larger than catered for in these calculations, and that the demarcation is effective and will be adhered to.

4.2 Methodology for Assessing Additional Impacts from Prospecting on Gamsberg

To clarify the appropriate sensitivity of the biodiversity features on Gamsberg, the full suite of biodiversity features on the Gamsberg were assigned nominal values based on whether they could be construed as "Critical Habitat" or "Natural Habitat" within the CBA1[2] designation. This allowed a sharper distinction to be made between the most important habitats to be avoided and which could effectively be classified as "CBA2" for purposes of determining appropriate offsets (see Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis) The Plateau Fine Quartz Gravels, Headwater seep, and a buffer around Pans were assigned sensitivity scores of 10000, while the Kloof and its catchment habitats were assigned scores of 1000. Buffer areas around the kloof and gravel patches were assigned 100. Previous impacted areas such as active roads were assigned a value of 0.

A detailed explanation of the methodology is given in Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis. This was used By BMM Exploration to devise a new prospecting plan (v2, Figure 2). Post appeal, further interrogation and interaction with specialists, a further reduction in impact was achieved through a final prospecting plan (v3, Figure 3).

4.3 Impact Avoidance Through Following the Mitigation Sequence.

4.3.1 Initial Prospecting Proposal (v1)

An initial set of 114 drill sites/collars and 30.34 km of their associated access tracks roads was analysed by overlaying them on the original fine scale vegetation map of the Gamsberg (see Figure 1). Roads were classified as 'planned roads' or 'existing tracks' (single tracks off main roads). Roads were assumed to be graded to a width of 4m which accords with existing impacts in other prospecting areas around BMM. Each drill site was initially assumed to permit one drill hole. Drill sites were assumed to be 225 m^2 each. See EndemicVision (2018b) for detailed assessments. Limited discounting for existing disturbance was taken into account as many of the previous access tracks and drill sites are in various stages of natural regeneration (see classification in Figure 2).

Spatial analysis comparing the prospecting footprint to biodiversity sensitivities yielded the following impacts (Botha & Desmet 2020):

1- Tracks and planned roads totalled 12.136 ha, of which 10.27 ha was in Aggeneys Vygieveld (Critical Habitat) and of that 0.56ha in Plateau Fine Quartz Gravel Habitats; and
2- Drill collar impacts totalled 2.565 ha, of which 2.13ha was in Aggeneys Vygieveld and of that 0.36ha was in the Plateau Fine Quartz Gravel Habitats.

[2] CBA is a Critical Biodiversity Area, one that must be maintained in a good ecological condition in order to meet biodiversity targets. CBA1 is irreplaceable (natural or near-natural condition), and CBA2 in this context refers to an area that should be CBA1 but is impacted and requires restoration to fulfil its ecological role.

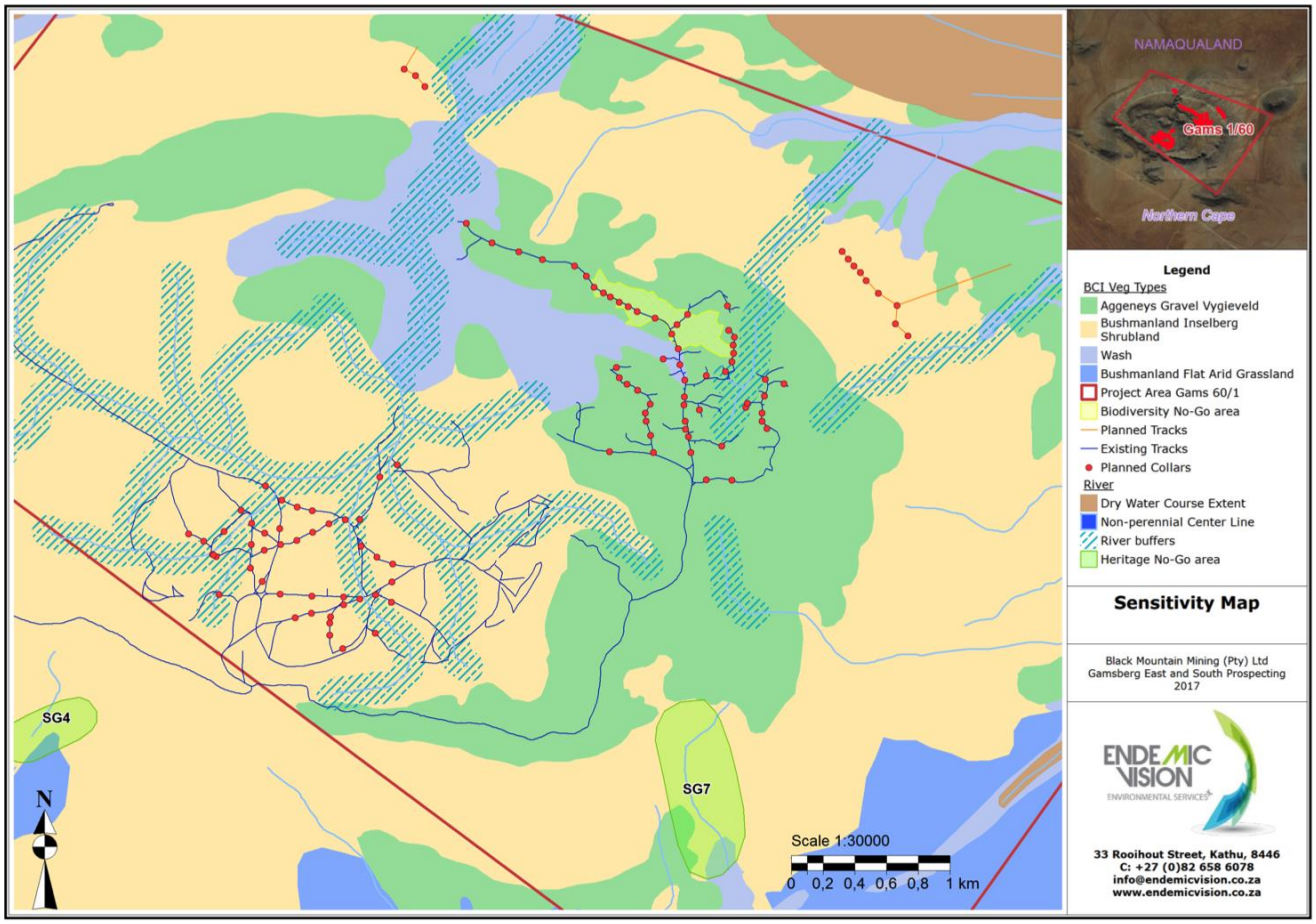

Figure 1. Initial prospecting proposal (v1) submitted by BMM exploration for Offset impact analysis (114 drill collars).

4.3.2 Revised Prospecting Proposal (v2)

The second revised drill plan incorporated a total of 80 drill sites of which 41 were on existing, previous drill pads (Figure 2). Multiple holes would be drilled from the bulk of these pads. Further, 39 new drill pads were proposed - only 2 of which are in the Plateau Fine Quartz Gravel Habitats, but located on existing active roads to reduce their impact as far as feasible. Of the 39 new drill pads, 32 are proposed on existing roads and it is assumed that this will reduce the impacted area by 27% per drill pad. A total of 11.19 km of tracks were proposed, of which 2.051km would be entirely new impact, in the less sensitive habitats. Although there is little difference in the footprint impact of the revised drill plan, it has shifted that impact away from irreplaceable habitats into those which have more options to be offset, and those which are already well represented in the existing offset properties.

4.3.1 Current Prospecting Proposal (v3)

The current iteration of the prospecting drill plan (v3) proposes 28 drill sites, 21 of which are located within the Set Aside area, only one of which is located in the highly sensitive habitat units on an existing historical drill pad, and one is a proposed new or greenfield site. The remaining 7 sites proposed are located on areas outside of the set aside within the demarcated mining area. Total extent of impacts on Gams East and South (on both set aside and mining area) cover 3.5 ha, the bulk of which is on access tracks and existing drill sites that are in some stage of recovery and only 0.46 ha or 13% of total impact is located in currently natural veld (Table 2). Overall, the impact footprint has been reduced by over 60% from 9.7 to 3.5 ha. Importantly, any new impacts are avoided in Very High sensitivity area (Table 2).

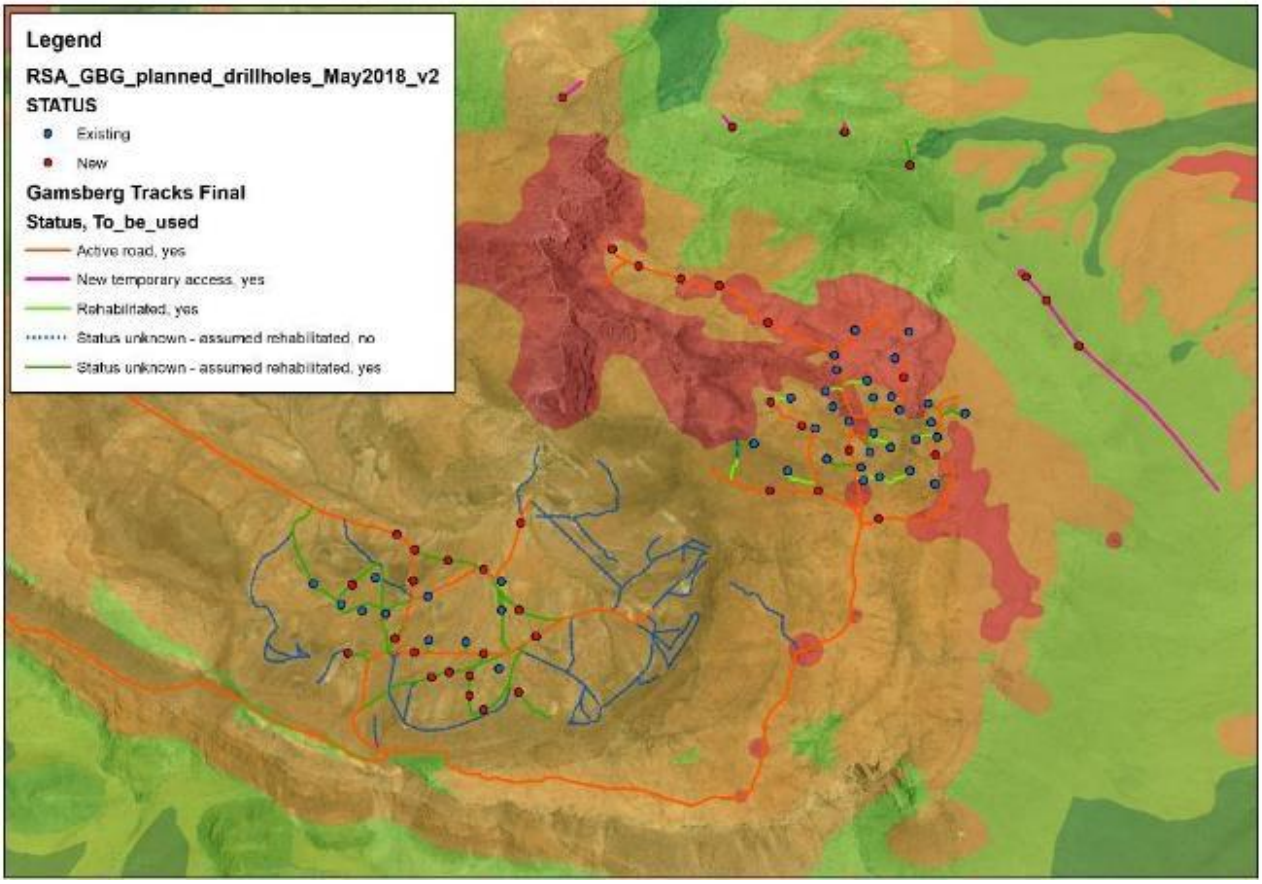

Figure 2. The revised prospecting layout (Drill Plan v2 at 80 drill collars) for Gamsberg showing active and rehabilitated roads, existing and new proposed drill pads, and the summed sensitive underlying biodiversity features on Gamsberg. Red areas indicate the most sensitive habitats.

