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ENVIRONMENTAL BASIC ASSESSMENT REPORT

TETRA4 PRODUCTION RIGHT EXTENSION

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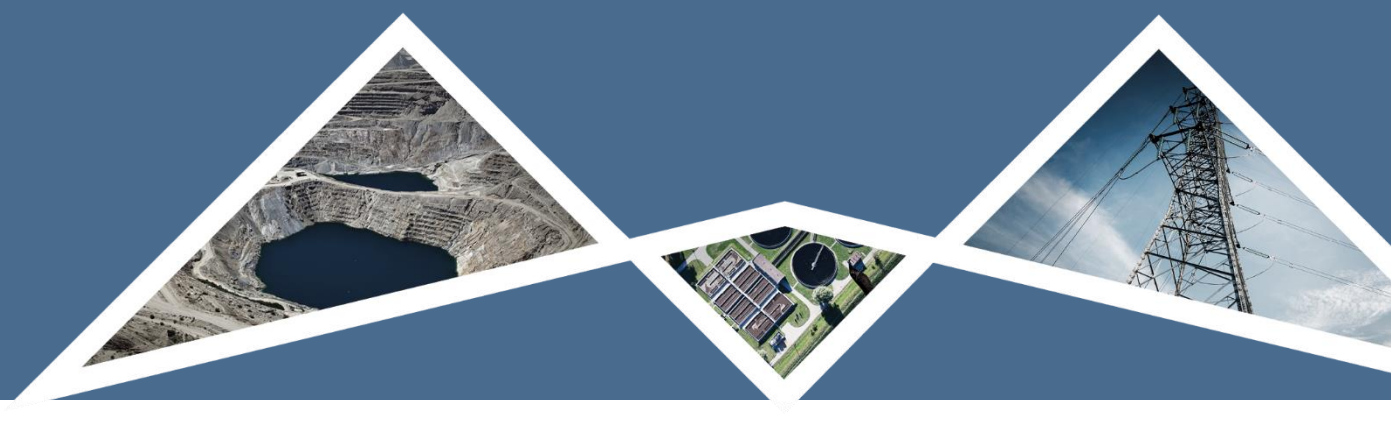

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EXECUTIVE SUMMARY

This non-technical executive summary provides a high-level overview of this Environmental Basic Assessment Report (BA Report). The reader is urged to consult later sections of this report should more specific information or detail be required on various aspects.

1.1 PROJECT OVERVIEW

Tetra4 (Pty) Ltd, hereby referred to as Tetra4, is the operator and holder of existing Exploration Rights (ER) and a Production Right (PR) for natural gas (including helium) in Welkom, Free State Province. Tetra4 intends to consolidate the Exploration Rights (ER32 and ER94, including the activities such as drilling of up to 18 wells), within the Production Right. Tetra4 has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to prepare and submit an application for Environmental Authorisation (in accordance with the National Environmental Management Act- NEMA) to support Tetra4's application to extend their existing Production Right area in accordance with Section 102 of the Minerals and Petroleum Resources Development Act (MPRDA). The applications aim to incorporate the existing exploration rights (ER32 and ER94) into the existing Production Right.

The proposed project necessitates a Basic Assessment (BA) as it constitutes listed activities in terms of NEMA Listing Notices 1, 2, and 3. As part of this BA Report, certain amendments have been made to the Production Right EMPr to include the Production Right Extension project as well as amendments and additions to mitigation measures that were identified during this assessment process. On issuance of the EA, these additional mitigation measures will be incorporated into the approved Production Right EMPr.

1.2 NEED FOR THE PROJECT

The concept of need and desirability is fundamental to the Basic Assessment (BA) process. This assessment evaluates the justification for the proposed exploration and production rights extension, considering various factors such as economic viability, resource management, and potential environmental impacts.

A comprehensive evaluation of need and desirability requires a thorough examination of alternatives and the potential consequences of the proposed action. This assessment should be integrated throughout the BA process, from the initial application to the final decision-making stage. By considering a wide range of environmental, social, and economic factors, the evaluation contributes to determining the overall acceptability of the project and selecting the best possible option.

The needs and desirability analysis, as outlined in the Guideline on need and desirability under the EIA Regulations, necessitates a comprehensive examination of the interconnections between human well-being, livelihoods, and ecosystem services within the project area. This analysis should also elucidate how the proposed project's ecological impacts could potentially translate into socio-economic consequences, such as livelihood disruptions, heritage site loss, or economic opportunities foregone.

It is acknowledged that the extraction of onshore gas represents the depletion of a non-renewable resource. Clumped isotope analyses conducted by the University of Edinburgh has confirmed that the gas is a mixture primarily composed of biogenic and abiogenic sources. By extending the production life of the existing gas field, the project contributes to helium supply and facilitates the transition from coal-based energy generation towards low carbon and renewable alternatives.

Moreover, the project presents an opportunity to decrease South Africa's dependence on imported gas and, if exploration is successful, to potentially reduce the nation's reliance on coal for energy production. This holistic approach to resource management underscores the project's broader contribution to national and global sustainability goals.

The proposed project extension will indirectly support the ongoing gas production activities, thereby extending the lifespan of community projects initiated by Tetra4 under their Social and Labour Plan. This alignment with local socio-economic initiatives enhances the project's overall contribution to the region.

1.3 PROJECT DESCRIPTION AND INFRASTRUCTURE

The proposed project area is located near the town Welkom in the Free State Province, South Africa. ER32, located north of the PR, is approximately 7.2 km Northwest of Welkom and the ER94, located to the south of the PR, is approximately 19.2 km South of Virginia. The project area encompasses a total of approximately 205 733 Ha which includes both the PR area (187 000 Ha) and the two ER areas, ER32 and ER94 (collectively 18 733 Ha). Please refer to Figure 3 for a locality map.

Exploration wells will be drilled and, if successful, converted into production wells. Eighteen (18) preliminary borehole locations have been proposed in the two exploration right areas. The drilling of exploration boreholes is a temporary and short-duration activity and the equipment to be used during drilling activities includes the use of a truck, trailer or skid-mounted drill rig (Figure 1) to drill to varying depths (~380 m to ~880 m) along known fault lines in order to strike the gas reserve, as well as other equipment such as an excavator, dozer, grader, water cart, light motor vehicle for transport of personnel and chemical toilets.

Figure 1: Example of a typical drill rig used during exploration drilling.

Drill rigs typically require temporary clearance or disturbance of an area of 50 m x 50 m to set up the rig and begin drilling activities which take approximately 3 to 4 months per well. Immediately after the drilling, testing of the gas volumes and compositions is undertaken which takes approximately 7 to 14 days. All exploration boreholes must be drilled and cased in accordance with applicable international standards and best practice guidelines and will be sealed with a combination of steel casing and grouting (cement) to ensure there is no mixing of gas or deep saline water with the shallower freshwater aquifers (groundwater).

The site is cleared of vegetation and prepared for drilling operations. Topsoil and subsoil are removed and stored separately. Sumps are dug and lined to prevent contamination. A concrete plinth is cast for the drilling rig and allowed to cure for five days. The rig is subsequently aligned to the specified entry angle and direction.

Drilling commences with utilizing an advance casing system (Symmetrix). This method involves inserting a temporary casing following the drilling hammer to prevent unconsolidated material and water ingress into the borehole. This process continues to a depth of approximately 450-500 meters. At this depth, a 168mm ASTM A106 threaded casing is installed and cemented in place. A rigorous pressure test is conducted to ensure the

integrity of the casing and to prevent potential leakage of water or gas into the borehole. A diverter is installed prior to continuing drilling to the end of hole (EoH). In the event of encountering additional water or unstable formations, a 114mm diameter casing would be inserted, cemented, and pressure tested. The final drilling phase to EoH is then initiated.

Upon successful well completion, a gas sample will be obtained and analysed to determine its composition. A flow meter skid will be calibrated according to this composition and subsequently attached to the wellhead. A flare system, operating at an efficiency of 97-99%, will be utilized for gas disposal. An initial two-day flow and flare period will be implemented, during which no venting of gas will occur. Subsequently, a second gas sample will be collected and analysed to refine the gas composition. The flow meter skid will be recalibrated accordingly, and the flow and flare process will continue for an additional five days.

Exploration boreholes that are successful (gas producing) will be turned into production wells by installing a valve within an underground concrete bunker with a manhole surface area of ~1.5 m^2. Unsuccessful exploration wells will be safely decommissioned and rehabilitated (Figure 2).

Figure 2: Example of a wellhead in the process of decommissioning, prior to being cut.

1.4 SPECIALIST STUDIES

Several specialist studies have been commissioned to investigate key issues and impacts, and findings from these studies are included in this report. The specialist study reports are included in Appendix 3. A list of the specialist studies conducted to inform this BA process is included below:

- Soils and Agriculture;
- Heritage and Palaeontology;
- Terrestrial Biodiversity; and

- Wetland and Aquatic.

1.5 IMPACTS IDENTIFIED AND SUMMARY OF IMPACT ASSESSMENT

A list of biophysical and socio-economic impacts (summarised in Table 1 below) that have been identified and assessed during this BA phase as well as the pre-mitigation environmental risk (ER), post mitigation environmental risk and final significance when applying a priority factor is presented in Appendix 6.

Table 1: Impacts Identified and Assessed during the BA.[1]

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
1	Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.	Planning	-3,5	-2,0	-2,0
2	Exploration Wells - Habitat	Planning	-4,0	-2,3	-2,5
3	Exploration Wells - Water Quality	Planning	-4,0	-2,3	-2,3
4	Exploration Wells - Flow	Planning	-3,0	-1,5	-1,5
5	Air Quality - Increase in air quality impacts due to construction of the road	Construction	-10,0	-6,8	-7,6
6	Air Quality - Increase in air quality impacts due to construction of the wells	Construction	-10,0	-6,0	-6,8
7	Noise - Increase in noise levels due to construction of the wells	Construction	-11,0	-7,5	-7,5
8	Groundwater deterioration and siltation due to contaminated stormwater run-off from the construction area.	Construction	-4,0	-1,8	-1,8
9	Poor quality leachate may emanate from the construction camp which may have a negative impact on groundwater quality.	Construction	-7,5	-4,5	-5,6

[1] The ER scoring system and colour coding are described in the table below:

Environmental Risk	Environmental Reward	Description	
<-9	<9	Low	This impact is unlikely to be a significant environmental risk / reward
≥-9≤-17	≥9≤17	Medium	The impact could have a significant environmental risk / reward
>-17	>17	High	The impact will have a significant environmental risk /reward

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
10	Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.	Construction	-9,8	-6,0	-7,5
11	Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.	Construction	-8,3	-4,5	-5,6
12	Hydrology - Loss of watercourse vegetation	Construction	-3,5	-1,5	-1,7
13	Erosion	Construction	-8,0	-3,5	-3,9
14	Stormwater contamination	Construction	-9,0	-3,0	-3,4
15	Alien and/or Invasive Vegetation	Construction	-6,5	-1,8	-2,0
16	Alterations of the river banks and river bed	Construction	-6,8	-3,5	-4,4
17	Impact on unidentified heritage resources	Construction	-3,3	-4,5	-6,2
18	Impact on burial grounds and graves	Construction	-14,0	-5,0	-6,9
19	Impact on historic to recent sites with possible graves	Construction	-9,8	-5,0	-6,3
20	Impact on structures of medium heritage significance	Construction	-8,3	-4,5	-5,6
21	Impact on palaeontology	Construction	-16,0	-6,5	-8,9
22	Impact on livelihoods	Construction	-15,0	-11,3	-14,1
23	Nuisance factor due to increase in ambient dust and noise levels	Construction	-12,5	-10,0	-11,3
24	Damage to farm roads, existing services, and infrastructure	Construction	-16,3	-10,0	-11,3
25	Impacts on livelihoods due to behaviour of contractors	Construction	-11,0	-6,8	-7,6

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
26	Impacts on safety and security of local residents	Construction	-13,0	-11,0	-16,5
27	Impacts on sense and spirit of place	Construction	-15,0	-10,0	-13,8
28	Increase in social pathologies	Construction	-11,0	-10,0	-11,3
29	Impact on Existing Agricultural Landscape Character	Construction	-8,0	-8,0	-9,0
30	Impact on Existing Natural Landscape Character	Construction	-8,0	-3,0	-3,4
31	The visual impact on views from local roads	Construction	-8,0	-5,3	-5,9
32	Change of Natural of Views from Homesteads	Construction	-10,0	-4,5	-5,1
33	The visual impact on views from local homesteads due to Lighting	Construction	-8,0	-1,0	-1,0
34	Destruction, further loss and fragmentation of the vegetation community	Construction	-11,0	-9,0	-11,3
35	Introduction of alien species, especially plants	Construction	-7,5	-6,0	-6,0
36	Erosion due to storm water runoff and wind	Construction	-7,5	-6,8	-7,6
37	Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).	Construction	-8,3	-6,8	-7,6
38	Potential leaks, discharges, pollutant from activities leaching into the surrounding environment	Construction	-9,0	-7,5	-7,5
39	Access Roads - Habitat	Construction	-4,5	-3,0	-3,0
40	Access Roads - Water Quality	Construction	-6,8	-4,0	-4,0

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
41	Access Roads - Flow	Construction	-3,5	-2,0	-2,0
42	Air Quality - Increase in air quality impacts due to the operation of vehicles on unpaved roads	Operation	-9,0	-6,0	-6,8
43	Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.	Operation	-9,8	-6,0	-7,5
44	Leakage of harmful substances from tanks or other equipment may cause groundwater pollution.	Operation	-9,8	-6,0	-7,5
45	Erosion	Operation	-5,0	-2,3	-2,8
46	Stormwater contamination	Operation	-7,5	-3,5	-4,4
47	Alien and/or Invasive Vegetation	Operation	-9,8	-4,0	-5,0
48	Impact on livelihoods	Operation	-17,5	-8,3	-10,3
49	Damage to farm roads, existing services, and infrastructure	Operation	-13,0	-11,0	-13,8
50	Impacts on safety and security of local residents	Operation	-16,3	-12,0	-15,0
51	Impact on Existing Agricultural Landscape Character	Operation	-3,0	-3,0	-3,4
52	Impact on Existing Natural Landscape Character	Operation	-6,0	-2,5	-2,8
53	The visual impact on views from local homesteads due to Lighting	Operation	-9,0	-1,3	-1,3
54	Environmental pollution due to potential leaks, discharges, pollutant leaching into the surrounding environment	Operation	-9,0	-5,0	-5,0

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
55	Introduction of alien species, especially plants	Operation	-7,5	-6,0	-6,0
56	Continued fragmentation, further loss and fragmentation of the vegetation community	Operation	-9,0	-8,3	-10,3
57	Vegetation loss due to erosion and encroachment by alien invasive plant species	Operation	-6,8	-4,5	-5,1
58	Potential leaks, discharges, pollutant from activities leaching into the surrounding environment	Operation	-9,0	-7,5	-7,5
59	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Operation	-11,0	-5,0	-5,6
60	Access Roads - Habitat	Operation	-7,5	-3,5	-3,5
61	Access Roads - Water Quality	Operation	-4,0	-3,0	-3,0
62	Access Roads - Flow	Operation	-4,0	-2,5	-2,5
63	Air Quality - Increase in air quality impacts due to decommissioning and closure	Decommissioning	-11,0	-6,8	-6,8
64	Noise - Increase in noise levels	Decommissioning	-11,0	-7,5	-7,5
65	Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the borehole closure and decommissioning phase.	Decommissioning	-16,0	-9,0	-11,3

#	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final Score
66	Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) borehole closure and decommissioning phase.	Decommissioning	-16,0	-9,0	-11,3
67	Erosion	Decommissioning	-5,5	-2,5	-3,1
68	Alien and/or Invasive Vegetation	Decommissioning	-6,5	-1,8	-2,0
69	Continued encroachment of vegetation community by alien invasive plant species as well as erosion due to disturbed soils	Decommissioning	-7,5	-4,5	-5,6
70	Decommissioning of Wells	Decommissioning	-6,0	-6,0	-6,8
71	Access Roads - Habitat	Decommissioning	-4,5	-3,0	-3,0
72	Access Roads - Water Quality	Decommissioning	-6,0	-4,0	-4,0
73	Access Roads - Flow	Decommissioning	-3,5	-2,0	-2,0

1.6 PUBLIC PARTICIPATION

The public participation process for this application has been undertaken in accordance with the requirements of the NEMA EIA Regulations, and in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project and have their views considered and included as part of project planning.