Table 2. Detailed summary by habitat type of the extent of impacts from proposed prospecting (v3) on the Gamsberg. Extent of impacts excludes considering existing management tracks used for the continued management of the site.

	Existing Disturbed		Currently Natural		
Vegetation Type Name (VT3) and Habitat Unit (VT4)	**Drill Pad**	**Road Access**	**Road Access**	**Drill Pad**	**Total Area (m²)**
1. Aggeneys Gravel Vygieveld:					***26184***
1.1 Mountain Plateau	1171	11365		115	12651
1.2 Plateau Fine Quartz Gravel Plains	210	1873			2084
1.3 Quartz Gravel Plains	13	277	1673		1962
1.4 Rocky Plains	1717	5096	772		7586
1.5 Wash	195		1706		1901
2. Bushmanland Inselberg Shrubland					***9106***
2.1 Bushmanland Inselberg Shrubland	1340	6979	319		8639
2.2 Kloof		467			467
Total Area (m²)	***4646***	***26058***	***4471***	***115***	***35290***
Total Area (ha)	***0.46***	***2.61***	***0.45***	***0.01***	***3.53***

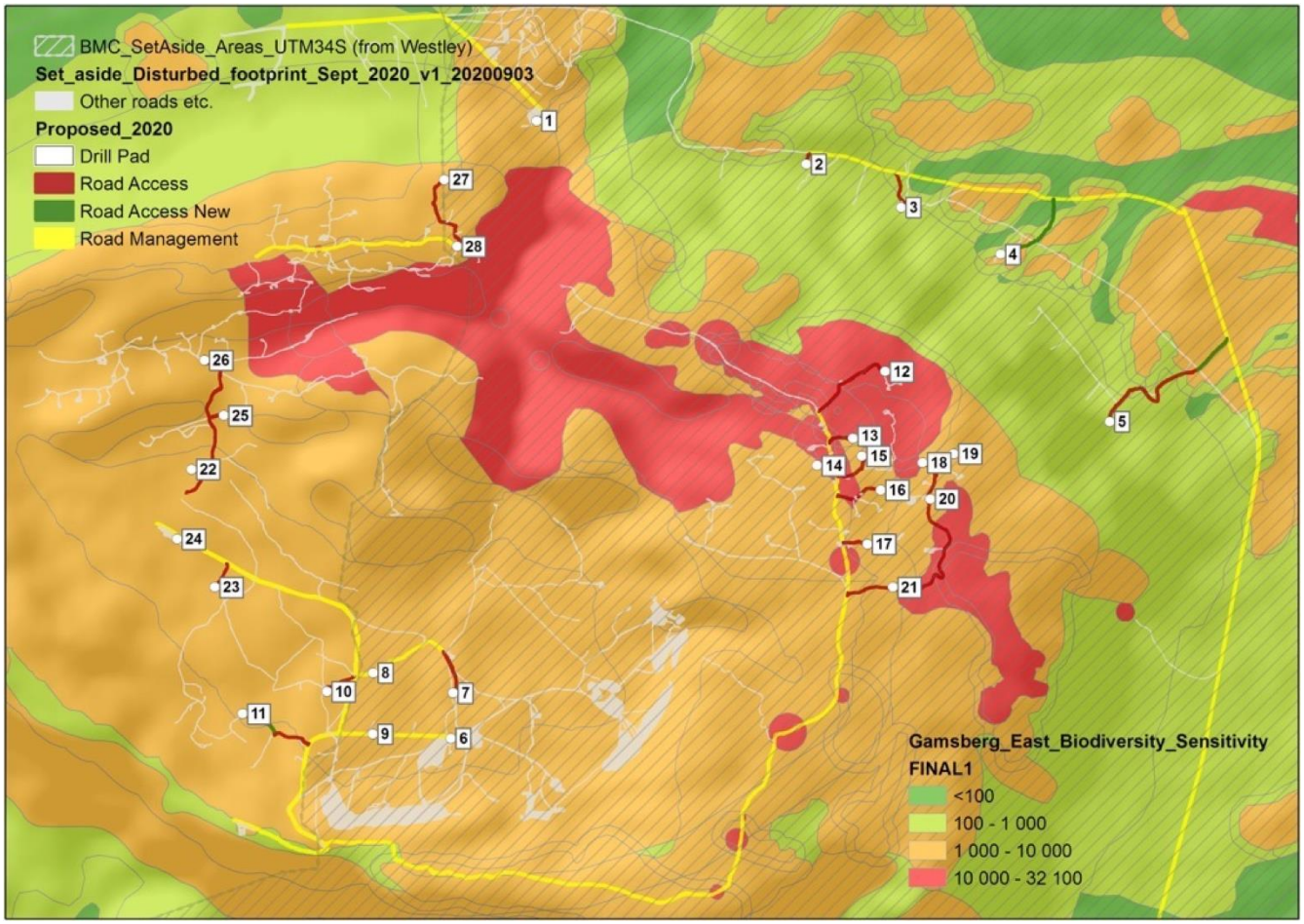

Figure 3. Final iteration of prospecting layout (v3) used for this assessment. The set aside portion is delineated by the hashed line. All sites with the exception of Site 21 occupy previously disturbed sites.

4.4 Assessment of significance of the residual impacts and whether they trigger re-estimation of the offset

Impacts and offsets related to the seven drill sites located outside of the set aside within the mining area are not considered here as any offset arising as a result of these has already been considered and met in the properties secured for the original offset (see Botha & Desmet 2020). For the remaining 21 drill sites and access tracks located within the set-aside area, given the biodiversity context of the site, their biodiversity impact is considered high significance. However, if the recommended mitigation measures are implemented then the medium to long term biodiversity impact of the activities is considered to be low significance.

Our findings indicate that, with this latest prospecting plan for Gamsberg:

- BMM has in our view satisfactorily followed the mitigation hierarchy on Gamsberg South and East;
- The scale and nature of impacts are manageable in the context of the set-aside and the receiving environment given the current degraded ecological state of areas to be impacted due to historic activities and the opportunity for recommended mitigation measures to improve post activity restoration prospects; and
- Appropriate mitigation now appears to be improved site-based management during activity and restoration post activity, a focus on securing the original offset outcomes, and thus not requiring a further increase in offset requirements.

Table 3. Extent of proposed impacts (ha) in relation to the previous prospecting proposals and the current Gamsberg Zinc Mine BOA requirements. Shaded colours indicate habitats for which the current portfolio of offset properties does not meet their offset requirements.

Vegetation Types and Habitat units	Offset Required	Mine properties	Current offset portfolio	Initial Impacts (v1)	Revised impacts (v2)	Current impacts (v3)	Total area secured to date over/under target
Aggeneys Gravel Vygieveld				**13.77**	**11.81**	**2.62**	
Mountain plateau; Constrained	1 090	420	553.5	5.34	4.49	1.27	**-117**
Plateau quartz gravel; **Irreplaceable**	309	137	91.7	0.74	0.75		**-81**
Plateau fine grain quartz gravel; **Irreplaceable**	58	9	0	0.92	0.66	0.21	**-49**
Plains quartz gravel; **Irreplaceable**	1 830	844	887.9	0.5	1.05	0.19	**-98**
Plains quartz gravel intermediate; Constrained	56		252.3				196
Plains feldspar gravel; Constrained	91		1102				1011
Plains rocky; Constrained	349		5628	6.27	4.91	0.76	3287
Bushmanland Inselberg Shrubland				**1.18**	**1.96**	**0.91**	
Mountains; Flexible	1 306		3013	1.18	1.96	0.91	13217
Southern Slopes; **Irreplaceable**	886		609			0	850
Bushmanland Arid Grassland				**0.5**	**0.48**		
Flat sandy plains; Flexible	2 394				0.48	0	10330
Hummocky sandy plains; Flexible	334			0.5		0	8372
Calcrete gravel plains; **Irreplaceable**	1 732		**222.36**				**-1510**

5 Required Mitigation Measures

As prospecting will occur in the set-aside's of the original offset, it is required to implement additional mitigation measures to ensure that the impacts of the prospecting achieve a low significance rating. Mitigation measures include pre-, during and post-prospecting activities, and cover both the drill sites and access to the drill site areas. These mitigation measures are included as suspensive conditions in the RA.

1. Prior to the commencement of the drilling campaign, a ***Prospecting Environmental Management Guideline*** document must be drawn-up that collates and includes all existing information and experience relating the minimisation, mitigation and management of the environmental aspects of prospecting in sensitive environments on the mine.
    a. The document must be written by a competent ecologist in collaboration with the mine exploration geologist and environmental manager.
    b. The document needs to be reviewed by an independent ecologist before being signed-off by the mine GM and included in the EMPR.
    c. Prior to the commencement of prospecting, a signed letter from the drilling contractor to the mine GM needs to acknowledge acceptance of the guideline document and a written undertaking to implement the guidelines.
    d. The drilling contractor contract milestones and deliverables need to be conditional to implementation of the guideline document as the blueprint for drilling implementation. Clear and effective sanctions need to be explicit in the contract for transgression of (1) the Prospecting Environmental Management Guideline and (2) the impact footprint as defined by this assessment - (Set_aside_Disturbed_footprint_Sept_2020_v1_20200903.shp).
    e. The guideline document needs to be specific as to the roles and responsibilities of all parties involved (mine, contractor, DENC, DMR, etc.) in terms of pre-drilling planning, drilling implementation, site management and inspection, and post drilling management and restoration activities and monitoring.
    f. The guideline needs to include an implementation monitoring and independent review components that includes:
        i. Each drill site needs to be photographed pre-, during and post drilling as a record of the site conditions.
        ii. Sites need to be visited weekly by the mine environmental officer and a weekly report submitted to the mine environmental manager and head geologist that details progress with implementing the Prospecting Environmental Management Guideline, issues arising and how these were addressed.
        iii. Provision must be made of 6-monthly independent environmental review of prospecting activities and restoration program. Findings of the review need to be submitted to the mine environmental manager and head geologist in writing within 30 days of site visit.
2. Within 6 months of the commencement of the drilling campaign, a **Prospecting Ecological Restoration Manual** must be drawn-up that collates and includes all existing information and experience relating the existing restoration at the site, and presents a draft ecological restoration protocol to be implemented by the restoration contractor. This manual will be included as an addendum in the Prospecting Environmental Management Guideline document. What is ecological restoration is defined in Section 8.4
3. The granting of the prospecting permit must be conditional to the implementation of a site-wide ecological restoration program that addresses **ALL current and historic prospecting impacts** within

the Set Aside area of the Gamsberg with the exception of the barite mining in the crater. Thus, the restoration program will address the impacts of this prospecting effort as well as previous impacts most particularly persistent degradation processes such as soil erosion. Of high importance is the addressing of continued erosion and the closure and restoration of surplus tracks and removal of historic infrastructure (discarded equipment) and earth works (i.e. re-contouring to remove berms, pits, etc. to restore natural hydrological flows). The restoration program needs to be prioritised in order to focus on persistent degradation processes. It is acknowledged that currently disturbed sites will likely be the preferred candidate sites for future surface infrastructure relating to the pursuit of underground mining on Gamsberg East and South (e.g. ventilation shafts, management roads). Therefore, the restoration plan must make provision for an annual review that takes into account mine planning to assess those sites earmarked for development where restoration management will be adapted to take into account planned infrastructure provided persist degradation process have been abated.

4. Prior to prospecting commencement and implementation of the updated Search and Rescue and transplantation plan (EndemicVision 2020) needs to be executed and transplanted to the mine nursery. This will include only species of conservation concern that have re-colonised in previously disturbed areas that are earmarked for this prospect, specifically, *Conophytum calculus* (Old43 and Old42), *Conophytum ratum* and *Avonia quinaria* (Old42). Removal of species with underground storage organs (e.g. bulbs, Tylecodon suffultus) should not be attempted except where the actual drill rig is to be placed. With the use of scaffolding reducing soil surface disturbance and compaction, these species are best conserved *in-situ*. Transplanting is also not recommended given very low historic success with this activity;
5. Recommendations for protocols to be included and elaborated in the management guideline document:
    a. Soil compaction reduces ability of plants to recolonise disturbed sites. Previous drill sites where scaffolding was used show very significant differences in the diversity and density of plants. Therefore, in the set-aside area it is mandatory for all drill sites to use scaffolding around the drill rig. Also, all lay down areas need to be on scaffolding. With the exception of the drill rig and vehicles, no equipment in excess of 50kg may be placed directly on the ground.
    b. Use existing roads (without further widening) to access sites, and avoid further clearing or bulldozing of tracks.
    c. Prior to drilling commencing at a site, the mine environmental officer together with the drill site manager need to demarcate drill site footprint and demarcate all access tracks and drill collars with high-visibility (removable) barriers to avoid accidental straying or footprint creep by contractors.
    d. In the case where new tracks are being created, the mine environmental officer together with the drill site manager need to walk and demarcate track prior to vehicles accessing the site. Under no circumstances must new tracks be graded or modified in any way other than through the normal vehicle traffic.
6. Additional mitigation measures:
    a. At site New09, the existing fence that runs parallel to the management track to leading to the site and the borehole pump at the mouth of the kloof needs to be extended along its current trajectory until the edge of the wash that exits the kloof. This fence needs to prevent ad-hoc vehicle traffic form venturing northwards from this road. This fence need only comprise steel droppers with 3-4 wires but no mesh is required.
    b. The rehabilitation of the south access route needs to be completed before prospecting commences. This has been discussed at length in previous reports. Road erosion perpetuates unnecessary ecological degradation and is a human safety risk. The recent rain has demonstrated how rapidly erosion can destroy the road and this illustrates the importance of

installing cut-off drains at 50m intervals. Prospecting shall not proceed until the road rehabilitation works have been inspected and signed-off in writing by ourselves.

c. Currently the future protection and conservation status of the set-aside areas post mining enjoys no long-term legal security. It is recommended that this be achieved through a title deed restriction and servitude in favour an appropriate conservation authority. Whilst it would be unreasonable to expect the implementation of this as a mitigation requirement for this project, we recommend that the implementation of the title deed restriction and servitude be a mandatory requirement for any future large-scale project being developed by BMM at the site.

6 Scope of Gamsberg Zinc Mine BOA Additional Actions and Considerations

The following objectives comprised the scope of the original Offset.

1. *"Establish a core Protected Area through purchase and consolidation of the top 7 identified properties and those Black Mountain Mine properties where no mining is or is likely to take place, or the purchase of development rights or other rights to the land to:*
    a. *Afford protection for ecosystems and/or habitats of affected species;*
    b. *Increase ecological connectivity;*
    c. *Restore ecological function; and*
    d. *Facilitate management of the protected area.*
2. *Protect and manage (through the EMP, BAP and CAMP) the remaining Black Mountain Mine properties where an active mining right is held, as a 'Protected Environment' buffer to the Protected Area, with permanent land use restrictions on the surface biodiversity;*
3. *Securing an appropriate implementation agency to manage the proposed Protected Area; and*
4. *Establishing a funding mechanism for the long-term management of the Protected Area*."

This project has highlighted some important over-arching issues limiting the ability to achieve the biodiversity offset agreement goals that need to be addressed within a broader biodiversity plan for the mine and the region as a whole. These include:

1- Setting the precedent of further impacting a set-aside (regardless of the scale of this impact and the historical errors which created the circumstances) is problematic. This needs to be addressed in frank discussions between the parties, and properly regulated in provincial and national policy.

2- There is a growing risk to the implementation of the original offset (not primarily due to actions or omissions by BMM) that is more cause for concern than the scope and scale of impacts on Gamsberg set aside, and it is unclear if DENC will be able to discharge its obligations to manage the offset.

3- The cumulative impacts on the unique biodiversity values of the Bushmanland region from the mine, and all associated infrastructure and developments (let alone the other renewable energy, infrastructure and economic developments) requires serious attention. This is not possible in project level EIAs or disconnected planning or economic development frameworks. As an appropriate legacy, BMM should invest in a regional strategy and implementation plan to secure the biodiversity and ecological processes of Bushmanland.

Any additional proposed prospecting impacts on the specific habitat features will not easily be offset by simply continuing with the original scope of the Offset. However, it seems crucial to pursue securing the remaining three required properties from the original offset. Once this is complete, the original offset agreement can be reviewed to stipulate the required additional biodiversity outcomes outlined in this

report and then revising any further requirements. The completion of the original requirements should however be required within a stipulated time period (not more than 3 years) to avoid any doubt about compliance with the original Authorisation.

If the offset is completed with the optimal portfolio of properties, as set out in the Offset Agreement, and a measure (or several measures) to compensate for the impacts which are not possible to offset or additional impacts which have occurred but were not predicted is implemented by DENC and independently audited, then we suggest that no additional offset measures are required for Gamsberg prospecting impacts outlined in version 3.

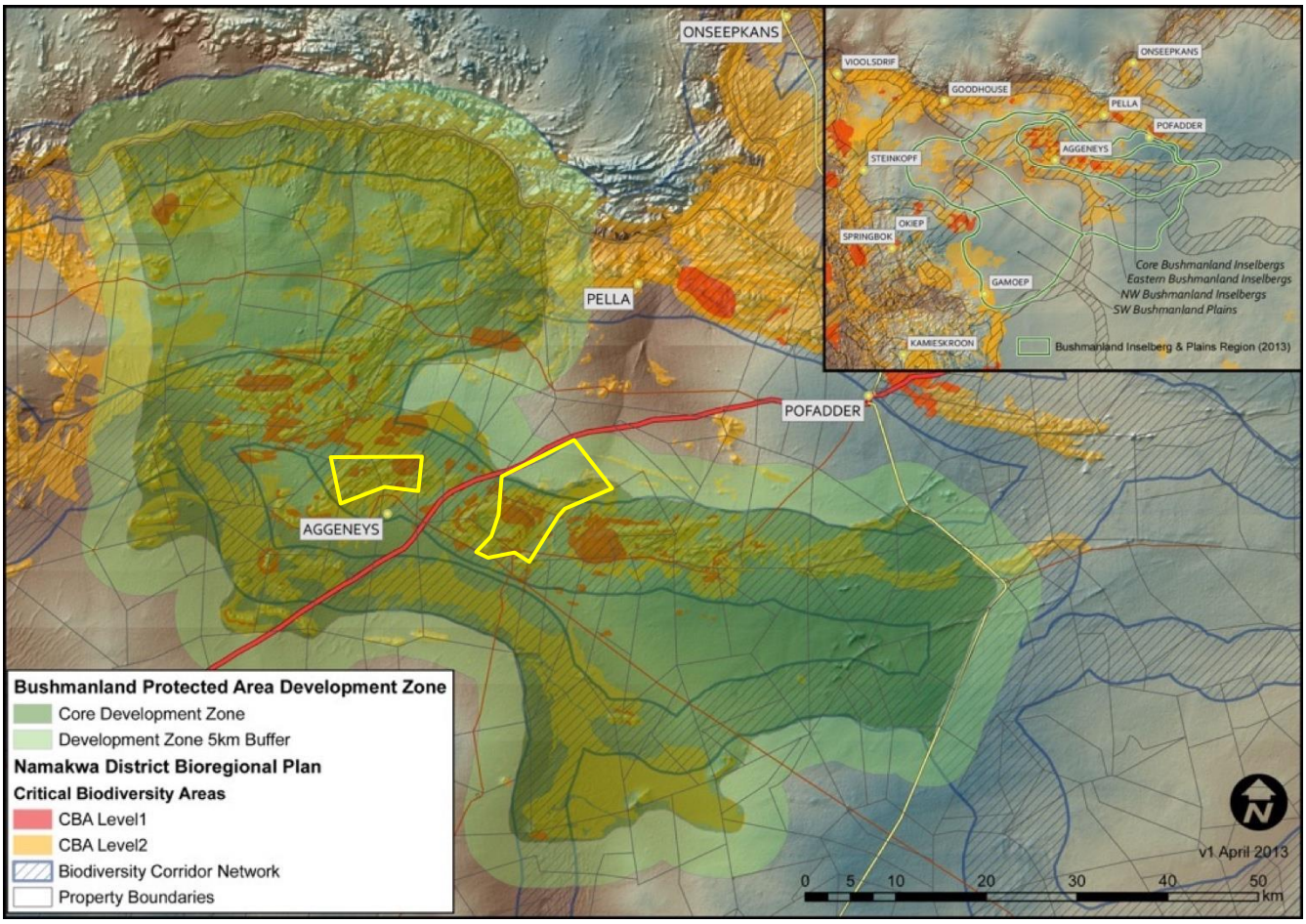

Figure 4 The Gamsberg Zinc Mine set-aside areas (yellow outline) in relation to the Bushmanland protected area development zone.

If there is no likelihood of meeting the terms of the original offset agreement, and BMM have demonstrated best endeavours in the manner set out in the agreement, then a new suite of biodiversity outcomes and compensation measures must be set out and agreed upon that considers properties elsewhere within the Bushmanland protected area development zone (Figure 4). Further, to compensate for non-offsetable habitat impacts, a broader approach of securing habitat within the Bushmanland protected area development zone should be pursued. Only once all options within this zone have been exhausted should habitats outside this zone be considered, for example, adjacent to and easily incorporated into another statutory protected area in the Namaqua district.

Currently, the set-aside areas have no long-term legal protection mechanism. When consolidating the 2014 biodiversity offset agreement or as a suspensive RA condition for a future large-scale development

at the site, this must be addressed. This could be done through a title deed restriction and servitude in favour an appropriate conservation authority. The servitude should require prior informed written consent from the holder before BMM can continue with any activity which may result in further biodiversity loss.

This report has reviewed the expected additional impacts and resultant offset requirements from an initial, revised and optimised prospecting plan on the Gamsberg. It does not take into account possible impacts from any new planned infrastructure or any future activities (such as vents, adits or decline shafts) under Gamsberg and the Big Syncline or around the mine (such as the mooted smelter and waste rock dumps). Further, it does not consider other biodiversity impacts related to ancillary infrastructure around Gamsberg (including the water pipeline, smelter, transport, power generation, and pit mining on Big Syncline). These are likely to be more significant than the relatively small impacts on Gamsberg.