The PPP commenced on 4th of June 2024 with an initial notification and call to register for a minimum period of 30 days. The initial notification was undertaken in English, Afrikaans and Sesotho and was given in the following manner:

- Registered letters, faxes, emails and sms's: Notification were distributed to all pre-identified I&APs including government organisations, NGOs, relevant municipalities, ward councillors, landowners and other organisations that may be interested or affected.
- Advertisements describing the proposed project and EIA process were published in the Vista Newspaper with circulation in the vicinity of the study area. The initial advertisements were placed in the Vista newspaper in English, Afrikaans and Sesotho on the 30th of May 2024 with a government gazette published (also in 3 languages) on the 14th of June 2024.
- A1 Correx site notices in English, Afrikaans and Sesotho were placed at 80 locations within and around the application area from 26th to the 29th of May 2024.
- A3 posters in English, Afrikaans and Sesotho were placed at local public gathering places.

Subsequent to the call to register notification, the BA report was made available to registered I&APs in the following manner:

- Registered letters with details on where the BA report can be obtained and/or reviewed, public meeting date and time, EIMS contact details as well as the public review comment period;
- Facsimile notifications with information similar to that in the registered letter described above;
- Email notifications with a letter attachment containing the information described above; and/or
- SMS notifications to inform I&APs of the BA Report availability and where additional information could be obtained in order to participate.

All comments and/or queries received to date involve parties requesting additional information on the project and to be registered on the I&APs database to receive future reports and feedback.

1.7 IMPACT STATEMENT

Specialist studies have concluded that the proposed project is environmentally viable, and no significant impacts are anticipated provided that the recommended mitigation and management measures are implemented. However, for the Terrestrial studies it was noted that development proposals situated within designated 'High' sensitivity areas are generally regarded unfavourably and require explicit demonstration of the mitigation hierarchy. For projects located in 'Medium' sensitivity zones, Tetra4 must prioritize impact minimization and restoration measures to the greatest extent practicable. Based on the nature and extent of the proposed project, the limited level of disturbance predicted as a result of the exploration activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the BA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized on condition that the below recommended conditions are included in the decision and that compliance with the EMPr must be strictly adhered to.

2 INTRODUCTION

Tetra4 (Pty) Ltd, hereby referred to as Tetra4, is the operator and holder of existing Exploration Rights (ER) and a Production Right (PR) in Welkom, Free State Province. Tetra4 intends to consolidate the Exploration Rights (ER32 and ER94, including the activities such as drilling of up to 18 wells), within the Production Right. Tetra4 has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) to prepare and submit a Production Right Extension Environmental Authorisation (EA) Application in terms of MPRDA Section 102 application, in terms of the Mineral and Petroleum Resources Development Act (No. 28 of 2002 - MPRDA), as well as in terms of the National Environmental Management Act (Act 107 of 1998 - NEMA) to consolidate ER32 and ER94 (with associated exploration activities) into the Production Right.

The two ERs and PR are situated in the Matjhabeng and Masilonyana Local Municipalities in the Free State Province. The Production Right covers an area of 187 000 ha and the two Exploration Rights, ER32 and ER94, cover a combined area of approximately 18 733.1 ha. The two ERs is comprised of ~80 farm portions situated within the Allanridge, Odendaalsrus and Theunissen districts. These farm portions will be incorporated into the existing PR. The ER32, located north of the PR is approximately 7.2 km Northwest of Welkom and the ER (ER94), located to the south of the PR, is approximately 19.2 km South of Virginia.

A Basic Assessment (BA) application process is being undertaken to accompany the EA application for the MPRDA Section 102 and the relevant EIA Listing Notices (GN R 983) listed activities applicable to the project namely:

- MPRDA Section 102 - A reconnaissance permission, prospecting right, mining right, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right, production right, prospecting work programme, exploration work programme, production work programme, mining work programme environmental management programme or an environmental authorisation issued in terms of the National Environmental Management Act, 1998, as the case may be, may not be amended or varied (including by extension of the area covered by it or by the additional of minerals or a shares or seams, mineralised bodies or strata, which are not at the time the subject thereof) without the written consent of the Minister.
- GN R 983, Listing Notice 1: Activity 21D - Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment.

2.1 REPORT STRUCTURE

Table 2: Report structure as per GN R 982.

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 1: Section 3(1)(a)	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	Section 2.2
Appendix 1: Section 3 (1)(b)	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 3
Appendix 1: Section 3 (1)(c)	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 3
Appendix 1: Section 3(1)(d)	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered and being applied for; and ii. A description of the associated structures and infrastructure related to the development;	Section 4
Appendix 1: Section 3 (1)(e)	A description of the policy and legislative context within which the development is proposed including- i. An identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	Section 5

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	ii. How the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments	
Appendix 1: Section 3 (1)(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 6
Appendix 1: Section 3 (1)(g)	A motivation for the preferred site, activity and technology alternative	Sections 7 and 12.2
Appendix 1: Section 3 (1)(h)	A full description of the process followed to reach the proposed preferred alternative within the site, including: – i. Details of the development footprint alternatives considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. Can be reversed; b. May cause irreplaceable loss or resources; and c. Can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk;	Sections 7, 8, 9, 10 and 12.2

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	ix. The outcome of the site selection matrix; x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and; xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity.	
Appendix 1: Section 31)(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including – i. A description of all environmental issues and risks that were identified during the environmental impact assessment process; and ii. An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Sections 7, 8, 9 and 10
Appendix 1: Section 3 (1)(j)	An assessment of each identified potentially significant impact and risk, including – i. Cumulative impacts; ii. The nature, significance and consequences of the impact and risk; iii. The extent and duration of the impact and risk; iv. The probability of the impact and risk occurring; v. The degree to which the impact and risk can be reversed; vi. The degree to which the impact and risk may cause irreplaceable loss of resources; and vii. The degree to which the impact and risk can be mitigated;	Appendix 6
Appendix 1: Section 3 (1)(k)	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Section 12.1
Appendix 1: Section 3 (1)(l)	An environmental impact statement which contains – i. A summary of the key findings of the environmental impact assessment;	Section 12.3

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	ii. A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicting any areas that should be avoided, including buffers; and iii. A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
Appendix 1: Section 3 (1)(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr;	Section 12.4
Appendix 1: Section 3 (1)(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 12
Appendix 1: Section 3 (1)(o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 13
Appendix 1: Section 3 (1)(p)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 12
Appendix 1: Section 3 (1)(q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	N/A (Operational phase is anticipated post exploration phase)
Appendix 1: Section 3 (1)(r)	An undertaking under oath or affirmation by the EAP in relation to – i. The correctness of the information provided in the reports; ii. The inclusion of comments and inputs from stakeholders and interested and affected parties; iii. The inclusion of inputs and recommendations from the specialist reports where relevant; and iv. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Sections 14 and 15

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 1: Section 3 (1)(t)	*[Para. (t) substituted by GN 326/2017 and deleted by GN 517/2021]*	N/A
Appendix 1: Section 3 (1)(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A - no further matters to those already listed above and included in this report.

2.2 DETAILS OF THE EAP

EIMS has been appointed by Tetra4 as the independent Environmental Assessment Practitioner (EAP) to prepare and submit the EA application, Basic Assessment Report, and undertaking a Public Participation Process (PPP) to accompany the Production Right Extension Application. The contact details of the EIMS consultant and EAP who compiled this Report are as follows:

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- Fax No: +27 86 571 9047
- E-mail address: prextension@eims.co.za

In terms of Regulation 13 of the EIA Regulations, 2014, as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting BA's and EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 30 years' experience in conducting EIA's. Please refer to the EIMS website (www.eims.co.za) for further details of expertise and experience.

Mr Sikhumbuzo Mahlangu holds a BSc. Master's degree in Zoology (Aquatic Health) from the University of Johannesburg. He is an aquatic and research scientist with over 2 years' experience, and over 13 years' experience as an environmental scientist. He is a registered professional EAP with the Environmental Assessment Practitioners Association of South Africa - EAPASA (2022/4496) and a professional Natural Scientist with the South African Council for Natural Scientific Professions - SACNASP (400447/13). He has completed certificate courses in Environmental Management Systems (ISO 14001: 2015) and Environmental Law with the North-West University. He has also completed an advanced course on Tools for Wetland Assessments as well as Aquifer Hydraulics and Groundwater Monitoring. His expertise lies mainly in environmental impact assessments, environmental management, auditing, monitoring, surface and ground water quality assessments, biomonitoring, wetland assessments, reporting and project management.

Mr Mahlangu has been assisted in the compilation of this report and the process by Ms Jessica Jordaan. Ms. Jordaan is an environmental consultant at EIMS and has been involved in numerous environmental audits, prospecting rights and development projects. She holds a BSc degree in Geology and a BSc Honours degree in Environmental Soil and Soil Science. The main undertaking is Environmental Impact Assessments, Basic Assessments, Environmental Audits, Water Use License Applications and Financial Provisioning. Ms Jordaan is a registered Candidate Natural Scientist (124758) with the South African Council of Natural and Scientific Professions (SACNASP), as well as a registered Candidate Environmental Assessment Practitioner (2023/7087) with the Environmental Assessment Practitioners Association of South Africa (EAPASA). She is a registered ISO 14001:2015 Lead Auditor with the Chartered Quality Institute (CQI) and a member of the International Register of Certified Auditors (IRCA). The Curriculum Vitae of the relevant EAPs can be found in Appendix 1.

2.3 SPECIALIST CONSULTANTS

Specialist studies have been undertaken to address the key impacts that require further investigation. Table 3 gives an overview of the specialists studies undertaken as part of this assessment.

Table 3: Overview of the specialist consultants and assessments (Appendix 3).

Assessment Report	Environmental Sensitivity Themes	Specialist
The Aquatic Biodiversity Compliance Statement	- Aquatic biodiversity.	The Biodiversity Company (Pty) Ltd
Soil and Agricultural Compliance Statement	- Agricultural.	The Biodiversity Company (Pty) Ltd
Terrestrial Biodiversity Assessment	- Animal species; - Plant species; and - Terrestrial Biodiversity.	The Biodiversity Company (Pty) Ltd
Archaeological and Cultural Heritage Assessment Report	- Archaeology; and - Heritage.	PGS (Pty) Ltd
Palaeontology Assessment Report	- Palaeontology.	Banzai Environmental (Pty) Ltd

Specialist studies were undertaken to gather data necessary for identifying and evaluating potential environmental impacts associated with the proposed project. These studies employed a pre-defined impact rating methodology, as detailed in Section 10.1. The methodology establishes a consistent framework for assessing the severity, extent, duration, and probability of potential impacts.

Mitigation measures are presented in this Basic Assessment (BA) Report to minimize any potential negative environmental consequences and maximize potential benefits. The specialist reports that informed this BA Report are included in Appendix 3 for reference.

3 DESCRIPTION OF THE PROJECT AREA

Table 4 provides a summary of the proposed project area. This includes the specific location of the project and its proximity to nearby towns.

Table 4: Project area and locality description.

Item	Description
Project Area	The proposed project area is located near the town Welkom in the Free State Province, South Africa. ER32, located north of the PR, is approximately 7.2 km Northwest of Welkom and the ER94, located to the south of the Production Right, is approximately 19.2 km South of Virginia.
Application Area	The project area encompasses a total of 205 733 Ha which includes both the PR area (187 000 Ha) and the two ER areas, ER32 and ER94 (collectively 18 733 Ha).
Magisterial Sub Districts	- Allanridge Sub District - Welkom Main Seat

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td></td><td>- Masilonyana Sub District
- Virginia Sub District
- Tswelopele Sub District
- Odendaalsrus Sub District</td></tr>
<tr><td>District Municipality</td><td>Lejweleputswa District Municipality</td></tr>
<tr><td>Local municipalities</td><td>- Matjhabeng Local Municipality
- Masilonyana local Municipality</td></tr>
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<tr><td>Le Souvenir 1548 Portion 1</td><td>F04200000000154800001</td></tr>
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<tr><td>Smaldeel 262 Portion 15</td><td>F03300000000026200015</td></tr>
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<tr><td>Gangers Cottage 345 Portion 0</td><td>F03300000000034500000</td></tr>
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Item	Description	
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	Damplaats 361 Portion 2	F02400000000036100002
	Kromdraai 386 Portion 0	F02400000000038600000
	Kromdraai 386 Portion 1	F02400000000038600001
	Dreyerskuil 420 Portion 0	F02400000000042000000
	Dreyerskuil 420 Portion 1	F02400000000042000001
	Allanridge 425 Portion 0	F02400000000042500000
	Allanridge 425 Portion 8	F02400000000042500008
	Allanridge 425 Portion 15	F02400000000042500015
	Allanridge 425 Portion 16	F02400000000042500016
	Allanridge 425 Portion 4	F02400000000042500004
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	Allanridge 425 Portion 9	F02400000000042500009
	Zuurbron 444 Portion 0	F02400000000044400000
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	Le Roex's Pan 455 Portion 0	F02400000000045500000
	Wesselsrust 58 Portion 1	F02400000000005800001
	Leclusa 70 Portion 0	F02400000000007000000
	Swartpan 436 Portion 0	F02400000000043600000
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	Diamant 37 Portion 0	F02400000000003700000
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	Dolly 404 Portion 0	F02400000000040400000
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	Thelma 104 Portion 0	F02400000000010400000
	Utopia 108 Portion 0	F03900000000010800000
	Eva 127 Portion 3	F02400000000012700003
	De Hoop 136 Portion 0	F03900000000013600000
	Hestersrust 29 Portion 1	F03900000000002900001
	Hestersrust 29 Portion 3	F03900000000002900003
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	Arrarat 56 Portion 0	F03900000000005600000
	Heldenmut 117 Portion 0	F02400000000011700000
	De Erf 140 Portion 0	F02400000000014000000
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	Grootkop 277 Portion 10	F03900000000027700010

Item	Description	
	Grootkop 277 Portion 7	F03900000000027700007
	Grootkop 277 Portion 9	F02400000000027700009

The consolidation of the two Exploration Rights, ER32 and ER94, with the existing Production Right will incorporate ~80 farm portions which are located within the Allanridge, Odendaalsrus, and Theunissen districts. The locality map of the proposed project area is shown in Figure 3, and the individual locality maps for ER32 and ER94 are shown in Figure 4 and Figure 5 respectively. The locality maps display the location of ER32, ER94 the proposed exploration borehole locations, and the existing Production Right area, in relation to the nearest towns.

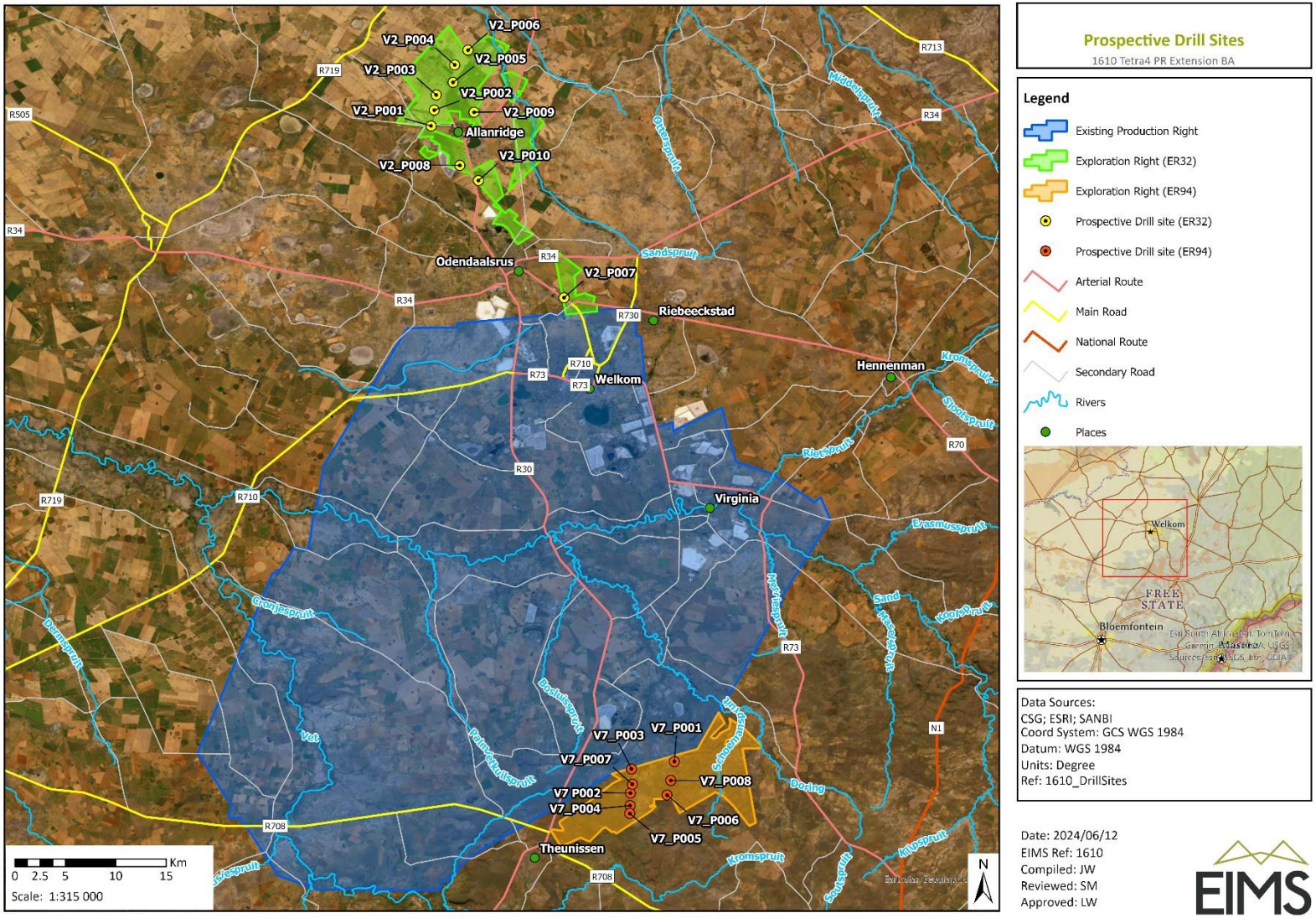

Figure 3: Locality map of the project area.

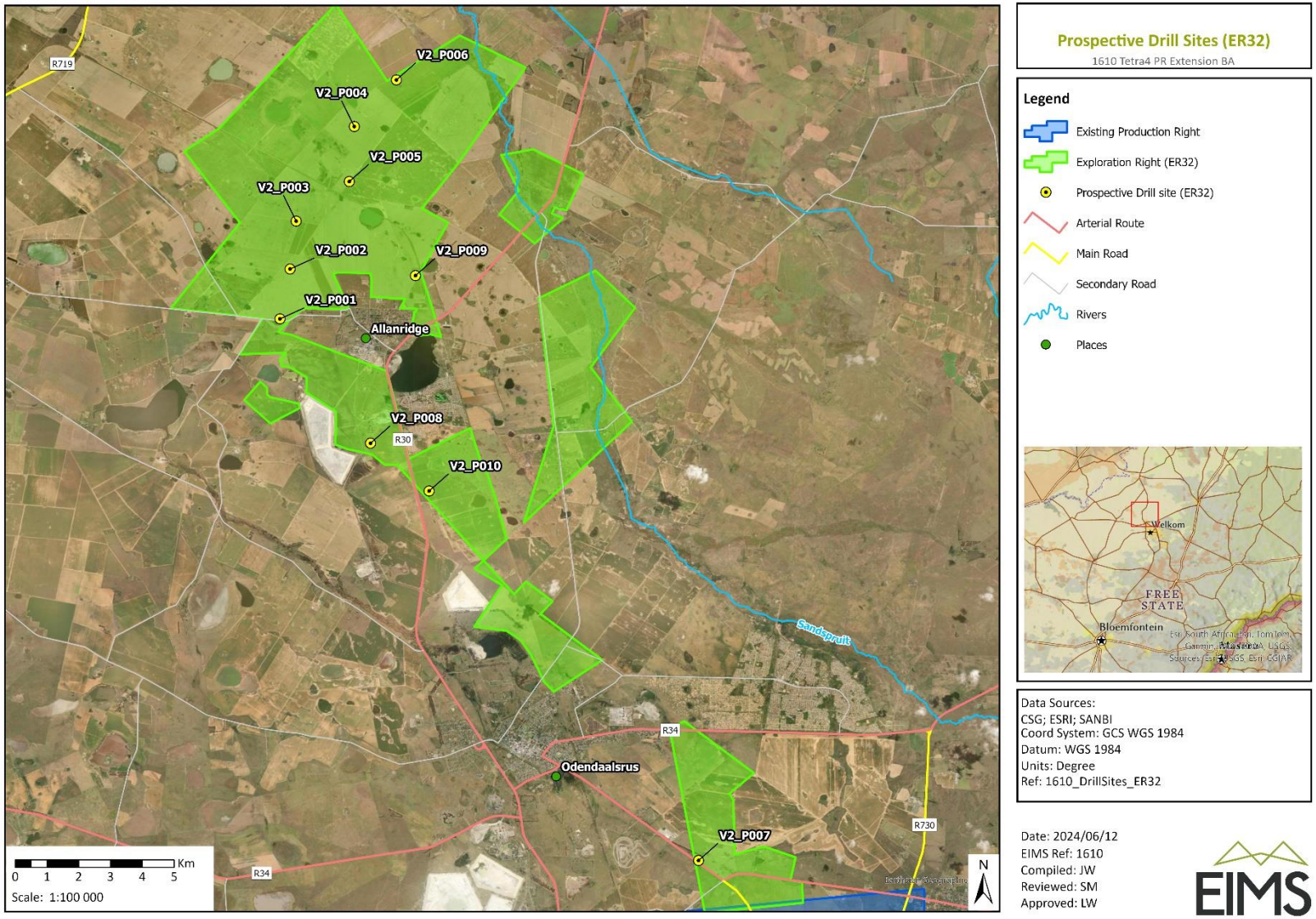

Figure 4: Locality map of ER32.

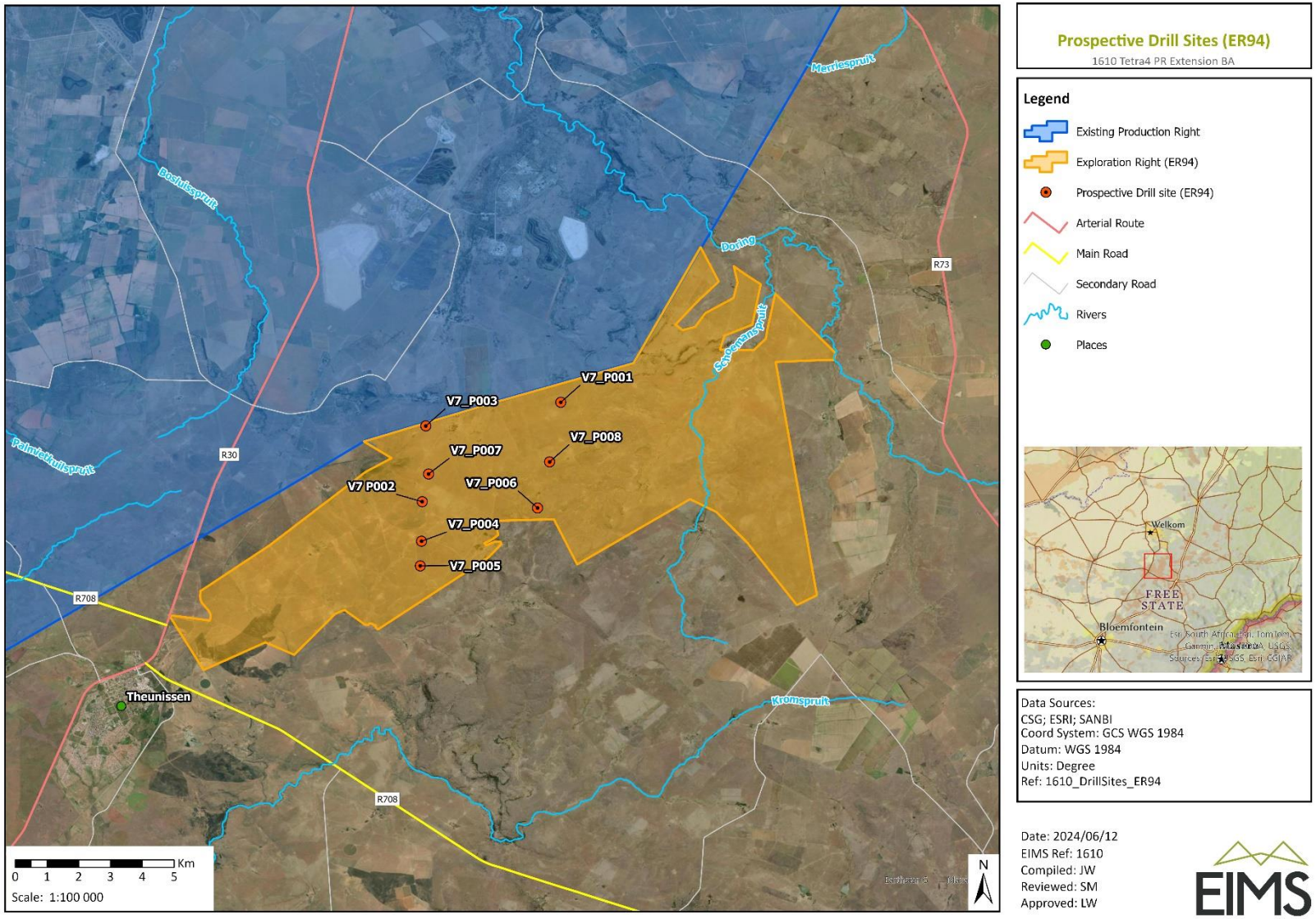

Figure 5: Locality map of ER94.

4 DESCRIPTION AND SCOPE OF THE PROPOSED ACTIVITY

The main undertaking of the project is to extend the PR by consolidating the two existing ERs, ER32 and ER94, thereby amending the current PR. This amendment triggers Activity 21D, Listing Notice 1 (NEMA GN R 983), and as per Section 102 of the MPRDA, an EA is required in terms of the NEMA. This amendment also includes the proposed activity; exploration drilling of 18 proposed boreholes.

The PR extends across Welkom as can be seen in Figure 3 (Blue area), the amalgamation of ER32 and ER94 with the PR will expand the PR's area from 187,000 to 205,733.1 hectares. This consolidation will incorporate 80 farm portions within the Allanridge, Odendaalsrus and Theunissen regions.

Currently there is no definite time frame or commencement date for the proposed exploration drilling, however the current PR Environmental Management Plan (EMP) states that I&APs be informed once a time frame and date of commencement has been established for exploration drilling. In the event that the exploration activity starts the activity will typically require clearing a 50m x 50m area to accommodate the drilling rig, associated equipment laydown areas, power supply, namely a generator, and lined sumps for water storage and recirculation during drilling, Figure 6 provides an example of the proposed drill site layout.

Additional infrastructure within the drill pad will also include portable ablutions, site offices, parking bays and a water tank. Municipal water sources will be used, with a requirement of approximately 75 000 to 150 000 litres per borehole. The drill site operations will utilize diesel-powered generators for electricity generation. The average weekly fuel consumption for these generators is estimated to be 3,000 litres per drilling operation.

The drilling process itself is temporary, utilizing truck-mounted or skid-mounted equipment such as a diamond drill rig (Figure 7), excavator, dozer, grader, water cart, and light vehicles for personnel transport. All exploration boreholes must be drilled and cased in accordance with applicable international standards and best practice guidelines[2]. In addition to the drill rig, lined sumps will be required to store and recirculate water for the drilling process. A maximum of 6000 litres of water per day per well is required for drilling purposes and will be sourced from the municipality and not from the surrounding environment.

Exploration drilling entails the use of a truck, trailer or skid mounted drill rig to drill to varying depths (approximately 380 m to 880 m) along known fault lines to strike the gas reserve. Although uncommon, blowout or blowback of water and/or gas is prevented using a blowout diverter which is installed in the drill line (on surface) and the blowout diverter valves safely redirect any water and/or gas to a discharge line for safe disposal. In addition, firefighting equipment and personnel are present during the drilling operation.

The site is first cleared of vegetation and prepared for drilling operations. Topsoil and subsoil are removed and stored separately. Sumps are dug and lined to prevent contamination. A concrete plinth is cast for the drilling rig and allowed to cure for five days. The rig is subsequently aligned to the specified entry angle and direction.

Drilling commences with utilizing an advance casing system (Symmetrix). This method involves inserting a temporary casing following the drilling hammer to prevent unconsolidated material and water ingress into the borehole. This process continues to a depth of approximately 450-500 meters. At this depth, a 168mm ASTM A106 threaded casing is installed and cemented in place. A rigorous pressure test is conducted to ensure the integrity of the casing and to prevent potential leakage of water or gas into the borehole. A diverter is installed prior to continuing drilling to the end of hole (EoH). In the event of encountering additional water or unstable formations, a 114mm diameter casing would be inserted, cemented, and pressure tested. The final drilling phase to EoH is then initiated.

Upon successful well completion, a gas sample will be obtained and analysed to determine its composition. A flow meter skid will be calibrated according to this composition and subsequently attached to the wellhead. A flare system, operating at an efficiency of 97-99%, will be utilized for gas disposal. An initial two-day flow and flare period will be implemented, during which no venting of gas will occur. Subsequently, a second gas sample

[2] Internationally accepted best practice should be applied and reference should be made to the relevant British Oil and Gas and/or the API guidelines and standards.

will be collected and analysed to refine the gas composition. The flow meter skid will be recalibrated accordingly, and the flow and flare process will continue for an additional five days.

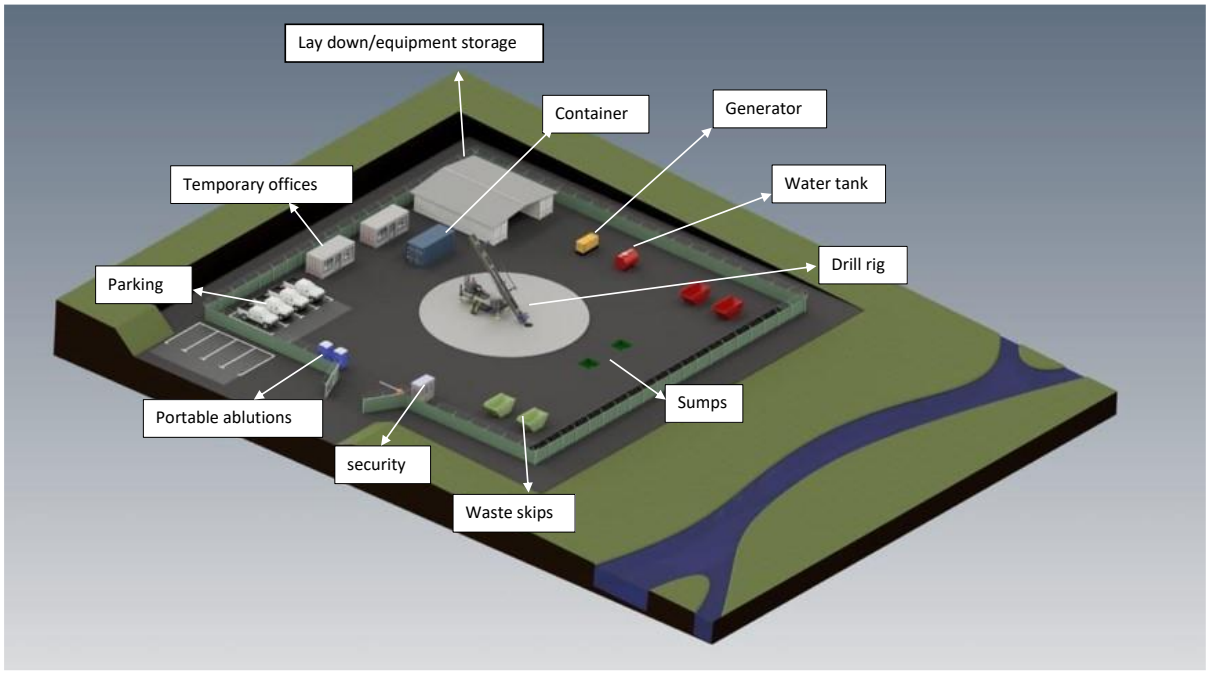

Figure 6: Drill site layout[3].