It is imperative to formally augment the original offset agreement or conclude a new one (including the required offset quantum, specifics and most suitable target sites) only once there is greater clarity on the full scope of anticipated biodiversity impacts from all prospecting activities and planned new infrastructure, acknowledging that there are some biodiversity features which are not possible to offset and which should not be further compromised by BMM, but which can be compensated for through the measures suggested in this report.

In this regard, BMM have commence with the compilation of a broader long-term Biodiversity Strategic Plan as recommended during the meeting with DENC, IUCN and several external specialists involved in the Biodiversity Offset Agreements on 4th February 2020 in Kimberly. This plan will look at the whole mining project pipeline of known orebodies, their cumulative impacts and offset requirements. Once that is completed a broader biodiversity strategic plan will be compiled and engagement with authorities regarding offset requirements and amendment of the Biodiversity Offset Agreement will be undertaken with a full public participation process. Unrelated developments by external parties in the area, e.g. renewable energy, will also be taken into account during cumulative impact assessment where information is available.

7 References

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8 Appendix 1. Baseline Biodiversity Assessment and Calculation of Area Impacted

This section summarises the baseline floristic and ecological condition of each proposed drill site based on the findings of the field assessment. These findings are used to make an assessment of the activity impact without and with mitigation recommendations being implemented.

8.1 Assessment Methodology

1. A site assessment was conducted 13, 14 and 17 August 2020 after a period of good rains. Veld conditions were good for making an accurate ecological assessment. In total 28 sites were assessed of which 21 are located within the set-aside areas of the eastern Gamsberg and seven are located within the demarcated mining area.
2. Each proposed site was assessed in person by Philip Desmet (botanist), Westley Price (Vedanta exploration geologist) and Neil MacDonald Biodiversity (BMM Environmental Officer).
3. At each site a drill pad footprint approximately 20m x 20m in extent was discussed and agreed upon by the three parties. For each drill pad the corners were demarcated by means of painted stones, co-ordinates recorded on a GPS and photographed. Where existing access tracks did not exist or were not visible on the ground, the route of a new track was recorded using the GPS. Criteria for deciding on the footprint area included:
    a. Extent of previously disturbed area;
    b. Presence of more disturbed area nearby (potential alternative sites);
    c. Presence of species or ecological features that should be avoided;
    d. State of vegetation (i.e. level to which site had naturally revegetated); and
    e. Length of track required to access the drill site.
4. A qualitative ecological assessment of each drill pad site and access track was made. Ecological attributes noted included:
    a. Signs of attempted restoration (e.g. rock packing, erosion control, brush packing, etc.);
    b. Species present within the footprint area particularly species of conservation concern (Neethling and van Tonder, 2015); and,
    c. Presence of ecological processes (e.g. erosion, fossorial animal activity, ants/termite activity).
5. Each site was assigned a date of impact relating to three major periods of activity: 1970's Newmont drilling program, 2010 Anglo drilling program; and, post 2010 Vedanta mine construction.
6. The in-field re-aligned activity footprint was mapped at high resolution in an ArcView GIS using by updating the existing August 2018 Set-aside disturbed footprint map to reflect the current proposed impact footprint:
    a. The GPS corner points recorded for each drill pad were used to create a polygon of the proposed impacted areas;
    b. High resolution satellite imagery (0.5m, ca. 2012) and drone aerial imagery (1.5cm, ca. 2019) were used as backdrops to verify the existing mapping of impacts.
7. The final shapefile of proposed impact areas (Set_aside_Disturbed_footprint_Sept_2020_v1_20200903.shp) was intersected with (1) the fine-scale vegetation map (Desmet 2013b) and (2) Gamsberg East and South Biodiversity Sensitivity map (Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis) to quantify the impact area in relation to existing biodiversity sensitivity informants. Note that the fine-scale vegetation map for Bushmanland developed by Desmet (2013b) has been included in the national vegetation map (South African National Biodiversity Institute, 2006).

8.2 Results

8.2.1 Baseline Vegetation

The in-field assessment and demarcation of drill sites together with the exploration geologist permitted the *ad hoc* moving of sites in-field to achieve the "lowest ecological cost" location in terms of minimising total area and species/habitat impacted. This interactive process is an important part of the impact avoidance hierarchy that has significantly lowered the spatial footprint and overall ecological impact of the activity.

After the in-field assessment, the proposed prospecting activities will impact a total of 3.51ha including 2.61 ha of Aggeneys Gravel Vygieveld and 0.91 ha of Bushmanland Inselberg Shrubland South African Vegetation Types (Table 4, Figure 5). The proposed activities have mostly been located within the existing disturbance footprint of previous prospecting or mining activities at the site that are currently under natural recovery[3]. In total 87% (3.07 ha) of the proposed activities are located on previously disturbed sites and 13% (0.46 ha) is considered greenfield (Table 4):

- Drill pads on existing disturbed sites currently recovering cover 0.46 ha or 13.17% of total impact area;
- Road access on existing tracks currently recovering cover 2.61 ha or 73.84%;
- New drill pad area 0.01 ha or 0.33%; and,
- New road access to be created 0.45 ha or 12.67%.

Note that the impact of the proposed activities only includes drill pads and access roads and not management roads (see Figure 5). Management roads or tracks are considered permanent infrastructure features that existed prior to this development and that are essential for the site's management. Management roads are not expected to be restored and do not contribute to the impact extent or biodiversity offset calculations.

With the revised prospecting plan only a single drill pad (Label 12 Figure 5) remains located in the very important north eastern Gamsberg plateau in the fine grain quartz patch habitat (

Table 7). During the in-field assessment, a new or greenfield site (label 21, Figure 5) was created in order to avoid the high sensitivity quartz patch area where the desktop drill plan had placed a drill pad. This new site contains no species or habitats of over-riding conservation concern compared to the proposed site that is rated very high biodiversity sensitivity (see below).

8.2.1 Biodiversity Sensitivity

The 2018 Gamsberg East and South Biodiversity Sensitivity map (see Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis) was used to assess the relative sensitivity of each drill pad location and the overall activity impact on biodiversity. This map integrates all available biodiversity informants into a single spatial layer to assist mine planners to plan mine activities in a manner that minimises environmental or biodiversity "cost" by avoiding the most sensitive or important sites.

[3] As there is no active restoration program at the mine addressing previous impacts on the set-aside, previously disturbed areas where there may or may not have been an initial attempt at rehabilitation (recovery to an undefined goal) or restoration (recovery to a natural ecosystem or trajectory towards a natural ecosystem) are referred to recovering areas. Natural elements are returning to the sites but there is no monitoring or additional interventions to accelerate this recovery.

Overlaying the revised post site-visit drilling plan on the biodiversity sensitivity map shows that compared to the previous version of the drill plan (v2) the impact footprint has been reduced by over 60% from 9.7 to 3.5 ha (

Table 5, Figure 3). Most importantly, however, any new impacts are avoided in Very High sensitivity areas.

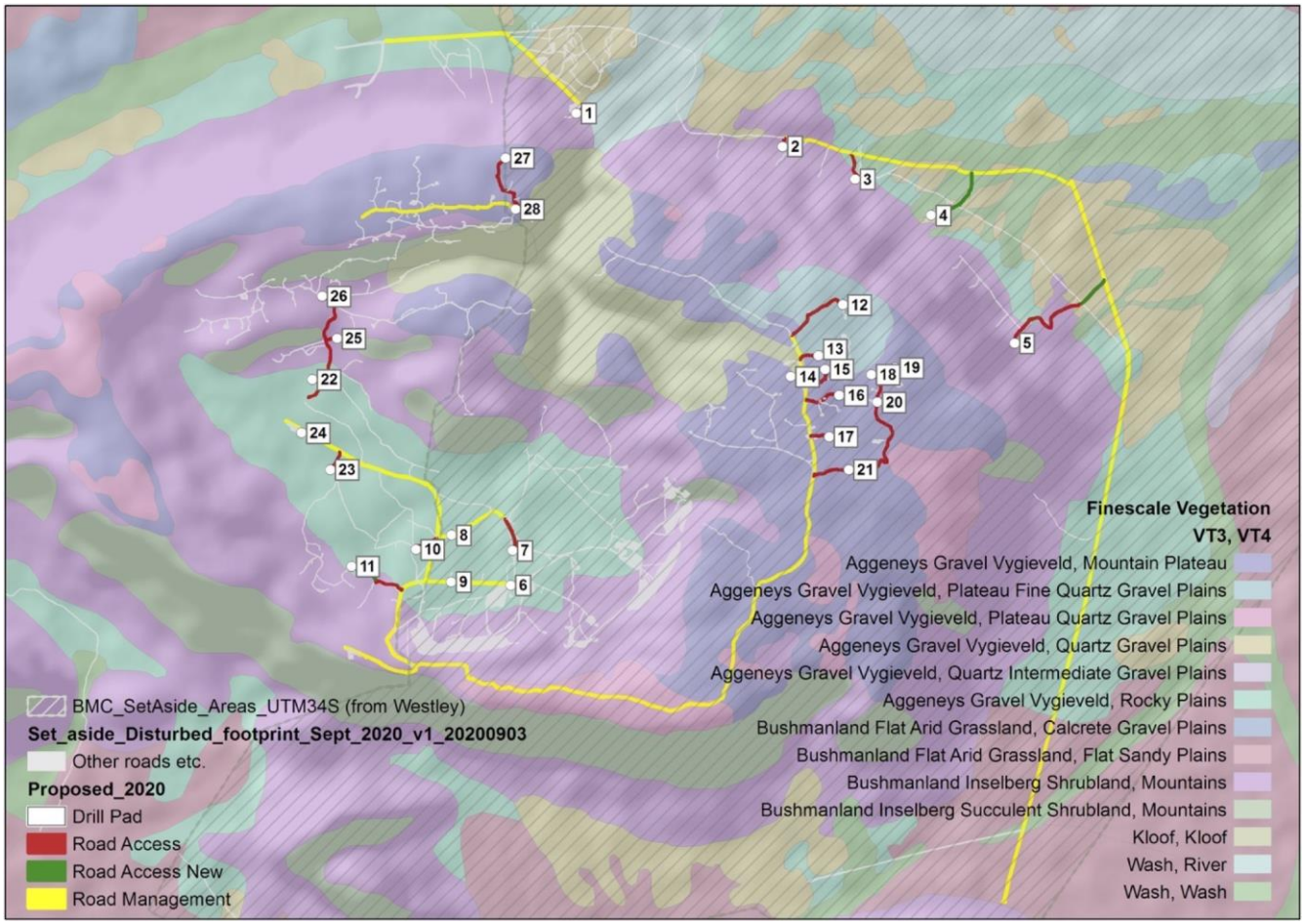


Figure 5. Map of the study area showing the location of the proposed activities in relation to vegetation types.

Table 4. The total area of vegetation types impacted by the proposed activities.

Vegetation Type Name (VT3) and Habitat Unit (VT4)	Drill Pad Existing	Road Access Existing	Road Access New	Drill Pad New	Total Area (m2)
1. Aggeneys Gravel Vygieveld:					***26184***
1.1 Mountain Plateau	1171	11365		115	12651
1.2 Plateau Fine Quartz Gravel Plains	210	1873			2084
1.3 Quartz Gravel Plains	13	277	1673		1962
1.4 Rocky Plains	1717	5096	772		7586
1.5 Wash	195		1706		1901
2. Bushmanland Inselberg Shrubland					***9106***
2.1 Bushmanland Inselberg Shrubland	1340	6979	319		8639
2.2 Kloof		467			467
Total Area (m²)	***4646***	***26058***	***4471***	***115***	***35290***
Total Area (ha)	***0.46***	***2.61***	***0.45***	***0.01***	***3.53***

Table 5 A summary of the area impacted by version 2 and 3 of the prospecting drill plan.

	Biodiversity Sensitivity Category			
ACTIVITY TYPE	**MEDIUM**	**HIGH**	**VERY HIGH**	**Total Area (m²)**
Drill Plan v2 (August 2018)				
Drill Pad Old	2467	5739	989	9195
Drill Pad New	5832	2468	449	8749
Road Access	40920	26054	4178	71151
Road Access New	7935			7935
Total Area (m²)	***57153***	***34260***	***5616***	***97029***
Drill Plan v3 (August 2020)				
Drill Pad Old	3252	1184	210	4646
Drill Pad New		115		115
Road Access	12076	11641	2341	26058
Road Access New	2798	1673		4471
Total Area (m²)	***18126***	***14613***	***2551***	***35290***
% Change from v2 to v3	-68.3	-57.3	-54.6	-63.6

8.2.2 Species Assessment

All drill pads but one are located on previously disturbed sites that are is various stages of recovery towards a natural ecological community. Consequently, the species or vegetation communities present contain elements of the pre-disturbance vegetation but are not representative of natural communities and numbers/density of individuals are very low (tens per site vs expected thousands).

Most sites assessed show fair to good natural recovery of vegetation in terms of species present. A summary of species observed at each drill pad and access road is presented in Table 8. Sites impacted in the 1970's show the best recovery with species diversity similar to surrounding veld. As these sites were never actively rehabilitated the physical impacts of disturbance (e.g. tracks and drill pads) are still visible. Sites on the eastern Plateau impacted by the 2010 drilling campaign also show fair to good natural recovery of vegetation. Species diversity and plant cover, however, are very low but the species that are returning are what could be expected based on the surrounding veld. Importantly, alien species are not occupying these disturbed spaces. What is encouraging is that in the fine grain quartz patch habitat on the north-eastern plateau (drill site 12: Old42) species of conservation concern (*Conophytum ratum, Conophytum calculus* and *Avonia quinaria*) have re-colonised quartz grit drifts that have formed on the access track. On sites where scaffolding was used in the 2010 drilling campaign, the species recovery is excellent especially amongst guilds with below ground storage (e.g. bulbs, *Bulbine striata, Tylecodon suffultus*).

Over-all, the natural recovery of vegetation indicates that (1) soil chemistry post-disturbance does not pose a limitation to restoration; and, (2) soil compaction (i.e. not using scaffolding) is limiting natural recovery of vegetation. Across all sites, irrespective of disturbance age, soil erosion is problematic. The problem is more evident on steeper topography. Erosion is leading to gully formation and where erosion is evident there is no revegetation occurring irrespective of disturbance age. Access tracks exacerbate erosion by capturing sheet-flow water and channelling it into erosion gullies or onto drill pads compounding the erosion problem on these sites. Design and implementation of active restoration measures specifically aimed to prevent water channelling need to be implemented post prospecting. Packing rocks back on site, as was done post 2010 drilling, is only partially successful at curbing erosion. Restoration activities need to address impacts on drill pads as well as access tracks. Post drilling all access tracks that are not essential and especially those on steeper slopes should be decommissioned and restored.

It is likely that for most sites assessed, whilst natural revegetation is occurring, they will not return to a pre-disturbance state without further active intervention aimed at accelerating revegetation by addressing soil compaction and erosion.

8.3 Impact Assessment

The following impacts on plants/habitats/vegetation are considered:

1. Direct impacts considered include:
    a. Loss of habitat as a direct result of prospecting activities and associated infrastructure (Habitat Loss);
    b. Reduced ecological functioning (degradation) of affected habitat as a result of prospecting and associated infrastructure due to soil erosion, and the continued self-propagation of this impact into natural areas away from the impact footprint area.

The following assumptions were made when quantifying the proposed prospecting impacts on the vegetation:

- The calculation of the spatial extent of the prospecting footprint (impact area) is accurate as reflecting in the optimised exploration plan version3.
- The activity does not require any removal of soil surface (i.e. takes place on the natural soil surface) and based on the natural re-vegetation of previous prospecting activities at the sites, and with the proposed mitigation measures implemented there is a good to excellent probability of restoring vegetation in impacted areas to a near-natural state within a 50 year time period including the return of species of conservation concern.

Table 6. (following page) Impact Assessment Table.

Impact Nature: Prospecting activities will result in the loss of natural habitat/populations/individuals and self-propagation/persistence of degradation processes (soil erosion) leading to further loss of habitat/populations/individuals outside of the direct impact area.									
Impact	*Nature*	*Extent*	*Duration*	*Intensity*	*Reversibility*	*Impact on Features of conservation concern*	*Probability*	*Significance*	*Confidence*
Without Mitigation	**Negative**	**Local**	**Long-term/ permanent**	**Moderate**	**Low**	**High**	**Definite**	**Major**	**High**
With Mitigation	**Neutral**	**Local**	**Medium-term**	**Low**	**High**	**High**	**Definite**	**Minor**	**High**
Mitigation Description: • See Section 5									
Residual Impact: Permanent loss of all natural habitats impacted can be avoided by implementing the recommended mitigation measures.									

With the recommended site management and ecological restoration measures applied even physical impacts of prospecting on the landscape (e.g. Access track "tweespoor") can be restored within a 50-year timeline. The likelihood of restoring the original ecosystems impacted to a state that is near-natural that includes species of conservation concern, and where self-propagation of degradation process is abated, is HIGH.
Cumulative Impact:
Impact Significance: Given that: 1. The activity is located in an area with very high biodiversity sensitivities; 2. However, all sites, but one, are previously impacted by exploration and mining activities; and, 3. Based on the field assessment it is unlikely that most sites will revert to a pre-disturbance natural state (equivalent species diversity and vegetation cover) within a 50 year period without further intervention; and, Without mitigation, irrespective of the current vegetation status/ecological condition and trend of the activity footprint, the impact of this activity will be HIGH given the exceptional biodiversity context of the site. With mitigation, however, if the recommended mitigation measures are successfully implemented especially with regard (1) to minimising impact during drilling (e.g. using scaffolding around the drill rig) and (2) better post impact ecological restoration and abatement of degradation processes, then the medium to long term impact of this activity should be LOW.

8.4 Definition of Ecological Restoration

Restoration under the mitigation measures proposed here refers specifically to ecological restoration of the impacted site to a state or trajectory to a state that is as closely equivalent to the ecosystems present prior to impact taking place.

Ecological restoration[4] is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecosystems are dynamic communities of plants, animals, and microorganisms interacting with their physical environment as a functional unit. These communities can be damaged, degraded, or destroyed by human activity. Ecological restoration seeks to initiate or accelerate ecosystem recovery following these impacts.

Restoration practitioners do not carry out the actual work of ecosystem recovery. Rather, they create the conditions needed for recovery so the plants, animals, and microorganisms can carry out the work of recovery themselves. Assisting recovery can be as simple as removing an invasive species or reintroducing a lost species or a lost function (like fire); or as complex as altering landforms, planting vegetation, changing the hydrology, and reintroducing wildlife. Given the nature of the prospecting impacts as well as the observations of the current recovery of ecosystems at the Gamsberg we expect restoration interventions to be relatively simple and the likelihood of achieving a satisfactory result being highly likely

The goal of ecological restoration is to return a degraded or damaged ecosystem to its historic trajectory, not necessarily its historic condition. The ecosystem may not recover to its former state since contemporary ecological realities, including global climate change or fugitive dust from mining in the Gamsberg context, may cause it to develop along an altered trajectory, just as these same realities may

[4] Definition adapted from the Society for Ecological Restoration https://www.ser-rrc.org/what-is-ecological-restoration/

have changed the trajectory of nearby undisturbed ecosystems. History plays an important role in restoration, but contemporary conditions must also be taken into consideration.

Ecological restoration aims to re-establish a self-organizing ecosystem on a trajectory to reach full recovery. While restoration activities can often place a degraded ecosystem on an initial trajectory of recovery relatively quickly, full recovery of the ecosystem can take years, decades, or even hundreds of years. For example, while we can initiate a forest restoration process by planting trees, for full recovery to be achieved, the site should be a fully functioning forest with mature trees in the age-classes representative of a mature native forest. If there were 500-year-old trees in the forest that was destroyed, then the restoration should logically take hundreds of years to achieve full recovery. During that recovery period, unforeseen barriers to recovery may be encountered, or additional restoration activities may become possible at later stages of development. Thus, while individual restoration activities may be completed, in most cases the restoration process is a continuous activity as the ecosystem recovers and matures that includes monitoring and occasional intervention if and when required.

While we can successfully restore biodiversity, structure, and function to a degraded ecosystem, ecological restoration is not a substitute for conservation, nor should the promise of restoration be used to justify destruction or unsustainable use. In reality, restoration may not succeed in re-establishing the full assemblage of native species or the full extent of the original ecosystem's structure and function.

Table 7. Extent of the proposed activities on vegetation broken down per drill site. Vegetation types are assigned biodiversity sensitivity rankings based on the occurrence of species of conservation concern, global extent of vegetation type units and sensitivity to disturbance (see Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis).

			Biodiversity Sensitivity			
Activity	**Site Name**	**Vegetation Type Name (VT3) and Habitat Unit (VT4)**	**MEDIUM**	**HIGH**	**VERY HIGH**	**Total Area m²**
Drill Pad Existing	Add01	Aggeneys Gravel Vygieveld Rocky Plains	100			100
	Add03	Aggeneys Gravel Vygieveld Rocky Plains	155			155
	Add04	Aggeneys Gravel Vygieveld Rocky Plains	244			244
	Add05	Bushmanland Inselberg Shrubland	172			172
	Add06	Bushmanland Inselberg Shrubland	155			155
	Add07	Aggeneys Gravel Vygieveld Mountain Plateau		116		116
	Add08	Aggeneys Gravel Vygieveld Mountain Plateau		111		111
	New09	Bushmanland Inselberg Shrubland	346			346
	New20	Bushmanland Inselberg Shrubland	277			277
	New40	Bushmanland Inselberg Shrubland	192			192
	Old15	Aggeneys Gravel Vygieveld Mountain Plateau		104		104
	Old18	Aggeneys Gravel Vygieveld Mountain Plateau		98		98
	Old20	Aggeneys Gravel Vygieveld Mountain Plateau		95		95
	Old27	Aggeneys Gravel Vygieveld Mountain Plateau		156		156
	Old35	Aggeneys Gravel Vygieveld Rocky Plains	358			358
	Old37	Aggeneys Gravel Vygieveld Rocky Plains	197			197
	Old39	Aggeneys Gravel Vygieveld Rocky Plains	173			173
	Old40	Aggeneys Gravel Vygieveld Rocky Plains	127			127
	Old41	Aggeneys Gravel Vygieveld Rocky Plains	188			188
	Old42	Aggeneys Gravel Vygieveld Plateau Fine Quartz Gravel Plains			210	210
	Old43	Aggeneys Gravel Vygieveld Mountain Plateau		103		103
	Old44	Bushmanland Inselberg Shrubland	198			198
	Old45	Aggeneys Gravel Vygieveld Quartz Gravel Plains		208		208
	Old46	Aggeneys Gravel Vygieveld Mountain Plateau		152		152
	Old50	Aggeneys Gravel Vygieveld Rocky Plains	175			175
	PDG2	Aggeneys Gravel Vygieveld Mountain Plateau		142		142
	PGD1	Aggeneys Gravel Vygieveld Mountain Plateau		90		90
Drill Pad Existing Total			***3057***	***1376***	***210***	***4646***
Drill Pad New	PGD3	Aggeneys Gravel Vygieveld Mountain Plateau		118		118
Drill Pad New Total				***118***		***118***

			Biodiversity Sensitivity			
Activity	**Site Name**	**Vegetation Type Name (VT3) and Habitat Unit (VT4)**	**MEDIUM**	**HIGH**	**VERY HIGH**	**Total Area m²**
Road Access		Aggeneys Gravel Vygieveld Mountain Plateau		11365		11365
		Aggeneys Gravel Vygieveld Plateau Fine Quartz Gravel Plains			1873	1873
		Aggeneys Gravel Vygieveld Quartz Gravel Plains		277		277
		Aggeneys Gravel Vygieveld Rocky Plains	5096			5096
		Bushmanland Inselberg Shrubland	6979			6979
		Kloof			467	467
Road Access Total			***12076***	***11641***	***2341***	***26058***
Road Access New		Aggeneys Gravel Vygieveld Quartz Gravel Plains		1673		1673
		Aggeneys Gravel Vygieveld Rocky Plains	772			772
		Bushmanland Inselberg Shrubland	319			319
		Wash	1706			1706
Road Access New Total			***2798***	***1673***		***4471***
Total Area m²			***18126***	***14613***	***2551***	***35290***

Table 8. Species list of plants observed within the proposed development footprint.