Figure 7: Example of a typical drill rig used during exploration drilling.

[3] The container and temporary offices are allocated to one drill site and shared by all drill sites, minimizing the overall footprint of disturbance, therefore the site layout provided is the maximum footprint of disturbance for one drill site.

During the exploration drilling campaign, gas composition, geology etc is assessed at each exploration well and this data is continually reassessed (modelled) to guide the future exploration campaign (i.e. location of future exploration wells). Only when viable gas reserves are found at a particular exploration well, can the exploration wells be converted into production wells. A separate application for EA will be needed to connect production well, via gas gathering pipelines to the production network.

Stringent safety measures are implemented throughout the drilling program. All boreholes are drilled and cased in strict accordance with applicable international standards and best practices[4]. If an exploration borehole proves unsuccessful (i.e. no viable gas flow), the well will be concrete sealed and cased to prevent any potential interaction between the gas or deep saline water with the shallower freshwater aquifers. Unsuccessful wells will have the wellheads cut at least 1 m below the surface and the surrounding and impacted area will be rehabilitated to the conditions prior to drilling. This will ensure existing land-use to continue unobstructed. Exploration drilling is a temporary activity with minimal long-term impact. Figure 8 and Figure 9 shows an example of one of Tetra4's wellheads in the process of being decommissioned, with the area rehabilitated to its original condition.

Figure 8: Example of a wellhead in the process of decommissioning, prior to being cut.

[4] Internationally accepted best practice should be applied and reference should be made to the relevant British Oil and Gas and/or the API guidelines and standards.

Figure 9: Rehabilitated area of a drill site in the process of decommissioning.

4.1 SITE ACCESS CONTROL

Access to the individual well sites will be controlled through a single entrance and exit point at each site. Well sites will be accessed via existing access roads (as far as possible). All visitors to the site will be required to sign in at the security check point located at the Plant. All employees will be required to retain proof of identification whilst on site and all vehicles will be branded for identification purposes.

The following specific conditions have been put forward for inclusion in the decision to address access control and safety while the EMPr contains additional conditions in this regard:

- Farm safety must be a priority and the landowners and Tetra4 must agree on security measures prior to construction on their farms.
- Tetra4 must consult with landowners about any new work or potential changes that may take place on their properties.
- Protocols on farm access, compensation, communication, and road maintenance must be agreed upon and be in place before exploration commences. The affected landowners must have input in the development of these protocols.
- A grievance mechanism and claims procedure must be in place and shared with all the stakeholders before the exploration commences.
- Tetra4 must share the works schedule per property prior to commencement of any activity onsite. This communication will include details of the respective contractors that are appointed, provide the affected landowners with a project schedule for their respective properties and any changes to the

schedule must be formally communicated in writing to the affected landowners prior to implementing such changes.

4.2 ROADS

Exploration and production wells will be accessed via existing access roads where possible. Some existing gravel roads may require temporary widening or reinforcement for larger construction vehicles such as drill rigs. Where there is no existing access to exploration wells, temporary gravel access will be constructed and if required, a suitable surface reinforcing will be temporarily installed to prevent damage to the environment (e.g. stone compacted layer). Any temporary access roads will be rehabilitated following completion of the construction activities requiring those temporary roads. The following serves as a guideline to how private access roads will be documented and maintained:

- Prior to the commencement of the exploration period, both the landowner and a representative of Tetra4 will take video footage and/or photographs of the road condition of the access roads.
- After the exploration period for each borehole, an access road inspection by both the landowner and Tetra4 will be undertaken. Tetra4 will be obliged to rehabilitate and/or reconstruct the access roads in the same condition as reflected in the initial photographs and/or video footage at its costs.
- In the case a landowner wishes to retain an access road developed for the purpose of accessing exploration drilling area, a written agreement is to be produced between the landowner and Tetra4.

4.3 WATER MANAGEMENT

As mentioned previously in this section, water for construction of the drilling sites, exploration drilling, drinking and domestic purposes will be sourced from existing municipal supply which is stored in tanks on-site.

4.3.1 WASTE WATER

Wastewater from the exploration activities will consist of water used during the drilling and sanitation from domestic activities. The amount of wastewater to be produced will approximately be 3,000 litres. The wastewater encountered will be disposed of as per the legislative requirements which includes disposal by a licensed contractor at a suitably registered waste disposal facility.

Exploration activities frequently necessitate land disturbance, which can elevate the risk of soil erosion and water pollution. A Storm Water Management Plan (SWMP) for the exploration area will be developed which will ensure separation of clean and dirty water. Clean water will be diverted back into the environment in a controlled manner to prevent scouring, sedimentation or erosion from forming, while dirty water will be collected and stored within an evaporation pond / Sumps for disposal. A stormwater plan, in conjuncture with the specialists' recommendations, should aim to:

- Implement effective stormwater management strategies, including control berms, mitre dams, and silt traps, to regulate runoff from the construction site.
- Minimize erosion and preserve the natural ecology of the site to the greatest extent possible.
- Maintain unimpeded construction operations while safeguarding human and animal health from stormwater runoff hazards.
- Clearly demarcate construction zones and prevent contaminated stormwater from entering pristine environments

Key elements to be included in the SWMP are listed in Figure 6 below.

Table 5: Key elements of a Stormwater Management Plan.

Element	Description
Site Assessment and Inventory	This initial step involves identifying potential sources of stormwater pollution associated with exploration activities. Examples include: • Exposed soils • Stockpiles of soil or waste materials • Equipment operation The plan should also evaluate existing drainage patterns on the site and how they might be altered by exploration activities. Additionally, any sensitive environmental features, such as wetlands or waterways, should be identified to inform the stormwater management strategy.
Best Management Practices (BMPs)	Once potential pollution sources and drainage patterns are understood, the plan should outline specific Best Management Practices (BMPs) to control erosion and sedimentation. These practices can include: • Silt fences; • Sediment traps; • Diverting clean water away from disturbed area; and • Stabilizing exposed soils after exploration activities. The selection of appropriate BMPs will depend on the specific characteristics of the exploration site and the surrounding environment.
Spill Prevention and Control	Exploration activities may involve the use of hazardous materials, such as fuels, lubricants, and drilling fluids. The stormwater management plan should incorporate a spill prevention and control plan to minimize the risk of spills and to ensure a prompt and effective response if a spill does occur. Key components include: • Developing procedures for storing hazardous materials properly and in designated containment areas; and • Training personnel on spill prevention and response measures
Monitoring and Maintenance	Regular inspection and maintenance of stormwater management facilities and the SWMP are crucial to ensure their effectiveness in controlling stormwater runoff and preventing pollution. The stormwater management plan should establish a monitoring schedule and procedures for inspecting BMPs, as well as a process for making necessary repairs or adjustments. Additionally, the plan should incorporate procedures for monitoring stormwater quality throughout the exploration project. This monitoring data can be used to assess the effectiveness of the BMPs and to identify any areas where the plan needs to be adapted.
Reporting	The stormwater management plan should include procedures for documenting and reporting on its implementation. Reports should typically include details of the BMPs employed, monitoring activities conducted, and any corrective actions taken. These reports are essential for demonstrating compliance with regulatory requirements and for ensuring that the plan is being implemented effectively.

4.3.2 WASTE MANAGEMENT

The design philosophies for waste management are based on applicable legislation, in particular NEMWA, DWAF (DWS) best practice guidelines, and currently accepted good industry practice for waste management. Principles of waste minimisation at source, segregation for reuse, recycling and treatment or disposal will be applied to

the handling of waste, wherever possible. The waste (general and hazardous) generated during construction and operations will be addressed as detailed below.

4.3.2.1 GENERAL WASTE

The following types of general waste, produced mainly during construction and exploration drilling (operation), with minimal amounts post construction, will be generated by the proposed exploration activities:

- Domestic solid waste;
- Scrap metal; and
- Construction waste.

The exploration activities will utilise a temporary general waste storage facility and all waste will be collected by an approved, licenced waste contractor for removal and final disposal at a registered general waste disposal facility. No new landfills will be directly established by the project within the project boundaries.

4.3.2.2 HAZARDOUS WASTE

Hazardous waste, including but not limited to hydrocarbon containing waste (used oil and filters, diesel, lubricants, and grease) will be stored in clearly marked skip bins (solids) and containers (liquids). These skip bins/ containers will be placed in an isolated area on a hard, impervious surface. When full, the bins/ containers will be collected by a contractor for safe disposal or recycling companies which will be appointed to collect waste. A waste disposal certificate will be required from the contractor to ensure safe disposal.

Drilling waste will consist of wastewater and drilling mud. This waste will be stored in lined sumps or containers adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licenced waste disposal facility.

Other liquid waste such as sewage and domestic wastewater will be generated and will be collected by a contractor for safe disposal or recycling companies which will be appointed to collect waste. A waste disposal certificate will be required from the contractor to ensure safe disposal.

5 POLICY AND LEGISLATIVE CONTEXT

The primary legal requirement for this project is the acquisition of an EA from the competent authority. The Department of Mineral and Petroleum Resources (DMPR) (Previously known as Department of Mineral Resources and Energy - DMRE) serves as the competent authority. The granting of the EA will be guided by the requirements of both the National Environmental Management Act (NEMA) and the Minerals and Petroleum Resources Development Act (MPRDA).

Beyond the primary requirement for an EA, a comprehensive assessment of potentially applicable legislation is crucial. This assessment encompasses a broad range of acts, regulations, standards, guidelines, and treaties at the international, national, provincial, and local levels. Subsequent sections will delve into the key pieces of legislation relevant to the proposed project.

5.1 CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: "*Everyone has the right –*

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

i. prevent pollution and ecological degradation;

ii. promote conservation; and

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development"

The BA and associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights.

5.2 THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (MPRDA)

The MPRDA aims to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources. The MPRDA outlines the procedural requirements that need to be met to acquire mineral and petroleum rights in South Africa. Several amendments have been made to the MPRDA. These include, but are not limited to:

- The amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration;

  (1) A reconnaissance permission, prospecting right, mining right, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right, production right, prospecting work programme, exploration work programme, production work programme, mining work programme environmental management programme or an environmental authorisation issued in terms of the National Environmental Management Act, 1998, as the case may be, may not be amended or varied (including by extension of the area covered by it or by the additional of minerals or a shares or seams, mineralised bodies or strata, which are not at the time the subject thereof) without the written consent of the Minister.

- The amendment of Section 5A, specifying that mineral or petroleum exploration and extraction activities require environmental authorization, relevant permits, and landowner notification;

No person may prospect for or remove, mine, conduct technical co-operation operations, reconnaissance operations, explore for and produce any mineral or petroleum or commence with any work incidental thereto on any area without-

(a) An environmental authorisation;

(b) a reconnaissance permission, prospecting right, permission to remove, mining right, mining permit, retention permit, technical co-operation permit, reconnaissance permit, exploration right or production right, as the case may be; and

(c) giving the landowner or lawful occupier of the land in question at least 21 days written notice.

5.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the BA process, as well as conduct the public participation process towards an application for EA. In South Africa, Environmental Impact Assessments (EIA) became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006, the Minister of Environmental Affairs and Tourism (now Department of Environment, Forestry and Fisheries – DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended in June 2010 and again in December 2014 as well as April 2017. The NEMA EIA Regulations, 2014, as amended, are applicable to this project. Exploration activities officially became governable under the NEMA EIA Regulations in December 2014 with the competent authority identified as the DMPR.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that are triggered by the proposed project. The

purpose of these procedures is to provide the competent authority with adequate information to make informed decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R 982) pertaining to the required process for conducting BAs and EIAs in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity.

In terms of these regulations a Basic Assessment process is required for the proposed project. Table 6 below identifies the listed activities the proposed project triggers and consequently requires authorisation prior to commencement.

Table 6: NEMA listed activities to be authorised.

Activity	Activity Description	Applicability
Listing Notice 1 GN R 983		
21D	Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment.	Production Right Extension in terms of MPRDA Section 102 application to consolidate ER32 and ER94 (with associated exploration activities) into the Production Right.
The following activities are included in the Activity 21D of LN1, GN R 983, however have been specified for the purpose of this report		
24	The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	Approximately 4.5 km of access roads may be required to service the various project infrastructure (~18 wells, including drill pads) although these roads will not be wider than ~2 m and many will only be 2-spoor tracks.
27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The drilling sites will be ~0.25 ha each and the cumulative clearance for the drilling site wells will be ~4.5 ha.
28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game	The proposed drilling sites are on land-used for agricultural

	farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	activities (grazing) and cumulatively covers an area greater than 1 hectare (outside urban area).
56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	Existing roads may require lengthening by more than 1km however this is dependent on the location of the exploration wells.
67	Phased activities for all activities- (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; excluding the following activities listed in this Notice- 17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21; 24(i); 29; 30; 31; 32; 34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55;	The Exploration Rights areas ER32 and ER94 may on their own not trigger a listed activity but when consolidated with the Production rights area, exceed the threshold for clearance of vegetation.

	61; 64; and 65; or (ii) listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	
Listing Notice 3 GN R 985		
4	The development of a road wider than 4 metres with a reserve less than 13,5 metres.	Approximately 4.5 km of access roads may be required to service the various project infrastructure (~18 wells, including drill pads) although these roads will not be wider than ~2 m and many will only be 2-spoor tracks.
12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.	Sections of the project footprint, such as the proposed drilling sites, fall within areas containing indigenous vegetation, listed in Section 9.10.2 and watercourses where more than 300 m^2 will be cleared of vegetation. According to the DFFE Screening tool the majority of the ER32 and ER94 areas fall within Critical Biodiversity Area, the listed indigenous vegetation can be found in Section 9.10.2. The construction of the exploration drill pads includes site clearance, i.e. 2500 square metres area of vegetation will be cleared.
18	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.	Existing roads may require lengthening by more than 1 km however this is dependent on the location of the exploration wells and existing access roads.

5.4 THE NATIONAL WATER ACT (NWA)

The National Water Act, 1998 (Act 36 of 1998 – NWA) makes provision for two types of applications for water use licences, namely individual applications and compulsory applications. The NWA also provides that the responsible authority may require an assessment by the applicant of the likely effect of the proposed licence on the resource quality, and that such assessment be subject to the NEMA EIA Regulations. A person may use water if the use is –

- Permissible as a continuation of an existing lawful water use (ELWU);
- Permissible in terms of a general authorisation (GA);
- Permissible under Schedule 1; or
- Authorised by a licence.

The NWA defines 11 water uses in Section 21 of the Act. A water use may only be undertaken if authorised by the Department of Water and Sanitation (DWS). The water uses for which an authorisation or licence can be issued include:

a) Taking water from a water resource;

b) Storing water; Impeding or diverting the flow of water in a watercourse;

c) Engaging in a stream flow reduction activity contemplated in section 36;

d) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduits';

e) Disposing of waste in a manner which may detrimentally impact on a water resource;

f) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

g) Altering the bed, banks, course or characteristics of a watercourse;

h) Removing discharging, or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

i) Using water for recreational purposes.

The proposed Production Right Extension Project includes activities which might have an impact on water resources in certain areas. The main water use that will be applicable is the Section 21 (c&i) uses for activities within proximity (or within) the regulated area of a watercourse. A watercourse is defined in terms of the Act as follows:

a) a river or spring;

b) a natural channel in which water flows regularly or intermittently;

c) a wetland, lake or dam into which, or from which, water flows; and

d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The regulated area of a watercourse for section 21(c) or (i) of the Act water uses is similarly defined in terms of the Act as follows:

a) The outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;

b) In the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or

c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

As part of this BA process, specialist input was obtained to delineate the watercourses as well as the 1 in 100-year floodlines and based on this input,

5.4.1 CATCHMENT MANAGEMENT STRATEGIES

South Africa is divided into nineteen Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level is achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA progressively develops a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA. This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a WMA is the Catchment Management Strategy (CMS) which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources. According to the DHSWS water management areas delineations, the Production Rights Extension Project is situated in primary catchment (C) of the Vaal River drainage system which covers a total area of approximately 246 674.5 km2. The resource management falls under the Vaal Water Management Area (WMA5) which spans portions of the North West Province, northern Free State as well northern sections of the Northern Cape. The application area is situated within quaternary catchments C25B (nett surface area of 1891.0 km^2), C41G (nett surface area of 272 km^2), and C42K (nett surface area of 669 km^2).