Site ID and Name	21	20	19	18	17	16	14	15	13	12	1	2	3	4	5	9	6	7	8	10	11	27	28	26	25	22	24	23
Species Name	PGD3	PGD2	Old46	Old20	PGD1	Old43	Old15	Old18	Old27	Old42	New09	Old44	New20	Old45	New40	Old40	Old35	Old41	Old37	Old39	Old50	Add07	Add08	Add06	Add05	Add01	Add04	Add03
Anacampseros filamentosa																							1					1
Antimima rugosa	1																											
Aptosimum sp.				1																								
Arctotis sp.				1																								
Aristida sp.																				1								
Augea capensis																								1	1		1	
Avonia albissima												1											1					1
Avonia papyracea							1															1						1
Avonia quinaria										1																		
Brownanthus ciliatus					1													1			1							
Brunsvigia namaquensis										1																		
Bulbine striata										1																		
Ceraria fruticulosa					1		1															1						1
Conophytum calculus						1				1																		

Site ID and Name	21	20	19	18	17	16	14	15	13	12	1	2	3	4	5	9	6	7	8	10	11	27	28	26	25	22	24	23
Species Name	PGD3	PGD2	Old46	Old20	PGD1	Old43	Old15	Old18	Old27	Old42	New09	Old44	New20	Old45	New40	Old40	Old35	Old41	Old37	Old39	Old50	Add07	Add08	Add06	Add05	Add01	Add04	Add03
Conophytum praesectum																												1
Conophytum ratum										1																		
Cotyledon orbiculata									1	1																		
Crassula deltoidea					1																	1	1					
Crassula garibina							1			1																		
Didelta carnosa																								1	1	2	1	
Dinteranthus microspermus		1																										
Drosanthemum hispidum					1		1				1								1				1					
Enneapogon scaber																						1						
Eragrostis nindensis			1	1	1	1		1		1	1	1			1		1											
Eriocephalus sp.												1									1							
Eriospermum sp.																	1											
Euphorbia gregaria														1	1							1						
Euphorbia mauritanica																												1
Euphorbia spinea																					1							
Gazania sp.				1																								
Hereroa puttkameriana	1																											
Hermannia sp.							1					1								1								
Hermannia stricta																								1				
Hypertelis salsoloides			1		1	1		1																				
Ihlenfeldtia sp.					1																							
Justicia sparmanii																			1									
Lithops olivacea							1																					
Mesembryanthemum crystallinum																							1			1		
Morea sp.			1																									
NO PLANTS																1												
Othonna sp.				1																								
Oxalis sp			1																									
Phyllobolus latipetalus						1																1						
Psilocaulon coriarium											1																	
Psilocaulon subnodosum																			1									
Pteronia glauca		1																				1						
Rhigozum trichotomum																				1						1		1

Site ID and Name	21	20	19	18	17	16	14	15	13	12	1	2	3	4	5	9	6	7	8	10	11	27	28	26	25	22	24	23
Species Name	PGD3	PGD2	Old46	Old20	PGD1	Old43	Old15	Old18	Old27	Old42	New09	Old44	New20	Old45	New40	Old40	Old35	Old41	Old37	Old39	Old50	Add07	Add08	Add06	Add05	Add01	Add04	Add03
Ruschia divaricata	1	1			1	1		1	1	1					1					1	1	1	1	1				1
Salsola zeyheri													1	1							1			1	1		1	
Sarcostemma viminale																					1							
Stipagrostis obtusa																								1		1		1
Tetragonia reduplicata		1																	1					1				
Tylecodon suffultus							1																					
Unknown bulbs									1														1					1
Zygophyllum decumbens																	1	1	1	1	1		1	1		1		1
Zygophyllum retrofractum														1														
Grand Total	3	4	4	5	8	5	7	3	3	9	3	4	1	3	3	1	3	2	5	5	7	9	8	8	3	6	3	11

9 Appendix 2: Gamsberg East and South Biodiversity Sensitivity Analysis

This is an extract from the dataset metadata document that describes how the biodiversity sensitivity layer was developed.

Date: 26 April 2018

Author: Dr Philip Desmet (drphil@ecosolgis.com)

Purpose: The purpose of this analysis is to provide the Vedanta drilling team with a GIS input that summarises available biodiversity information into a single relative measure of biodiversity sensitivity as well as indicate potential for biodiversity offset.

This analysis integrates all available fine-scale mapped biodiversity information for the Gamsberg using a basic categorical ranking approach where each input is assigned a numerical category equivalent to a standard low-high ranking approach. The numerical categories are used as these simplify the GIS analysis, however, it does not indicate a quantitative relationship between features.

Each input feature was ranked according to the following scale:
Low = 10
Medium = 100
High = 1000
Very High = 10 000

Features were assigned a rank based on existing sensitivity rankings as well as the potential to offset features based on their availability in the wither Bushmanland landscape.

Any feature assigned a value of 10 000 indicates that this feature cannot be offset. In the final integration the value is an indication of the number of overlapping features. For example: A polygon with a final rank of 32100 indicates that there are at total of 6 out of 9 possible features overlapping in that polygon: 3 features with rank of 10 000; 2 features with rank of 1000; and, 1 feature with a rank of 100.

Hydrological features are also included in the analysis as these areas are sensitive to chemical pollution that can arise from drilling. Environmental hazards such as steep slopes are not included in this analysis.

The output shapefile can be used in a “biodiversity cost” analysis to optimise the drilling program to minimise drilling impact on the mountain.

Input Data: The following inputs were used:

	Description of Variable	Rank
1	Fine grain quartz patch map produced for Anglo Exploration in 2006. This maps is based on walking boundaries in the fields and supplemented with mapping from Quick bird imagery	10 000
2	Location of all springs buffered by 50m	10 000
3	Areas of temporary pan concentration based on field observation	10 000
4	Headwater seep catchment boundaries modelled from DEM	10 000
5	Modelled kloof extent	1 000
6	Kloof catchment modelled from DEM	1 000
7	Kloof catchment 200m buffer	100
8	Gravel patch setback buffer identified in the 2013 EIA	100
9	Fine scale habitat map (see details of ranking below)	10-10 000

		BCI BIODIVERSITY SENSITIVITY RANK			
FINESCALE VEGETATION TYPE	**RANK**	**LOW**	**MEDM**	**HIGH**	**VERY HIGH**
Aggeneys Gravel Vygieveld Mountain Plateau	100			1000	
Aggeneys Gravel Vygieveld Plateau Fine Quartz Gravel Plains	10000				10000
Aggeneys Gravel Vygieveld Plateau Quartz Gravel Plains	1000				1000
Aggeneys Gravel Vygieveld Quartz Gravel Plains	1000			1000	
Aggeneys Gravel Vygieveld Quartz Intermediate Gravel Plains	100	100			
Aggeneys Gravel Vygieveld Rocky Plains	100		100		
Bushmanland Flat Arid Grassland	10	10			
Bushmanland Flat Arid Grassland Calcrete Gravel Plains	10000				10000
Bushmanland Inselberg Shrubland	100		100		
Bushmanland Inselberg Succulent Shrubland	1000			1000	
Kloof	10000				10000
Wash	10		10		

Method:

1. Input layers were clipped to the Area of Interest (i.e. the Gamsberg)
2. Input layers were categorised according to the table above
3. Input layers were unioned into a single shapefile and the ranks for the 9 inputs variables summed to give an overall rank ranging from 10 to 32100.

Outputs:

1. Gamsberg_East_Biodiversity_Sensitivity.shp

Projection: UTM34s

10 Appendix 3: Photographic record of drill sites

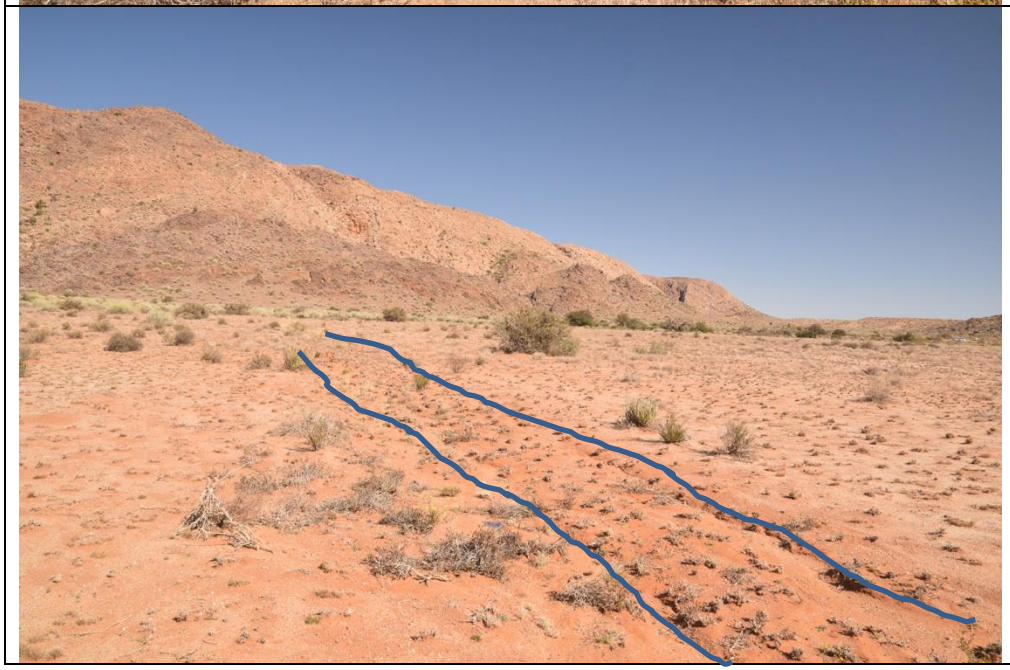
This section contains photographs of all proposed drill sites. Photographs are ordered 1-28 in order that they were surveyed. Basic photograph metadata is summarised in the table below. Blue lines on photographs indicate the location of erosion channels.

Site Unique Identifier	Site name that links to existing datasets	Date site was surveyed	Year in which site disturbance occurred
1	New09	20200813	1970
2	Old44	20200813	1970
3	New20	20200813	1970
4	Old45	20200813	1970
5	New40	20200813	1970
6	Old35	20200813	1970
7	Old41	20200813	1970
8	Old37	20200813	1970
9	Old40	20200813	1970
10	Old39	20200813	1970
11	Old50	20200813	1970
12	Old42	20200814	2010
13	Old27	20200814	2010
14	Old15	20200814	2010
15	Old18	20200814	2010
16	Old43	20200814	2010
17	PGD1	20200814	2010
18	Old20	20200814	2010
19	Old46	20200814	2010
20	PGD2	20200814	2010
21	PGD3	20200814	Greenfield
22	Add01	20200817	Post 2010
23	Add03	20200817	Post 2010
24	Add04	20200817	Post 2010
25	Add05	20200817	Post 2010
26	Add06	20200817	Post 2010
27	Add07	20200817	Post 2010
28	Add08	20200817	Post 2010

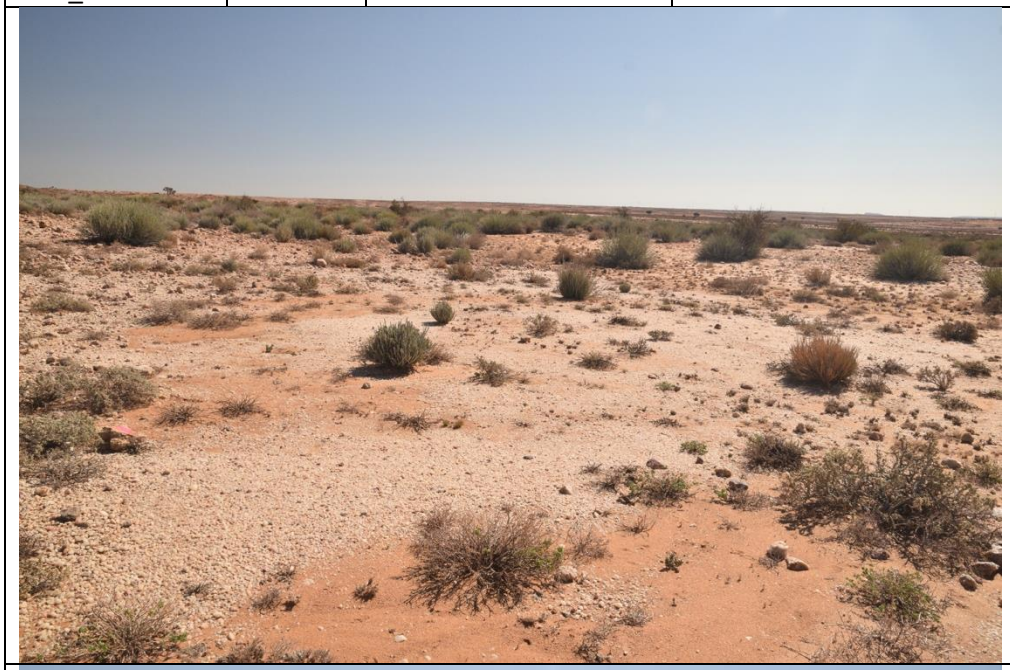
SITE_ID	1	SITE NAME	New09	DATE	20200813	YEAR	1970

SITE_ID	2	SITE NAME	Old44	DATE	20200813	YEAR	1970

SITE_ID	3	SITE NAME	New20	DATE	20200813	YEAR	1970



SITE_ID	4	SITE NAME	Old45	DATE	20200813	YEAR	1970



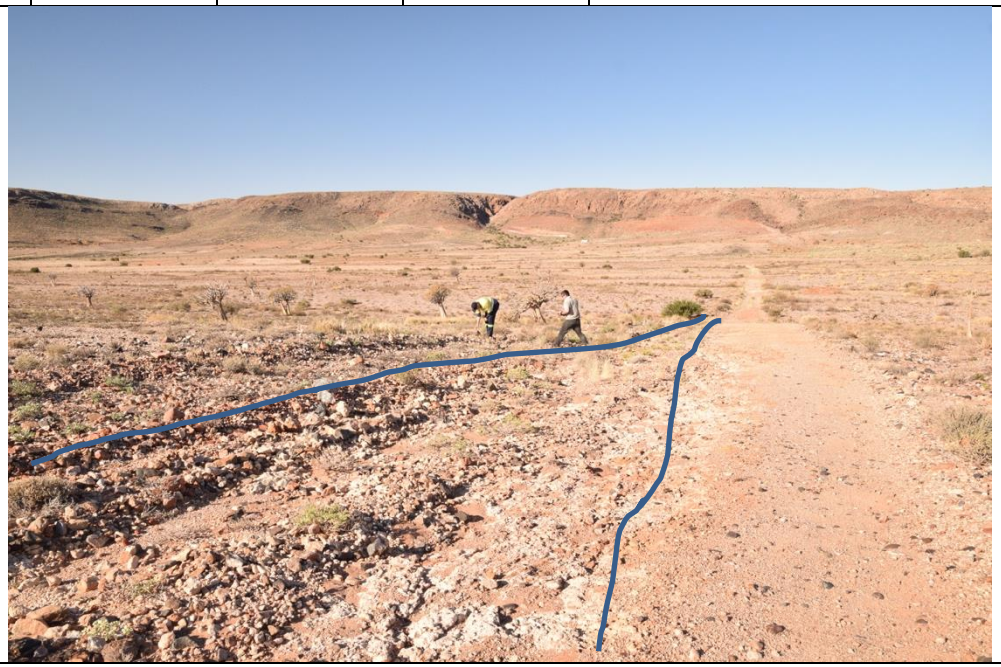
SITE_ID	5	SITE NAME	New40	DATE	20200813	YEAR	1970

SITE_ID	6	SITE NAME	Old35	DATE	20200813	YEAR	1970

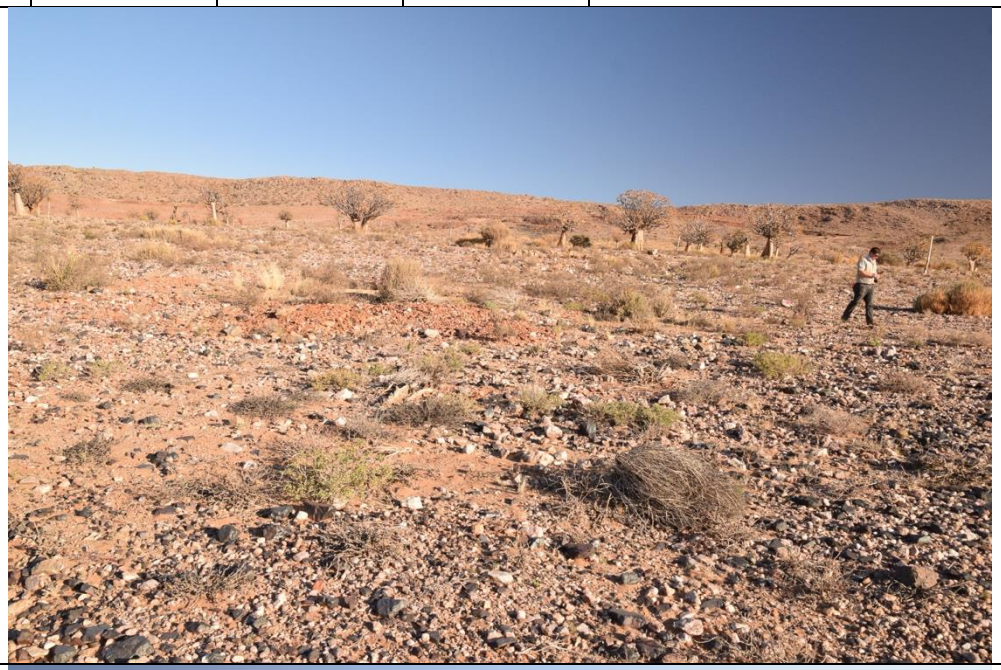
SITE_ID	7	SITE NAME	Old41	DATE	20200813	YEAR	1970

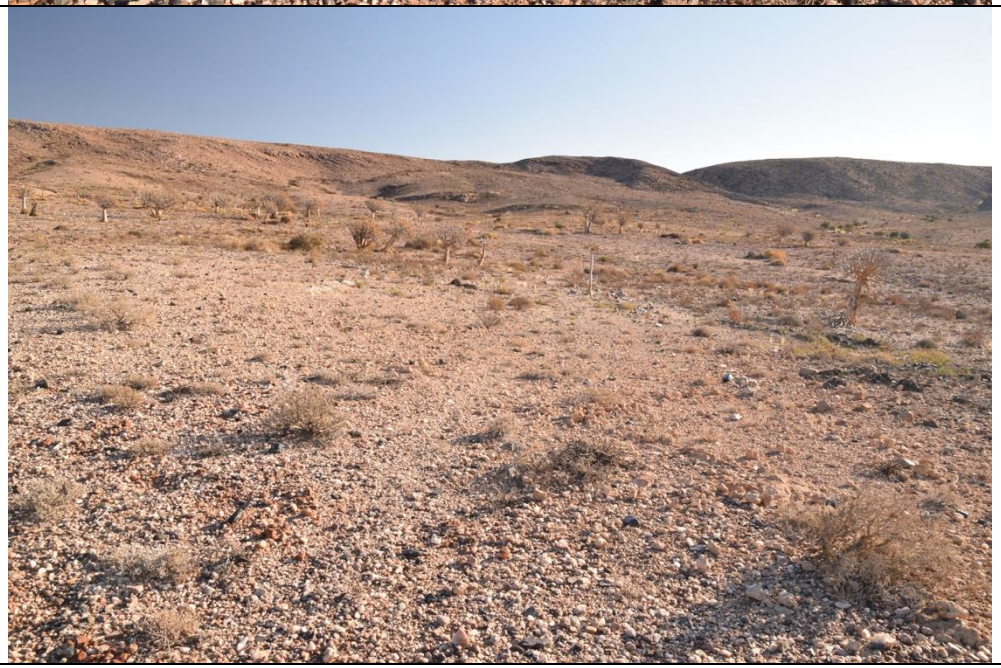
SITE_ID	8	SITE NAME	Old37	DATE	20200813	YEAR	1970