5.5 THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (NEMWA)

On 2 June 2014, the National Environmental Management: Waste Amendment Act came into force. Waste is accordingly no longer governed by the MPRDA but is subject to all the provisions of the National Environmental Management: Waste Act, 2008 (NEMWA).

Section 16 of the NEMWA must also be considered which states as follows:

1. A holder of waste must, within the holder's power, take all reasonable measures to-

    a) "*Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;*

    b) Reduce, re-use, recycle and recover waste;

    c) Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

    d) Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;

    e) Prevent any employee or any person under his or her supervision from contravening the Act; and

    f) *Prevent the waste from being used for unauthorised purposes.*"

These general principles of responsible waste management have been incorporated into the requirements in the EMPr to be implemented for this project. In order to attempt to understand the implications of these waste groups, it is important to ensure that the definitions of all the relevant terminologies are defined:

- Hazardous waste: means "*any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles*."

- Residue deposits: means "*any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right*."
- Residue stockpile: means "*any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act*."
- General waste: means "*waste that does not pose an immediate hazard or threat to health or to the environment and includes – domestic waste; building and demolition waste; business waste; inert waste; or any waste classified as non-hazardous waste in terms of the regulations made under Section 69*."

Furthermore, the NEMWA provides for specific waste management measures to be implemented, as well as providing for the licensing and control of waste management activities. The Production Extension Project with the associated activities triggers waste management activities in terms of Category A as well as Category B of GN 921, the latter of which states that "*a person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct an environmental impact assessment process, as stipulated in the environmental impact assessment regulations made under section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as part of a waste management licence application*."

The listed waste activities that are triggered by the project, and which form the basis of this integrated waste management licence application, are presented in Table 7).

Table 7: List of Triggered Activities.

Activity No.	Activity Description	Applicability
NEMWA Category A1	The storage of general waste in lagoons.	Drilling waste (drill mud) will be stored in lagoons at each of the exploration drill sites. Although previous samples of drill mud were classified as hazardous waste, there remains the possibility that certain exploration wells will be drilled through rock strata that does not result in a hazardous classification. Therefor this activity is applied for.
NEMWA Category A6	The treatment of general waste using any form of treatment at a facility that has the capacity to process in excess of 10 tons but less than 100 tons per day calculated as a monthly average, excluding the treatment of organic waste using composting and any other organic waste treatment.	Drilling waste (drill mud) will be stored in lagoons and the liquid fraction (water) removed from the solid fraction (drill cuttings or mud) which constitutes "treatment". Although previous samples of drill mud were classified as hazardous waste, there remains the possibility that certain exploration wells will be drilled through rock strata that does not result in a hazardous classification. Therefor, this activity is applied for.

NEMWA Category A7	The treatment of hazardous waste using any form of treatment at a facility that has the capacity to process in excess of 500kg but less than 1 ton per day calculated as a monthly average, excluding the treatment of effluent, wastewater, sewage or organic waste using composting or any other organic waste treatment.	Drilling waste (drill mud) will be stored in lagoons and the liquid fraction (water) removed from the solid fraction (drill cuttings or mud) which constitutes "treatment". Previous samples of drill cuttings (drill mud) were classified as hazardous and therefore it can be expected that this may represent a similar situation for the new exploration wells (albeit this may not apply in all exploration wells).
NEMWA Category A12	The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity).	The construction of lagoons for the storage of drilling muds.
NEMWA Category A14	The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.	On completion of exploration drilling at each drill site, the lagoons will be decommissioned and rehabilitated.
NEMWA Category B1	The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.	Drilling mud will be stored in lagoons at each exploration well and this drill waste falls within the hazardous class of wastes due to the chemical properties of the underlying rock strata.
NEMWA Category B10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The construction of lagoons for the storage of drilling muds.
NEMWA Category B11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	Drilling mud is classified as a residue deposit or residue stockpile in terms of the NEMWA. This activity will therefore be triggered.
NEMWA Category C1	The storage of general waste at a facility that has the capacity to store in excess of 100m3 of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste.	During construction, general waste will be stored by various contractors in the laydown area/camp and will store more than 100 m3 when combined. *Note: This NEMWA trigger does not require a waste management*

		licence but rather requires registration and compliance with the Norms and Standards.
NEMWA Category C2	The storage of hazardous waste at a facility that has the capacity to store in excess of 80m3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.	During construction, hazardous waste will be stored by various contractors in the laydown area/camp and will store more than 80 m3 when combined. *Note: This NEMWA trigger does not require a waste management licence but rather requires registration and compliance with the Norms and Standards.*

The Waste Classification and Management Regulations (GN R 634) pertain to waste classification and management, including the management and control of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation which is relevant to the proposed project. The purpose of these Regulations is to –

- Regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;
- Establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence;
- Prescribe requirements for the disposal of waste to landfill;
- Prescribe requirements and timeframes for the management of certain wastes; and
- Prescribe general duties of waste generators, transporters and managers.

Waste classification, as presented in Chapter 4 of these regulations, entails the following:

- Wastes listed in Annexure 1 of these Regulations do not require classification in terms of SANS 10234;
- Subject to sub regulation (1), all waste generators must ensure that the waste they generate is classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation;
- Waste must be kept separate for the purposes of classification in terms of sub regulation (2), and must not be mixed prior to classification;
- Waste-must be re-classified in terms of sub regulation (2) every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors;
- Waste that has been subjected to any form of treatment must be re-classified in terms of sub regulation (2), including any waste from the treatment process; and
- If the Minister reasonably believes that a waste has not been classified correctly in terms of sub regulation (2), he or she may require the waste generator to have the classification peer reviewed to confirm the classification.

Furthermore, Chapter 8 of the Regulations stipulates that unless otherwise directed by the Minister to ensure a better environmental outcome, or in response to an emergency so as to protect human health, property or the environment –

- Waste generators must ensure that their waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the Act prior to the disposal of the waste to landfill;
- Waste generators must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the Act; and
- Waste managers disposing of waste to landfill must only do so in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7 (1) of the Act.

Tetra4 intends to undertake a waste classification study of the drill waste once the exploration drilling commences. The purpose of the classification is to confirm if the drill waste is hazardous or not, in order to ensure the waste is handled, treated and disposed of at the correct waste disposal facility. Past experience has indicated drill muds to be hazardous as a result of underlying geology that was classified as a Type 3 hazardous waste, however this may differ for the proposed drill sites relevant to this project.

5.6 THE NATIONAL ENVIRONMENTAL MANAGEMENT AIR QUALITY ACT (NEMAQA)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004 as amended – NEMAQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

- To protect the environment by providing reasonable measures for –
    I. the protection and enhancement of the quality of air in the republic;
    II. the prevention of air pollution and ecological degradation; and
    III. securing ecologically sustainable development while promoting justifiable economic and social development; and
- Generally, to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The NEMAQA mandates the Minister of Environment to publish a list of activities which result in atmospheric emissions and consequently cause significant detrimental effects on the environment, human health and social welfare. All scheduled processes as previously stipulated under the Air Pollution Prevention Act (APPA) are included as listed activities with additional activities being added to the list. The updated Listed Activities and Minimum National Emission Standards were published on the 22nd of November 2013 (Government Gazette No. 37054).

According to the NEMAQA, air quality management control and enforcement is in the hands of local government with District and Metropolitan Municipalities as the licensing authorities. Provincial government is primarily responsible for ambient monitoring and ensuring municipalities fulfil their legal obligations, with national government primarily as policy maker and co-ordinator. Each sphere of government must appoint an Air Quality Officer responsible for co-ordinating matters pertaining to air quality management. Given that air quality management under the old Act was the sole responsibility of national government, local authorities have in the past only been responsible for smoke and vehicle tailpipe emission control.

The National Pollution Prevention Plans Regulations were published in March 2014 (Government Gazette 37421) and tie in with the National Greenhouse Gas (GHG) Emission Reporting Regulations which took effect on 3 April 2017 (GN R 275, 2016), and was amended by the NEMAQA (39/2004): Amendments to the National Greenhouse Gas Emission Reporting Regulations (GN R 994, 2020). According to amendment GN R 994, Standby generators require registration when applicable thresholds are met. Registration is to be completed using Annexure 5 of the regulations. If the generator is not associated with a facility, emissions should be reported at the data provider level using relevant Intergovernmental Panel on Climate Change (IPCC codes). However, if the generator is part of or supports a facility, emissions must be reported according to Annexure 3 summary, the

Regulations aim to prescribe the requirements that pollution prevention plans of greenhouse gases declared as priority air pollutants, need to comply with in terms of the NEMAQA.

The Regulations specify who needs to comply, and by when, as well as prescribing the content requirements. Tetra4 has an obligation to report on the GHG emissions under these Regulations. There is also a requirement to account for the amount of pollutants discharged into the atmosphere (total emissions for one or more specific GHG pollutants) by 31 March each year.

5.6.1 NATIONAL DUST CONTROL REGULATIONS

Dust fall is assessed for nuisance impact and not for inhalation health impact. The National Dust Control Regulations (Department of Environmental Affairs, 2013) prescribes measures for the control of dust in residential and non-residential areas. Acceptable dust fall rates are measured (using American Standard Testing Methodology (ASTM) D1739:1970 or equivalent) at and beyond the boundary of the premises where dust originates. In addition to the dust fall limits, the National Dust Control Regulations prescribe monitoring procedures and reporting requirements. Dust that may be created from the exploration activities (including but not limited to the construction phase) will be managed in accordance with these Regulations.

5.7 THE NATIONAL HERITAGE RESOURCES ACT (NHRA)

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 13 states that the South African Heritage Resources Agency (SAHRA) is the statutory organisation responsible for the protection of South Africa's cultural heritage. Section 34(1) of the NHRA states that, "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…". The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the NEMA, MPRDA and the Development Facilitation Act (DFA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA. The NEMA 23(2)(b) states that an integrated environmental management plan should;

"Identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2".

Appendix 2 of the NEMA: Environmental Impact Assessment Regulations (GN R 982, 2014) states that during the BA process, A consultative impact and risk assessment process is to be undertaken, including an evaluation of cumulative impacts, to determine the heritage and cultural sensitivity of potential sites and locations. This assessment must focus on identifying and evaluating the potential impacts of proposed activities and alternative technologies on these aspects, considering their nature, significance, consequences, extent, duration, and likelihood of occurrence. The reversibility of impacts, potential for irreplaceable loss of resources, and opportunities for avoidance, management, or mitigation are also to be assessed. By ranking site sensitivities and potential impacts, the process facilitated the identification and justification of a preferred site, activity, and technology; the development of appropriate avoidance, management, and mitigation measures; and the management of residual risks. A further important aspect to be taken into account of in the EIA Regulations under the NEMA relates to the Specialist Report requirements (Appendix 6 of EIA Regulations 2014, as amended). The specialist consulted is to undertake the Heritage assessment that will follow the procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the Act (NEMA), when applying for environmental authorisation (GN 320, 2020).

The MPRDA defines 'environment' as it is in the NEMA and, therefore, acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and

identification of impacts on all heritage resources as identified in Section 3(2) of the NHRA that are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities.

In accordance with the legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive and legally compatible Heritage Report is compiled.

5.8 THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT (NEMBA)

The National Environmental Management Biodiversity Act (Act No. 10 of 2004 – NEMBA) provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA as well as the protection of species and ecosystems that warrant national protection. Within the framework of this act, various regulations are promulgated which provide specific requirements and management measures relating to protecting threatened ecosystems, threatened or protected species as well as the control of alien and invasive species. A summary of these regulations is presented below.

5.8.1 NATIONAL LIST OF ECOSYSTEMS THAT ARE THREATENED AND NEED OF PROTECTION (GN 1002 OF 2011)

The NEMBA provides for listing of threatened or protected ecosystems in one of the following categories:

- Critically Endangered (CR) ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- Endangered (EN) ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- Vulnerable (VU) ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and
- Protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

The DFFE Screening Tool identified ER32 as overlapping both endangered and least concern ecosystems, while ER94 overlaps only least concern ecosystems. Several endangered and near-threatened species, flagged in the Screening Report and assessed by biodiversity specialists (detailed in Section 9.10), necessitate the application of the relevant NEMBA regulations. Consequently, management measures for protecting threatened ecosystems, species, and controlling alien and invasive species must be implemented.

5.8.2 THREATENED OR PROTECTED SPECIES REGULATIONS (GN R 152 OF 2007)

The purpose of these regulations is to -

(a) further regulate the permit system set out in Chapter 7 of the Biodiversity Act insofar as that system applies to restricted activities involving specimens of listed threatened or protected species;

(b) provide for the registration of captive breeding operations, commercial exhibition facilities, game farms, nurseries, scientific institutions, sanctuaries and rehabilitation facilities and wildlife traders;

(c) provide for the regulation of the carrying out of a specific restricted activity, namely hunting;

(d) provide for the prohibition of specific restricted activities involving specific listed threatened or protected species;

(e) provide for the protection of wild populations of listed threatened species; and

(f) provide for the composition and operating procedure of the Scientific Authority

The DFFE Screening Tool identified multiple endangered and near-threatened species within ER32, which were subsequently assessed by a biodiversity specialist. Should any additional endangered or near-threatened species be encountered, the provisions of GN R 152 must be strictly adhered to. The biodiversity specialist's assessment was conducted in accordance with this regulation.

5.8.3 ALIEN AND INVASIVE SPECIES LIST

This Act is applicable since it protects the quality and quantity of arable land in South Africa. Loss of arable land should be avoided and declared Weeds and Invaders in South Africa are categorised according to one of the following categories, and require control or removal:

- Category 1a Listed Invasive Species: Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combated or eradicated;
- Category 1b Listed Invasive Species: Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled;
- Category 2 Listed Invasive Species: Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be; and
- Category 3 Listed Invasive Species: Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice.

Alien and invasive species (AIS) control has been included as a management measure in the EMPr. Tetra4 will be required to continually monitor their development footprint areas for the presence of AIS and implement suitable control measures to prevent further establishment or spread of these species.

5.9 THE CONSERVATION OF AGRICULTURAL RESOURCES ACT (CARA)

The Conservation of Agricultural Resources (Act 43 of 1983) aims to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. In order to achieve the objectives of this Act, control measures related to the following may be prescribed to land-users to whom they apply:

- The cultivation of virgin soil;
- The utilisation and protection of land which is cultivated;
- The irrigation of land;
- The prevention or control of waterlogging or salination of land;
- The utilisation and protection of vleis, marshes, water sponges, water courses and water sources;
- The regulating of the flow pattern of run-off water;
- The utilisation and protection of the vegetation;
- The grazing capacity of veld, expressed as an area of veld per large stock unit;
- The maximum number and the kind of animals which may be kept on veld;

- The prevention and control of veld fires;
- The utilisation and protection of veld which has burned;
- The control of weeds and invader plants;
- The restoration or reclamation of eroded land or land which is otherwise disturbed or denuded;
- The protection of water sources against pollution on account of farming practices;
- The construction, maintenance, alteration or removal of soil conservation works or other structures on land; and
- Any other matter which the Minister may deem necessary or expedient in order that the objects of this Act may be achieved.

Further, different control measures may be prescribed in respect of different classes of land-users or different areas or in such other respects as the Minister may determine. Impacts on the agriculture and soil, biodiversity and water resources have been identified with regards to this project, and mitigation and management measures recommended.

5.10 THE ENVIRONMENT CONSERVATION ACT (ECA)

The Environment Conservation Act (Act 73 of 1989 – ECA) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control noise and general prohibitions relating to noise impact and nuisance.

5.10.1 NOISE CONTROL REGULATIONS, 1992 (GN R 154)

In terms of section 25 of the ECA, the National Noise Control Regulations (GN R. 154 – NCRs) published in Government Gazette No. 13717 dated 10 January 1992, were promulgated. The NCRs were revised under GN R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Provincial noise control regulations have been promulgated in Gauteng, Free State and Western Cape Provinces.

The NCRs will need to be considered in relation to the potential noise that may be generated mainly during the construction phase of the proposed project. The two key aspects of the NCRs relate to disturbing noise and noise nuisance.

Section 4 of the Regulations prohibits a person from making, producing or causing a disturbing noise, or allowing it to be made produced or caused by any person, machine, device or apparatus or any combination thereof. A disturbing noise is defined in the Regulations as “a noise level which exceeds the zone sound level or if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.”

Section 5 of the NCRs in essence prohibits the creation of a noise nuisance. A noise nuisance is defined as “any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person”. The South African National Standard 10103 also applies to the measurement and consideration of environmental noise and should be considered in conjunction with these Regulations.

5.10.2 NOISE STANDARDS

There are a few South African scientific standards (SABS) relevant to noise from mines, industry and roads. They are:

- South African National Standard (SANS) 10103:2008 – ‘The measurement and rating of environmental noise with respect to annoyance and to speech communication’;
- SANS 10210:2004 – ‘Calculating and predicting road traffic noise’;

- SANS 10328:2008 – 'Methods for environmental noise impact assessments';
- SANS 10357:2004 – 'The calculation of sound propagation by the Concave method';
- SANS 10181:2003 – 'The Measurement of Noise Emitted by Road Vehicles when Stationary'; and
- SANS 10205:2003 – 'The Measurement of Noise Emitted by Motor Vehicles in Motion'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land-use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful per se.

5.11 THE SPATIAL PLANNING AND LAND-USE MANAGEMENT ACT (SPLUMA)

The Spatial Planning and Land-use Management (Act 16 of 2013 – SPLUMA) is set to aid effective and efficient planning and land-use management, as well as to promote optimal exploitation of minerals and mineral resources. The SPLUMA was developed to legislate for a single, integrated planning system for the entire country. Therefore, the Act provides a framework for a planning system for the country and introduces provisions to cater for development principles; norms and standards; inter-governmental support; Spatial Development Frameworks (SDFs) across national, provincial, regional and municipal areas; Land-use Schemes (LUS); and municipal planning tribunals.

5.12 THE OCCUPATIONAL HEALTH AND SAFETY ACT

The Occupational Health and Safety Act (Act 85 of 1993 - OHSA) provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith. Worker safety will form part of the contractor's safety requirements and be guided by the OHSA. This would entail a full health and safety file including but not limited to pre-mobilization medical assessments, work environment and task specific risk assessments and method statements etc. Once the exploration activities commence, worker safety will be covered by the Tetra4 safety philosophy, risk assessments and Standard Operating Procedures which are all required to comply with the OHSA and or Mine Health and Safety Act (dependent on the specific aspect of the production operations). Therefor safety of all personnel will be guided by overarching South African legislation.

5.13 THE BASIC CONDITIONS OF EMPLOYMENT ACT

The Basic Conditions of Employment Act (Act 75 of 1997) gives effect to the right to fair labour practices referred to in section 23(1) of the Constitution by establishing and making provision for the regulation of basic conditions of employment; and thereby to comply with the obligations of the Republic as a member state of the International Labour Organisation. The Basic Conditions of Employment Amendment Act, No. 20 of 2013 was published and became effective on 1 September 2014.

5.14 THE LABOUR RELATIONS ACT

The Labour Relations Act (Act 66 of 1995) aims to promote economic development, social justice, labour peace and democracy in the workplace. It sets out to achieve this by fulfilling the primary objectives of the Act, which are to give effect to and regulate the fundamental rights conferred by section 27 of the Constitution, including the right to fair labour practices, to form and join trade unions and employer's organisations, to organise and bargain collectively, and to strike and lock out; to provide a framework for regulating the relationship between employees and their unions on the one hand, and employers and their organisations on the other hand. At the same time, it also encourages employers and employees to regulate relations between themselves; and to promote orderly collective bargaining, collective bargaining at sectoral level, employee participation in decision-making in the workplace and the effective resolution of labour disputes.

5.15 THE EMPLOYMENT EQUITY ACT

The Employment Equity Act (Act 55 of 1998) promotes equity in the workplace, ensures that all employees receive equal opportunities and that employees are treated fairly by their employers. The law protects employees from unfair treatment and any form of discrimination. The law states that an employer may not discriminate against an employee directly or indirectly through employment policy or practice on the grounds of race, gender, pregnancy, marital status, family responsibility, ethnic or social origin, colour, sexual orientation, age, disability, religion, HIV status, conscience, belief, political opinion, culture, language, and birth.

The law aims to redress injustices of the past by implementing affirmative action measures. According to the legislation, it isn't unfair discrimination to promote affirmative action consistent with the Act or to prefer or exclude any person on the basis of an inherent job requirement.

5.16 THE PROMOTION OF EQUALITY AND PREVENTION OF UNFAIR DISCRIMINATION ACT

The Promotion of Equality and Prevention of Unfair Discrimination Act (Act 4 of 2000) gives expression to the right to equality. Section 8 stipulates that no person may be unfairly discriminated against on the grounds of gender, expressly including gender-based violence. Section 8 of this Act goes on to prohibit any limitation of women's access to social services, such as health or education, and the denial or systemic inequality of access to opportunities.

5.17 THE FIREARMS CONTROL ACT

Firearm Control Act (Act no. 60 of 2000) and associated amendments establishes the procedures under which a firearm is permitted. It includes the provisions for permitting procedures for persons in South Africa who seek to obtain a firearm, including procedures for ensuring competency and associated licencing and permits as well as procedures to terminate firearm licences. Any safety and/or security personnel working on the project must comply with the Firearms Control Act where relevant and ensure that their actions always consider the safety of the public.

5.18 OTHER APPLICABLE ACTS AND LOCAL OR INTERNATIONAL GUIDELINES OR STANDARDS

Other applicable acts and guidelines include: The National Veld and Forest Fire Act 101 of 1998; and Masilonyana and Matjhabeng Local Municipalities Integrated Development Plans. In addition, the municipal planning documents such as the Local Municipality By-laws on Spatial Planning and Land-use Management are also applicable to the project. These Acts, Ordinances, plans and guidelines have been considered in the preparation of this report.

In addition to the relevant provincial or local guidelines, there exists various international guidelines or standards that have relevance to this project and application, and these are described below.

5.18.1 FREE STATE NATURE CONSERVATION ORDINANCE 8 OF 1969

This Ordinance makes provision with respect to the protection and conservation of wildlife in the Free State Province. It makes provision for, among other things, hunting and the protection of wild animals, fishing and the protection of aquatic resources, the protection of indigenous plants and the establishment and management of nature reserves. The Ordinance defines, in Schedule1, protected game and, in Schedule 2, ordinary game and sets out specific rules relating to hunting of each class of game. It also defines prohibited acts in respect of wild or exotic game and rules regarding the importation and exportation of endangered or exotic animals. According to the list of protected species under the Schedule, if any individuals of these plant species are to be disturbed, permits must be obtained from the Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs (FSDESTEA). An assessment of floral species within the study area is covered by the Terrestrial Biodiversity Assessment and discussed in detail in subsequent sections of the report.

5.18.2 FREE STATE PROVINCIAL SPATIAL DEVELOPMENT PLAN

The Free State Provincial Spatial Development Framework (PSDF) is a policy document that promotes a 'developmental state' in accordance with national and provincial legislation and directives. It aligns with the Free State Provincial Growth and Development Strategy which has committed the Free State to 'building a prosperous, sustainable and growing provincial economy which reduces poverty and improves social development'. The PSDF includes comprehensive plans and strategies that collectively indicate which type of land-use should be promoted in the Free State Province, where such land-use should take place, and how it should be implemented and managed. The proposed exploration activities are within an approved exploration right.

5.18.3 FREE STATE BIODIVERSITY PLAN, 2015

The development of provincial biodiversity plans is a key component of the systematic biodiversity planning in South Africa and therefore a strong focus of the Biodiversity Planning Forum. Many of the innovative approaches and methodologies have been initiated and established through the development of these provincial biodiversity plans. A key objective of the Provincial Spatial Development Framework (PSDF) is to integrate and standardize planning at all spheres of government in the province with specific reference to amongst others facilitating land-use classification of the entire land surface of the province. To this extent a set of dedicated Spatial Planning Categories (SPCs) were developed which provide a spatial framework to guide decision-making regarding land-use at all levels of planning. The SPCs represent a classification system that indicates the most suitable, or a range of, land-use options for a certain piece of land. Associated with each SPC category is land-use guidelines which when implemented ensures a balance between development and conservation. Mainstreaming of the biodiversity plan into spatial planning process will be achieved by aligning the biodiversity plan categories with those of the SPCs so that planning according to SPC will then automatically also adopt the biodiversity plan categories and their associated land-use guidelines. Various biodiversity layers were overlaid to the study area and used to determine the sensitivity and/or certain requirements thereof. The results are provided in in subsequent sections of the report.

5.18.4 IFC PERFORMANCE STANDARDS

The International Finance Corporation (IFC) is an international financial institution that offers investment, advisory, and asset management services to encourage private sector development in developing countries. The IFC is a member of the World Bank Group (WBG) and is headquartered in Washington, D.C., United States. It was established in 1956 as the private sector arm of the WBG to advance economic development by investing in strictly for-profit and commercial projects that purport to reduce poverty and promote development.

The IFC's stated aim is to create opportunities for people to escape poverty and achieve better living standards by mobilizing financial resources for private enterprise, promoting accessible and competitive markets, supporting businesses and other private sector entities, and creating jobs and delivering necessary services to those who are poverty-stricken or otherwise vulnerable. Since 2009, the IFC has focused on a set of development goals that supported projects are expected to target. Its goals are to increase sustainable agriculture opportunities, improve health and education, increase access to financing for microfinance and business clients, advance infrastructure, help small businesses grow revenues, and invest in climate health.

The IFC is owned and governed by its member countries but has its own executive leadership and staff that conduct its normal business operations. It is a corporation whose shareholders are member governments that provide paid-in capital, and which have the right to vote on its matters. Originally more financially integrated with the WBG, the IFC was established separately and eventually became authorized to operate as a financially autonomous entity and make independent investment decisions. It offers an array of debt and equity financing services and helps companies face their risk exposures, while refraining from participating in a management capacity. The corporation also offers advice to companies on making decisions, evaluating their impact on the environment and society, and being responsible. It advises governments on building infrastructure and partnerships to further support private sector development.

The IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Policy on Environmental and Social Sustainability describes IFC's commitments, roles, and responsibilities related to environmental and social sustainability. IFC's Access to Information Policy reflects IFC's commitment to transparency and good governance on its operations and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services. The Performance Standards (PSs) are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. In the case of its direct investments (including project and corporate finance provided through financial intermediaries), IFC requires its clients to apply the PSs to manage environmental and social risks and impacts so that development opportunities are enhanced. IFC uses the Sustainability Framework along with other strategies, policies, and initiatives to direct the business activities of the Corporation to achieve its overall development objectives. The PSs are often also applied by other financial institutions and therefore these PSs are discussed in Table 8 in terms of the applicability of the various PSs to this Production Rights Extension and the activities associated with it.

Table 8: IFC Performance Standards applicability to this project.

<table>
<tr><th colspan="4">Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts</th></tr>
<tr><td>Overview</td><td colspan="3">Performance Standard 1 (PS1) underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.</td></tr>
<tr><td>Objectives</td><td colspan="3">➢ To identify and evaluate environmental and social risks and impacts of the project.
➢ To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
➢ To promote improved environmental and social performance of clients through the effective use of management systems.
➢ To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately.
➢ To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.</td></tr>
<tr><td rowspan="4">Aspects</td><td>1.1</td><td>• Policy</td><td rowspan="4"><u>Consideration of PS1 to this project:</u>
The South African NEMA EIA Regulations are specifically geared towards ensuring that a projects environmental and social risks and impacts are identified and assessed in order to put forward suitable impact management actions and outcomes for final decision making by the Competent Authority.
This BA Report includes a detailed assessment of this PSs aspects relating to environmental and social risks and impacts and the culmination of an EMPr containing the relevant</td></tr>
<tr><td>1.2</td><td>• Identification of Risks and Impacts</td></tr>
<tr><td>1.3</td><td>• Management Programmes</td></tr>
<tr><td>1.4</td><td>• Organisational Capacity and Competency</td></tr>
</table>

	1.5	• Emergency Preparedness and Response	mitigation measures which are aimed at limiting the final significance of each identified impact. Throughout the BA process, stakeholder engagement has been undertaken to solicit input from I&APs and ongoing stakeholder engagement and communication will be ongoing during the lifecycle of the project.
	1.6	• Monitoring and Review	
	1.7	• Stakeholder Engagement	
	1.8	• External Communication and Grievance Mechanism	
	1.9	• Ongoing Reporting to Affected Communities	
Performance Standard 2: Labour and Working Conditions;			
Overview	Performance Standard 2 (PS2) recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers.		
Objectives	➢ To promote the fair treatment, non-discrimination, and equal opportunity of workers. ➢ To establish, maintain, and improve the worker-management relationship. ➢ To promote compliance with national employment and labour laws. ➢ To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. ➢ To promote safe and healthy working conditions, and the health of workers. ➢ To avoid the use of forced labour.		
Aspects	2.1	• Working Conditions and Management of Worker Relationship • Human Resources Policy and Management • Working Conditions and terms of Engagement • Workers organisation • Non- Discrimination and Equal Opportunity • Retrenchment	**<u>Consideration of PS2 to this project:</u>** This project will require a number of temporary as well as permanent workers during the variou sphases of the exploration activities. In terms of South African labour legislation (OHSA/MHSA), it will be obligatory on Tetra4 and all sub-contractors to ensure that workers operate in a safe working environment and that employment contracts are fair and reasonable.

		• Grievance Mechanism	
	2.2	• Protecting the Workforce • Child Labour • Forced Labour	
	2.3	• Occupational health and Safety	
	2.4	• Workers Engaged by Third Parties	
	2.5	• Supply Chain	
Performance Standard 3: Resource Efficiency and Pollution Prevention			
Overview	Performance Standard 3 (PS3) recognises that increased economic activity and urbanisation often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. There is also a growing global consensus that the current and projected atmospheric concentration of greenhouse gases (GHG) threatens the public health and welfare of current and future generations. At the same time, more efficient and effective resource use and pollution prevention and GHG emission avoidance and mitigation technologies and practices have become more accessible and achievable in virtually all parts of the world.		
Objectives	➢ To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. ➢ To promote more sustainable use of resources, including energy and water. ➢ To reduce project related GHG emissions.		
Aspects	3.1	• Policy Resource Efficiency • Greenhouse Gases • Water Consumption	**<u>Consideration of PS3 to this project:</u>** The various pollution sources and associated impacts of this project have been identifieid in this BA. Surface and groundwater pollution during drilling operations will be prevented through the casing of the drillholes which prevents interplay between the gas resource and shallower freshwater aquifers. Various procedures and plans will be put in place which put forward management actions for general and hazardous waste, pesticide use and management, etc.
	3.2	• Pollution Prevention • Air Emissions • Stormwater • Waste Management • Hazardous Materials Management • Pesticide use and Management	
Performance Standard 4: Community Health, Safety, and Security			
Overview	Performance Standard 4 (PS4) recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts.		