SITE_ID	9	SITE NAME	Old40	DATE	20200813	YEAR	1970

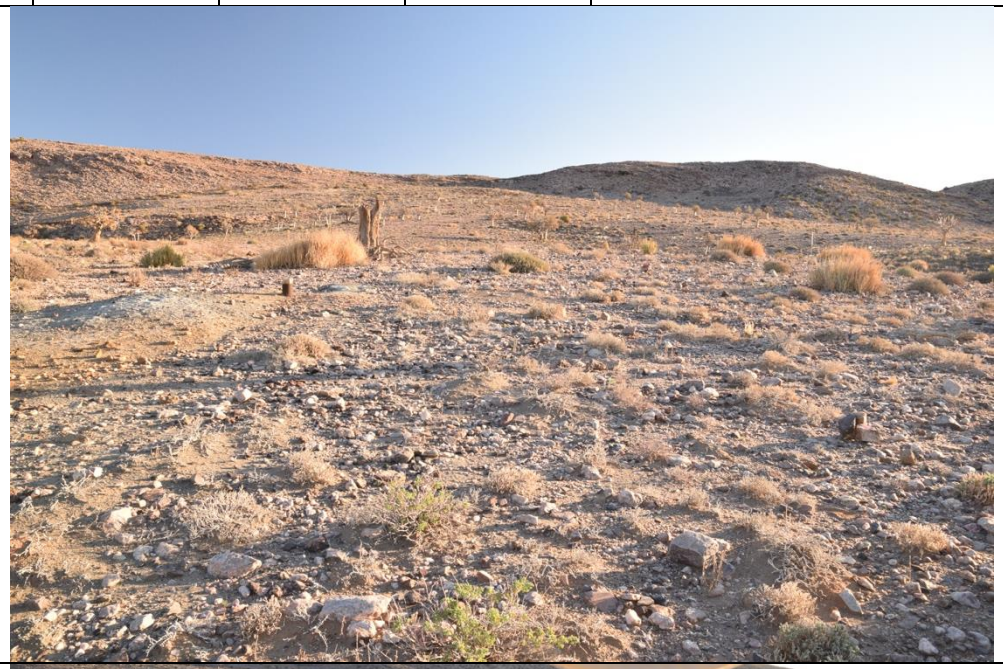


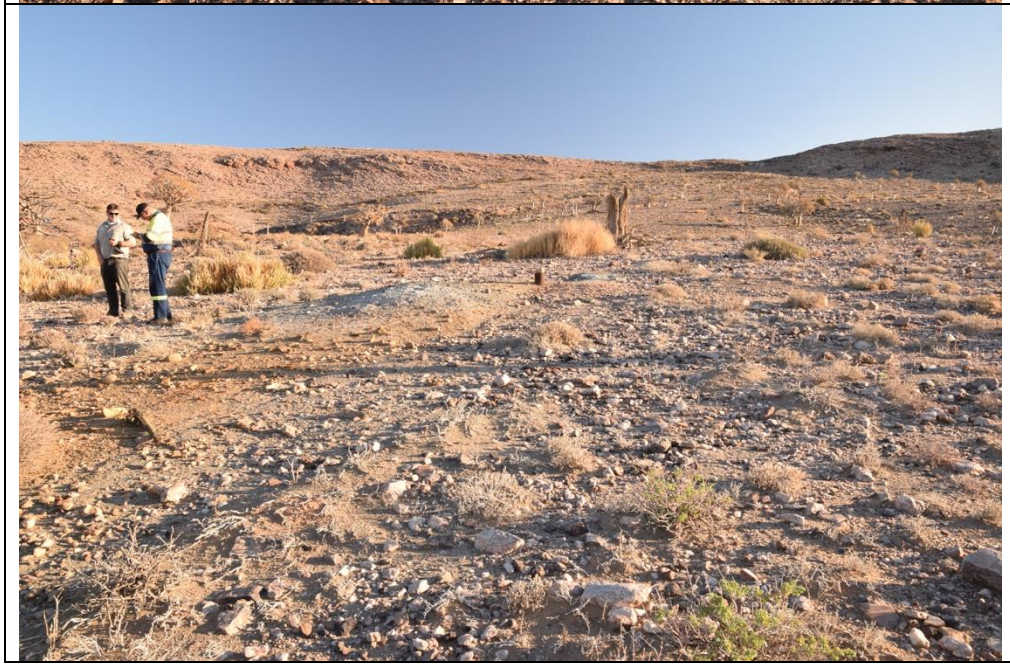
SITE_ID	10	SITE NAME	Old39	DATE	20200813	YEAR	1970





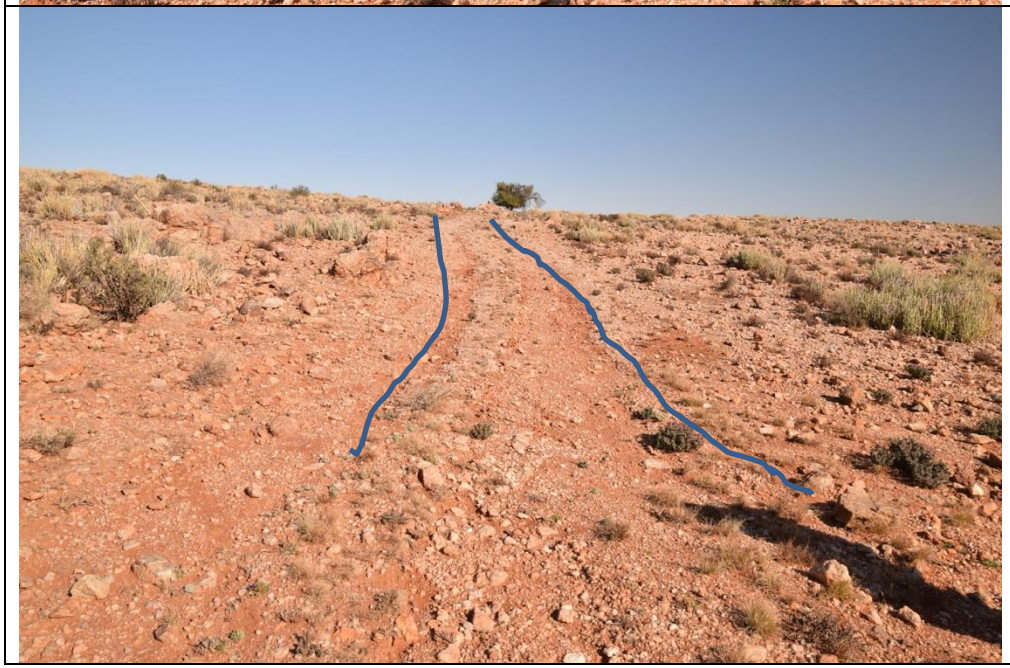
SITE_ID	11	SITE NAME	Old50	DATE	20200813	YEAR	1970



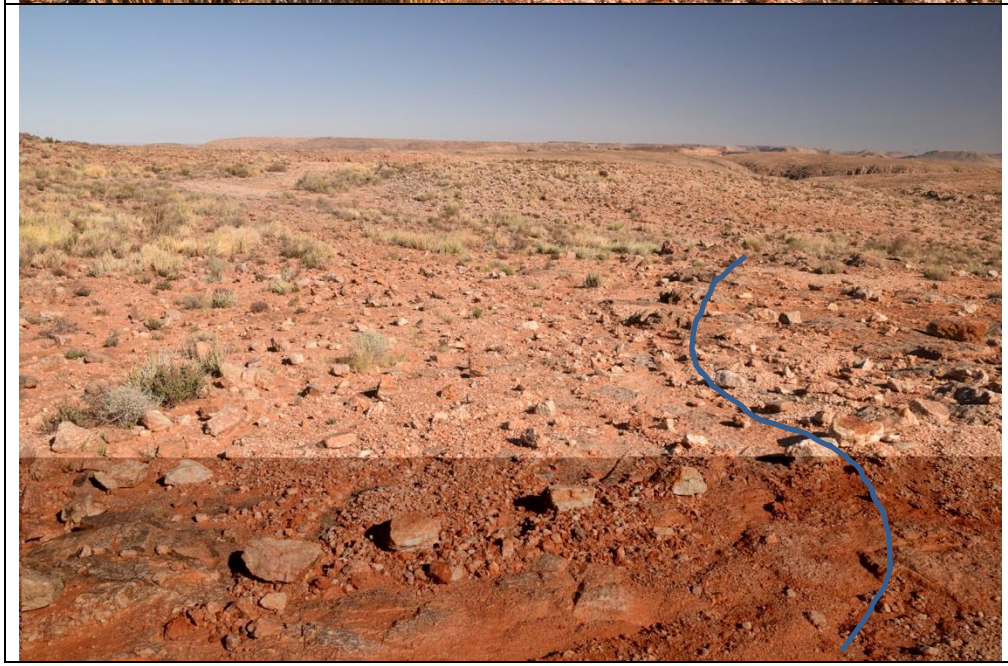


SITE_ID	12	SITE NAME	Old42	DATE	20200814	YEAR	2010

SITE_ID	13	SITE NAME	Old27	DATE	20200814	YEAR	2010



SITE_ID	14	SITE NAME	Old15	DATE	20200814	YEAR	2010



SITE_ID	15	SITE NAME	Old18	DATE	20200814	YEAR	2010

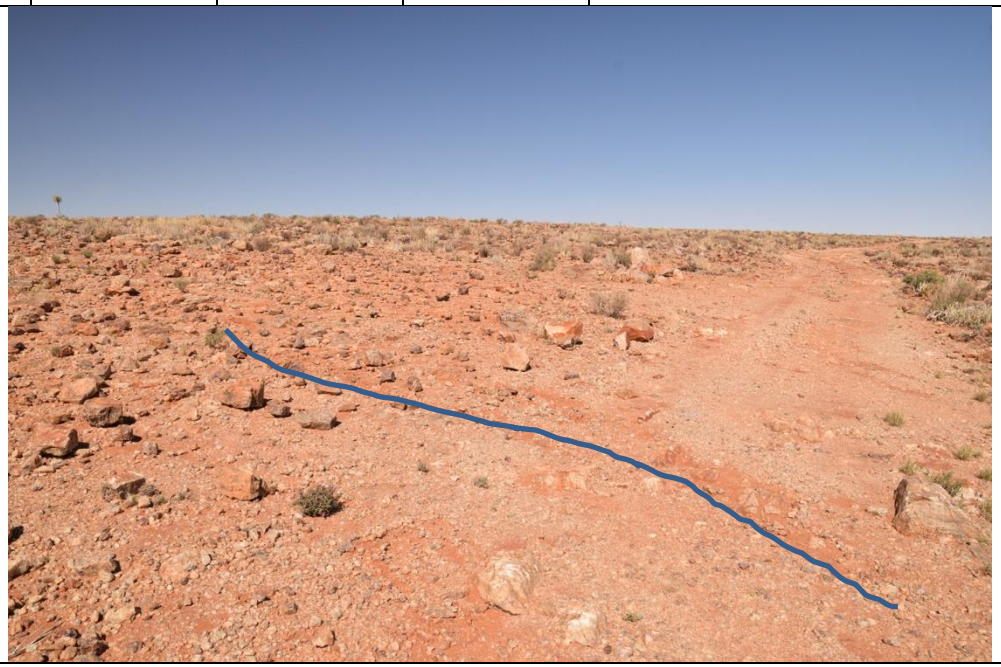
SITE_ID	16	SITE NAME	Old43	DATE	20200814	YEAR	2010

SITE_ID	17	SITE NAME	PGD1	DATE	20200814	YEAR	2010

SITE_ID	18	SITE NAME	Old20	DATE	20200814	YEAR	2010

SITE_ID	19	SITE NAME	Old46	DATE	20200814	YEAR	2010

SITE_ID	20	SITE NAME	PGD2	DATE	20200814	YEAR	2010



SITE_ID	21	SITE NAME	PGD3	DATE	20200814	YEAR	Greenfield

SITE_ID	22	SITE NAME	Add01	DATE	20200817	YEAR	Post 2010

SITE_ID	23	SITE NAME	Add03	DATE	20200817	YEAR	Post 2010

SITE_ID	24	SITE NAME	Add04	DATE	20200817	YEAR	Post 2010

SITE_ID	25	SITE NAME	Add05	DATE	20200817	YEAR	Post 2010

SITE_ID	26	SITE NAME	Add06	DATE	20200817	YEAR	Post 2010

SITE_ID	27	SITE NAME	Add07	DATE	20200817	YEAR	Post 2010




SITE_ID	28	SITE NAME	Add08	DATE	20200817	YEAR	Post 2010