Objectives	➢ To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. ➢ To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.		
Aspects	4.1	• Community Health and Safety • Infrastructure and Equipment Design and Safety • Hazardous Materials Management and Safety • Ecosystem Services • Community Exposure to Disease • Emergency Preparedness and Response	**<u>Consideration of PS4 to this project:</u>** The aspects included in this PS are considered in this project BA and mitigation measures included in the EMPr. The following conditions have been included in the recommendationed conditions of authorisation to ensure that community health and safety is specifically considered: • All workers must be educated on the need to ensure safety of surrounding communities and the public in general. Road safety legislation must be complied with at all times with additional consideration of the World Bank Group Environmental Health and Safety Guidelines. A community health and safety plan inclusive of a Traffic Management Plan will be developed based on risks identified in consideration of community health and safety. • Risks associated with the potential use of security personnel will be assessed prior to operations and a security management plan will be developed if required and in accordance with IFC PS4.
	4.2	• Security Personnel	
Performance Standard 5: Land Acquisition and Involuntary Resettlement			
Overview	Performance Standard 5 (PS5) recognises that project-related land acquisition and restrictions on land-use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land-use.		
Objectives	➢ To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. ➢ To avoid forced eviction. ➢ To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land-use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ➢ To improve, or restore, the livelihoods and standards of living of displaced persons. ➢ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.		
Aspects	5.1	• Displacement • Physical Displacement	**<u>Consideration of PS5 to this project:</u>** Due to the nature of this Product Right extension project, the proposed exploration drilling activities will impact on existing land-users (mainly farmlands as well as lawful occupiers of

		• Economic Displacement • Private Sector Responsibilities under Government Managed Resettlement	land including host communities). Socio-economic sensitivities within the proposed development areas have been identified (such as noise, visual, land-use, etc.) as a primary means of avoidance however the final placement of infrastructure will be negotiated with affected parties to ensure minimal impact on existing land-use. Tetra4 has compiled a Stakeholder Engagement Procedure (Document Ref: T4-PP-SHERQ-048). The intention of this procedure is to stipulate measures for effective engagement and the recording of engagement with relevant stakeholders. This document is applicable to all parties undertaking Works as or on behalf of Tetra4 within the Virginia Production Right area. The document highlights the requirements of all parties with regards to stakeholder engagement, the establishment and maintenance of good working relationships and recording of stakeholder interactions during any Works undertaken. In addition, a contractual document (Access Use and Servitude Agreement) is shared with affected stakeholders for negotiation prior to commencement with the exploration activities, including but not limited to the construction phase. Agreements are reached with affected parties in terms of suitable compensation (per hectare per year) during the construction, operational and decommissioning phases of the exploration project.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources			
Overview	Performance Standard 6 (PS6) recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development.		
Objectives	➢ To protect and conserve biodiversity. ➢ To maintain the benefits from ecosystem services. ➢ To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.		
Aspects	6.1	• Protection and Conservation of Biodiversity	**<u>Consideration of PS6 to this project:</u>** Due to the extensive spatial distribution of the project infrastructure, various sensitive environmental features occur within the proposed project footprint and include CBAs, ESAs, rivers, wetlands, indigenous vegetation, etc. Specialist assessments have been undertaken to identify and assess the projects impact on sensitive biodiversity areas and include a Biodiversity Impact Assessment and Wetland and Aquatic Impact Assessment. Various levels of mitigation are put forward by the specialist studies based on the sensitivity of the receiving environment. Alien and invasive species will be controlled throughout the lifecycle of the project through the implementation of the Declared Weeds and Invasive Alien Plant Management Procedure (Document Ref: T4-PP-SHERQ-038).

<table>
<tr><th colspan="4">Performance Standard 7: Indigenous People</th></tr>
<tr><td>Overview</td><td colspan="3">Performance Standard 7 (PS7) recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded.</td></tr>
<tr><td>Objectives</td><td colspan="3">➢ To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples.
➢ To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts.
➢ To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner.
➢ To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle.
➢ To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.
➢ To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.</td></tr>
<tr><td rowspan="2">Aspects</td><td>7.1</td><td>• General
• Avoidance of Adverse Impacts
• Participation and Consent</td><td rowspan="2"><u>Consideration of PS7 to this project:</u>
As per IFC Guidance Note 7, in this Performance Standard, the term "Indigenous Peoples" is used in a generic sense to refer to a distinct social and cultural group possessing the following characteristics in varying degrees:
• Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
• Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
• Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or
• A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.
With due consideration of the above accepted definition in IFC Guidance Note 7 and as per the international instruments under the United Nations (UN) Human Rights Conventions, no indigenous peoples are present within the study area and therefore PS7 is not triggered by this proposed development and no further assessment in this regard is required.</td></tr>
<tr><td>7.2</td><td>• Circumstances Requiring Free, Prior, and Informed Consent
• Impacts on Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use
• Critical Cultural Heritage
• Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use</td></tr>
</table>

	7.3	• Mitigation and Development Benefits	
	7.4	• Private Sector Responsibilities Where Government is Responsible for Managing Indigenous Peoples Issues	
Performance Standard 8: Cultural Heritage			
Overview	Performance Standard 8 (PS8) recognizes the importance of cultural heritage for current and future generations.		
Objectives	➢ To protect cultural heritage from the adverse impacts of project activities and support its preservation. ➢ To promote the equitable sharing of benefits from the use of cultural heritage.		
Aspects	8.1	• Protection of Cultural Heritage in Project Design and Execution	**Consideration of PS8 to this project:** A detailed Heritage Impact Assessment as well as a Palaeontological Impact Assessment have been undertaken by suitably qualified specialists. Various cultural heritage resources have been identified within the study area and specific mitigation measures for each (depending on significance) put forward. Chance Finds and Heritage Protection Procedure (Document Ref: T4-PP-SHERQ-037) has been prepared by Tetra4 for implementation by relevant project role-players.

5.18.5 WORLD BANK (WB) AND INTERNATIONAL FINANCE CORPORATION (IFC) GUIDELINES

5.18.5.1 **WORLD BANK EHS GUIDELINES FOR ONSHORE OIL AND GAS DEVELOPMENT**

The EHS Guidelines for Onshore Oil and Gas Development include information relevant to exploration and decommissioning. Key issues identified for onshore gas developments related to environmental issues and occupational health and safety issues, and community health and safety issues (World Bank, 2007).

Potential environmental issues associated with onshore gas development projects include the following:

- Air emissions;
- Wastewater discharges;
- Solid and liquid waste management;
- Noise generation;
- Terrestrial impacts and project footprint;
- Impacts on subsoil and aquifers;
- Spills; and

In addition to the typical OHS issues of large industrial activities, the following additional issues relate to onshore gas development projects:

- Asset Integrity Management;
- Fire and explosion;
- Air quality;
- Hazardous materials;
- Transportation;
- Well blowouts; and

Community health and safety impacts during the construction, exploration (operation) and decommissioning of onshore gas developments include:

- Physical hazards;
- Exposure to emissions;
- Security; and
- Impacts on land-use.

5.18.5.2 IFC ENVIRONMENTAL NOISE GUIDELINE

The IFC General Environmental Health and Safety Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines. The IFC states that noise impacts should not exceed the levels presented in Table 9, or result in a maximum increase above background levels of 3 dBA at the nearest receptor location off-site (IFC, 2020). For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. Δ = 3 dBA is therefore a useful significance indicator for a noise impact.

It is further important to note that the IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts.

Table 9: IFC noise level guidelines.

Area	One Hour LAeq (dBA) 07:00 to 22:00	One Hour LAeq (dBA) 22:00 to 07:00
Industrial receptors	70	70
Residential, institutional and educational receptors	55	45

5.18.6 GHG AND CLIMATE CHANGE

Greenhouse Gasses (GHG) are defined as "Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of radiation emitted by the Earth's surface, by the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4) and ozone (O3) are the primary GHGs in the Earth's atmosphere. Human-made GHGs include sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), chlorofluorocarbons (CFCs) and perfluorocarbons (PFCs); several of these are also O3-depleting and are regulated under the Montreal Protocol (IPPC, 2024). Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) (UNCC, 1997). Since the onset of industrialization in the eighteenth century, anthropogenic activities have elevated atmospheric carbon dioxide concentrations by 50 %. Consequently, current CO_2 levels are 150 % of pre-industrial

values. The amount of CO2 has increased from 365 ppm in 2002 to over 420 ppm in 2024 (Figure 10). This human-induced increase surpasses the natural rise observed at the conclusion of the last ice age, approximately twenty thousand years ago (NASA, 2024). This increase has occurred despite the uptake of a large portion of the emissions by various natural "sinks" involved in the carbon cycle (NASA, 2024). The naturally occurring gas, CO2 is also a byproduct of the combustion of fossil fuels (oil, gas, and coal), biomass burning, and various industrial processes, including land-use changes (IPCC, 2007).

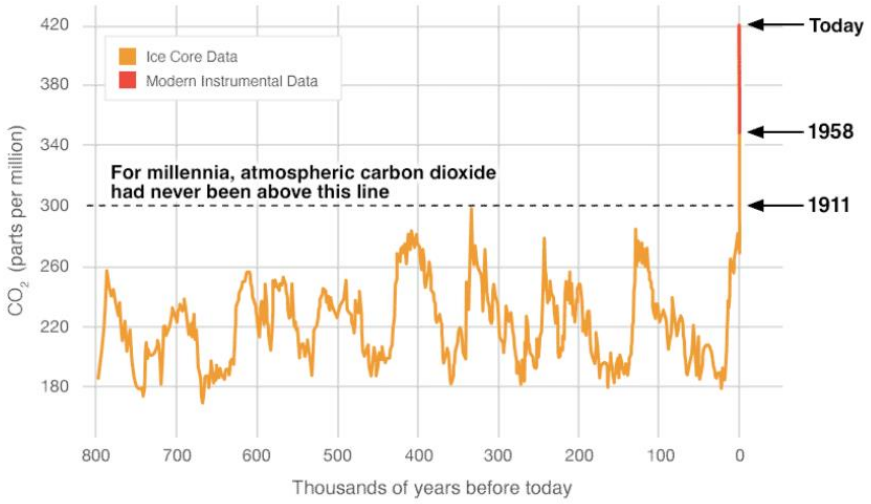

Figure 10: Historical changes in global carbon dioxide over time, (NASA, 2024).

The International Finance Corporation (IFC) lists methods that countries and projects can reduce GHG impacts. These include carbon financing; improvement of energy efficiency; GHG sinks and reservoir protection and improvements; that environmentally friendly agriculture and forestry be encouraged; the increased use of renewable energy methods; implementation of carbon capture and sequestration methods; and improved waste management (recovery and use of methane emissions) as well as reducing GHG emissions from vehicle use and industrial, construction and energy production processes (IFC, 2007). Carbon financing may have much potential in developing countries as well as sustainable agriculture and forestry practices, and when supported by governments may be a way of reducing the country's GHG impacts, where projects receive carbon credits and financing for reducing GHG emissions and installing more environmentally friendly alternatives (IFC, 2007). Because different industries contribute various amounts of GHG emissions, the IFC performance standards states that projects anticipated to generate or currently producing carbon dioxide equivalent emissions exceeding 25,000 tonnes annually will necessitate the quantification of direct emissions originating from facilities owned or controlled within the project boundary. Additionally, indirect emissions associated with off-site energy consumption must be quantified. The client will conduct annual greenhouse gas emissions quantification aligned with internationally recognized methodologies and best practices (IFC, 2012).

5.18.6.1 INTERNATIONAL AGREEMENTS

In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UN, 1992) as a framework for international cooperation to combat climate change by limiting average global temperature increases and the resulting climate change, and coping with impacts that were, by then, inevitable.

By 1995, countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol (UNCC, 1997). The Kyoto Protocol legally binds developed country parties to emission reduction targets. The Protocol's first commitment period started in 2008 and ended in 2012. As agreed in Doha in 2012, the second commitment period began on 1 January 2013 and would end in 2020 (UN, 2017) but due to lack of ratification has not come into force.

The Paris Agreement was adopted by 196 Parties at Conference of the Parties (COP21) in Paris, on 12 December 2015 and commenced 4 November 2016 (UN, 2015). The Paris Agreement (2016) builds upon the Convention and – for the first time – brings all nations into a common cause to undertake ambitious efforts to combat

climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework and an enhanced capacity building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their own national objectives.

The Paris Agreement is founded on the idea of countries improving on their climate change strategies in 5-year cycles. The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. The Paris Agreement proposes that Parties submit long-term low greenhouse gas emission development strategies (LT-LEDS) by 2020 but this was not mandatory.

Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties. Ethiopia submitted their first NDC to the UNFCCC secretariat and ratified the Paris agreement on 9 March 2017. Existing Parties were expected to submit their updated NDC in 2020; and new Parties their original NDCs. Parties are to submit updated NDCs every 5 years. As of May 2021, there are 192 parties that have submitted their NDCs and 8 parties that have submitted their second NDC. There are only 191 Parties to the Paris Agreement; Eritrea has not become a Party to the Paris Agreement but has submitted its first NDC.

Countries as part of the Paris agreement established an enhanced transparency framework (ETF). ETF is to start in 2024 and all countries will need to openly report on all activities untaken and progress in climate change mitigation, adaptation measures as well as any support provided or received. ETF also sets out a procedure for reviewing submitted reports. The information provided as part of the ETF will be used as an input for the global stocktake which will assess the collective progress towards the long-term climate goals.

5.18.6.2 GLOBAL GHG EMISSION INVENTORY

The proposed Tetra4 exploration activities would most likely fall under the category of "energy" for the global GHG inventory. According to the "mitigation of climate change" document as part of the Intergovernmental Panel on Climate Change (IPCC) fifth Assessment Report (AR5) the 2010 global GHG emissions were 49 (±4.5) Gt CO_2-e, of which 35% (17 Gt CO_2-e) was a result of the energy sector (IPCC, 2014). The World Resources Institute Climate Watch global GHG emissions from the "industrial processes" sector were 2.7711 Gt CO_2-e in 2016 (6% of total anthropogenic GHG emissions).

5.18.6.3 SOUTH AFRICA'S STATUS IN TERMS OF CLIMATE CHANGE AND QUANTIFICATION OF GREENHOUSE GASES

5.18.6.3.1 PARIS AGREEMENT - NATIONALLY DETERMINED CONTRIBUTION

South Africa ratified the UNFCCC in August 1997 and acceded to the Kyoto protocol in 2002, with effect from 2005. However, since South Africa is an Annex 1 country it implies no binding commitment to cap or reduce GHG emissions. The South African Intended Nationally Determined Contribution (INDC) was completed in 2015 and submitted to the UNFCCC on 1 November 2016. This was undertaken to comply with decision 1/CP.19 and 1/CP.20 of the Conference of the Parties to the UNFCC. This document describes South Africa's INDC on adaptation, mitigation and finance and investment necessities to undertake the resolutions.

As part of the adaption portion the following goals have been assembled:

1. Goal 1: Development and implementation of a National Adaption Plan. The implementation of this will also result in the implementation of the National Climate Change Response Plan (NCCRP) per the 2011 policy.

2. Goal 2: In the development of national, sub-national and sector strategy framework, climate concerns must be taken into consideration.
3. Goal 3: An official institutional function for climate change response planning and implementation needs to be assembled.
4. Goal 4: The creation of an early warning, vulnerability, and adaptation monitoring system
5. Goal 5: Develop policy regarding vulnerability assessment and adaptation needs.
6. Goal 6: Disclosure of undertakings and costs with regards to past adaptation strategies.

As part of the mitigation portion the following have been, or can be, implemented at National level:

- The approval of 79 (5 243 MW) renewable energy Independent Power Producer (IPP) projects as part of a Renewable Energy Independent Power Producer Procurement Programme (REI4P). An additional 6 300 MW is being deliberated.
- A "Green Climate Fund" has been created to back green economy initiatives. This fund will be increased in the future to sustain and improve successful initiatives.
- It is intended that by 2050 electricity will be decarbonised.
- Carbon Capture and Sequestration (or Carbon Capture and Storage) (CCS).
- To support the use of electric and hybrid electric vehicles.
- Reduction of emissions can be achieved through the use of energy efficient lighting; variable speed drives and efficient motors; energy efficient appliances; solar water heaters; electric and hybrid electric vehicles; solar photovoltaic; wind power; CCS; and advanced bioenergy.

A draft update of the first NDC was published for public comment on the 30th of March 2021 and the final updated of the first NDC was published and submitted to the UNFCCC on the 27th of September 2021 in preparation for the 26th Conference of the Parties (to held in Glasgow, Scotland in November 2021). The final update of the first NDC South Africa has not submitted its second NDC to UNFCCC. The draft document describes South Africa's NDC on adaptation, mitigation and finance and investment necessities to undertake the resolutions with updated revisions to the adaptation goals and mitigation targets.

As part of the updated adaption portion the following goals have been assembled:

1. Goal 1: Enhance climate change adaptation governance and legal framework.
2. Goal 2: Develop an understanding of the impacts on South Africa of 1.5 and 2°C global warming and the underlying global emission pathways through geo-spatial mapping of the physical climate hazards, and adaptation needs in the context of strengthening the key sectors of the economy. This will provide the scientific basis for strengthening the national and provincial governments' readiness to respond to climate risk.
3. Goal 3: Implementation of National Climate Change Adaptation Strategy (NCCAS) adaptation interventions for the period 2021 to 2030, where priority sectors have been identified as biodiversity and ecosystems; water; health; energy; settlements (coastal, urban, rural); disaster risk reduction, transport infrastructure, mining, fisheries, forestry and agriculture.
4. Goal 4: Mobilise funding for adaptation implementation through multilateral funding mechanisms.
5. Goal 5: Quantification and acknowledgement of the national adaptation and resilience efforts.

As part of the mitigation portion the following have been, or can be, implemented at National level:

- The approval of 79 (5 243 MW) renewable energy Independent Power Producer projects as part of a Renewable Energy Independent Power Producer Procurement Programme. An additional 6 300 MW is being deliberated.

- A “Green Climate Fund” has been created to back green economy initiatives. This fund will be increased in the future to sustain and improve successful initiatives.
- It is intended that by 2050 electricity will be decarbonised.
- CCS.
- To support the use of electric and hybrid electric vehicles.
- Reduction of emissions can be achieved through the use of energy efficient lighting; variable speed drives and efficient motors; energy efficient appliances; solar water heaters; electric and hybrid electric vehicles; solar photovoltaic (PV); wind power; CCS; and advanced bioenergy.
- Updated targets based on revised 100-year global warming potential (GWP) factors (published in the Annex to decision 18/CMA.1 of the IPCC 5th assessment report) and based on exclusion of land sector emissions arising from natural disturbance. The updated NDC mitigation targets, consistent with South Africa’s fair share, are presented in Table 10.

Table 10: South Africa's NCD mitigation targets.

Year	Target	Corresponding period
2025	South Africa’s annual GHG emissions will be in a range between 398 - 510 Mt CO_2-e.	2021-2025
2030	South Africa’s annual GHG emissions will be in a range between 398 - 440 Mt CO_2-e.	2026-2030

5.18.6.3.2 NATIONAL CLIMATE CHANGE RESPONSE POLICY

The National Climate Change Response White Paper stated that in responding to climate change, South Africa has two objectives: to manage the inevitable climate change impacts and to contribute to the global effort in stabilising GHG emissions at a level that avoids dangerous anthropogenic interference with the climate system. The White Paper proposes mitigation actions, especially a departure from coal-intensive electricity generation, be implemented in the short- and medium-term to match the GHG trajectory range. Peak GHG emissions are expected between 2020 and 2025 before a decade long plateau period and subsequent reductions in GHG emissions.

The White Paper also highlighted the co-benefit of reducing GHG emissions by improving air quality and reducing respiratory diseases by reducing ambient particulate matter, ozone and SO_2 concentrations to levels in compliance with NAAQS by 2020.

In order to achieve these objectives, the Department of Forestry, Fisheries and Environment (DFFE) has appointed a service provider to establish a national GHG emissions inventory, which will report through SAAQIS.

The draft Climate Change Bill was published for comment on the 8th of June 2018 and introduced to parliament on the 18th of February 2022 (B9-2022). The Bill has since been signed into law as the Climate Change Act on the 23rd of July 2024. The Act is aligned with international policies guidelines and South Africa’s Nationally Determined Contribution and aim to reduce GHG emissions as primary driver to anthropogenic climate change. The aim of the Bill is to achieve an effective climate change response through a long-term just transition to a low carbon economy that is climate resilient and allows for sustainable development of South Africa. The Act ensures that:

- Provincial and municipal forums are established on climate change which will be responsible for coordinating climate change response actions in each province.

- The establishment of the Presidential Climate Change Coordinating Commission (4PC) is strengthened. The 4PC has already been established and has been working for the Government since December 2020 and is legally required now.
- Within one year of the Act coming into force, a National Adaptation Strategy is established. This strategy will guide South Africa's adaptation to the impacts of climate change and develop adaptation scenarios which anticipate the likely impacts over the short, medium, and long term.
- A national GHG emissions trajectory is determined, which must be reviewed every five years, and which indicates an emissions reduction objective.
- A 5-yearly sectoral emission targets is put in place for identified sectors and sub-sectors. The sectoral targets must be aligned with the national GHG emissions trajectory and include quantitative and qualitative GHG emission reduction goals.
- The carbon budget allocation mechanism is brought into force, which will replace the current National Pollution Prevention Plan mechanism which is enforced under the National Environmental Management: Air Quality Act (NEM:AQA). The carbon budget will be linked to the Carbon Tax Act, in relation to carbon tax rates which will be charged on emissions above the carbon budget.

Exploration activities often necessitate the development of new infrastructure, such as roads and pipelines. The construction and operational phases of these facilities can result in greenhouse gas emissions, thereby subjecting the project to the provisions of the Climate Change Act. Furthermore, the subsequent extraction and utilization of the explored resource, such as natural gas, may contribute to greenhouse gas emissions, necessitating compliance with the Act's regulations. While exploration itself does not directly trigger the Act's application, the associated activities and potential environmental impacts may bring the project within its scope.

5.18.6.3.3 GREENHOUSE GAS EMISSIONS REPORTING

Regulations pertaining to GHG reporting using the National Atmospheric Emissions Inventory System (NAEIS) were published in 2017 (Republic of South Africa, 2017) (as amended by GN R994, 11 September 2020). The South African mandatory reporting guidelines focus on the reporting of Scope 1 emissions only.

The South African Greenhouse Gas Emission Reporting System (SAGERS) web-based monitoring and reporting system will be used to collect GHG information in a standard format for comparison and analyses. The system forms part of the national atmospheric emission inventory component of South African Atmospheric Emission Licensing and Inventory Portal (SAAELIP). Tetra4 operations will have to report their GHG emissions to SAGERS since there is no threshold for annual GHG emissions reporting for the Natural Gas producers as per the amended GHG reporting guidelines (GG43712, 7 September 2020).

The DFFE is working together with local sectors to develop country specific emissions factors in certain areas; however, in the interim the IPCC default emission figures may be used to populate the SAAQIS GHG emission factor database. These country specific emission factors will replace some of the default IPCC emission factors. Technical guidelines for GHG emission estimation have been issued.

5.18.6.3.4 NATIONAL GHG EMISSIONS INVENTORY

South Africa is perceived as a global climate change contributor and is undertaking steps to mitigate and adapt to the changing climate. DFFE is categorised as the lead climate change institution and is required to coordinate and manage climate related information such as development of mitigation, monitoring, adaption, and evaluation strategies (DEA, 2019). This includes the establishment and updating of the National GHG Inventory. The National Greenhouse Gas Improvement Programme (GHGIP) has been initiated; it includes sector specific targets to improve methodology and emission factors used for the different sectors as well as the availability of data.

The 2000 to 2017 National GHG Inventory was prepared using the 2006 IPCC Guidelines (IPCC, 2006) based on updated sector information and emission estimation techniques. According to the 4th Biennial Update Report to the UNFCCC (DFFE, 2021), the total GHG emissions in 2017 were estimated at approximately 512.14 million

metric tonnes CO_2-e (excluding Forestry and Other Land-use [FOLU]). This was a 14.2% increase from the 2000 total GHG emissions (excluding FOLU) and 2.8% decrease from the 2015 total GHG emissions (excluding FOLU). FOLU is estimated to be a net carbon sink which reduces the 2017 GHG emissions to 482.02 million metric tonnes CO_2-e. The estimated GHG emissions (excluding FOLU) for 2017 showed the Industrial Processes and Product Use (IPPU) sector contributed 6.3% to the total GHG emissions (excluding FOLU). The estimated CO_2-e emissions (excluding FOLU) for 2017 for the IPPU sector is 32.08 million metric tonnes.

By integrating the exploration rights, Tetra4 will gain access to potentially new helium reserves adjacent to their current production zone. This bolsters their helium resource base and extends the lifespan of the existing production right, ensuring a more sustainable and long-term helium production capability. Integrating exploration rights into the production right simplifies operational logistics and reduces administrative burdens. Managing exploration and production activities under a single right, streamlines processes and potentially reduces administrative costs associated with maintaining separate exploration rights.

Expanding helium exploration within a contiguous area minimizes the overall environmental footprint associated with exploration activities. This avoids the need to establish entirely new exploration zones, potentially reducing land disturbance and associated environmental impacts. Helium is a critical resource with a wide range of irreplaceable applications in science, medicine, and technology. Global demand for helium is projected to rise steadily, driven by its essential role in sectors like MRI machines, semiconductors, and space exploration. By incorporating these exploration rights, Tetra4 position themselves to contribute to a stable and reliable supply of helium to meet this growing demand.

This project aligns with principles of responsible resource management. Integrating exploration rights allows for a more comprehensive understanding of the helium resource potential within a defined area. This facilitates the development of a long-term production plan that maximizes resource recovery while minimizing environmental impact.

Incorporating the two exploration rights into the existing production right presents a strategic and responsible approach to helium resource development. This project offers significant benefits for extending production life, streamlining operations, and contributing to a sustainable helium supply. By implementing this project, Tetra4 will be able to foster economic development, social upliftment, and environmental responsibility within South Africa, particularly in the Free State Province.

6 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITY

The concept of "need and desirability" plays a crucial role within the Environmental Impact Assessment (EIA) process. This section outlines the considerations involved in evaluating need and desirability for this BA, along with its connection to the overall assessment stages. This section outlines the need and desirability of incorporating two exploration rights for helium gas into the existing production right. This strategic action offers significant benefits for the project and responsible resource management.

During the application phase, a preliminary description of factors relevant to need and desirability should be provided. This description should encompass feasible and reasonable alternatives to the proposed Tetra4 PR Extension activity. The actual assessment stages of the EIA process require a specific focus on need and desirability. This evaluation should incorporate specialist input and studies as deemed necessary.

The EIA Regulations have further solidified the need to consider "need for and desirability of the proposed activity." This consideration extends beyond socio-economic aspects to encompass the geographical, physical, biological, social, economic, and cultural aspects of the environment, as outlined in the Regulations. NEMA defines "evaluation" as the process of weighing information based on public values and preferences to reach a decision. This evaluation process requires integrating need and desirability into the analysis of all environmental impacts (both positive and negative) throughout the BA assessment.

Ultimately, determining the "best option" within the context of need and desirability necessitates a holistic consideration of all identified impacts. In this sense, need and desirability function as an impact summary for the proposed activity.

The needs and desirability analysis component of the "Guideline on need and desirability in terms of the EIA Regulations (Notice 819 of 2014)" includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.). Table 11 presents the needs and desirability analysis undertaken for the project.

Table 11: Needs and Desirability analysis for the Proposed Tetra4 Production Right Extension.

Ref No.	Question	Answer
1	**Securing ecological sustainable development and use of natural resources**	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	A number of specialist studies have informed this application and environmental impact assessment and include: • Soil and Agricultural Study • Terrestrial Biodiversity Study • Aquatic and Wetland Study These studies assisted in identifying any Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets and Ecological drivers of the ecosystem. Where sensitive species or ecosystem drivers were identified, relevant mitigation measures were put forward to prevent or minimise the impacts.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	The nature of this project does not cover an extensive area. The infrastructure associated with the exploration will be temporary. Where infrastructure is to be constructed or installed in natural areas, various measures are put forward to mitigate the impacts on biological diversity. The mitigation measures have been developed in consultation with the relevant specialists as mentioned above. Existing and future alien and invasive species will be controlled which will enhance the opportunities for indigenous and beneficial species in the environment.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	This development will generate various general and hazardous waste, the majority of which will be generated during the construction and operation (exploration) phase. The general waste will be stored in designated areas and through the process of recovery and recycling, the volume of general waste being disposed to landfill will be minimised. The hazardous portion of the waste stream will also be adequately stored prior to disposal at a suitably licenced hazardous waste disposal facility.
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided	A specialist heritage and palaeontological study has been commissioned in order to identify sites of cultural heritage or palaeontological significance. The identified sites including suitable buffers will be identified as highly sensitive / no-go areas to prevent adverse impacts in these areas.

Ref No.	Question	Answer
	altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	In addition to the above, a chance find procedure has been put forward by the specialist should any unidentified sites of cultural heritage or palaeontological significance be identified during the construction process.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	It is acknowledged that due to the nature of gas resources, an onshore (potentially non-renewable) gas resource will be depleted. Clumped isotope analyses conducted by the University of Edinburgh has confirmed that the gas is a mixture primarily composed of biogenic and abiogenic sources. This project offers significant benefits for extending production life, streamlining operations, and contributing to a sustainable helium supply, and contribute to the transition from dirtier energy production (coal) to renewable energy production in the future.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed project, by extending the production life, will provide an opportunity for South Africa to move away from dirtier energy (coal) while transitioning to a more renewable energy source. This can be translated into a “reduced dirty resource dependency”.
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	Exploration activities do not entail the consumption of the target resource beyond what is necessary for feasibility assessments. The potential long-term consequences of expanding the production area and intensifying helium exploration efforts will be carefully evaluated to ensure intergenerational equity. A focus on sustainable extraction methods and technological innovation will be adopted to mitigate resource depletion. Subsequent to the successful identification of viable exploration wells and the commencement of production, a comprehensive analysis of alternative resource utilization strategies will be undertaken to optimize resource allocation.
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The location, type and scale of the proposed PR extension will increase exploration opportunity and may lead to promoting of reduced dependency on the

Ref No.	Question	Answer
		importation of gas resources from other countries. It will further potentially contribute to an opportunity to reduce dependency on more harmful resources such as coal for energy production, if the exploration proves successful and wells are put in production. As such, this project should not be viewed in isolation in terms of resources but in a holistic manner both nationally and globally.
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	In order to prevent repetition, the reader is directed to the assumptions and limitations presented in Section 13.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk associated with extending production rights is influenced by geological uncertainties, technological limitations, potential environmental impacts, regulatory adequacy, and market volatility. A comprehensive risk assessment is essential to mitigate potential adverse consequences stemming from insufficient knowledge regarding subsurface conditions and resource potential.
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As preferred drilling locations cannot be accurately identified at this stage due to the nature of exploration activities (i.e. updated exploration model based on initial drilling to inform subsequent drilling), a strategic assessment of transects has been undertaken as part of this BA process in order to identify areas of high sensitivity and no-go areas. The sensitivity planning approach will guide the preferred placement of wells and other infrastructure and will additionally be guided by specific landowner consultations and negotiations. In this manner, a risk-averse and cautious approach is able to be more fully realised in future project planning.
1.9	**How will the ecological impacts resulting from this development impact on people's environmental right in terms following?**	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	The application and proposed development footprint occur predominantly on properties that are commercial agricultural concerns. The well placing will be discussed and agreed with each affected landowner prior to commencement of drilling and where necessary, appropriate compensation negotiated. Furthermore, as mentioned above, this BA process has been undertaken at a more strategic level assessment of the receiving environment within proposed development corridors which allows input from numerous specialist disciplines to identify highly sensitive or no-go areas which can then be excluded from development where necessary. The positive impact of job creation has been identified and the requirement for local upliftment in the form of employment creation or social programmes put forward.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	

Ref No.	Question	Answer
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	The impact on third party wellbeing, livelihoods and ecosystem services is not of a high negative significance as the predominant land use of the affected properties is commercial agriculture as mentioned above, and the site sensitivities from a socio-economic and biophysical point of view have been identified and / or mitigation measures put forward which must be considered prior to the final placement of infrastructure. Furthermore, landowner negotiations prior to final placement of infrastructure will additionally be undertaken to limit any negative impacts on human wellbeing, livelihoods and/or ecosystems.
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	As described above, this project is anticipated to have a low overall impact on the ecological integrity objectives or targets as consideration of these aspects will be undertaken prior to final placement of infrastructure.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Consultation with ecology and biodiversity experts has identified alternative borehole locations and mitigation measures to establish the proposed sites as the most environmentally suitable option.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to Section 9.12 of this report.
2	**Promoting justifiable economic and social development**	
2.1	**What is the socio-economic context of the area, based on, amongst other considerations, the following:**	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area,	Details of the IDP's for the Lejweleputswa District Municipality (LDM) as well as the Matjhabeng and Masilonyana Local Municipalities are included in Section 9.5.
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	This project will result in positive socio-economic impacts in the local, regional and national economy. Refer to the impact assessment in Section 9.12 in this report.

Ref No.	Question	Answer
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The proposed PR extension project will indirectly assist with increasing the gas production project which will ensure that the community projects initiated by Tetra4 under their Social and Labour Plan will also have an increased life. This will complement the local socio-economic initiatives identified for the area.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Tetra4 is currently in the process of providing certain basic services such as water and electricity to the Adamsons Vley community as part of the Social and Labour Plan commitments for their existing production project. This is an ongoing process throughout the project implementation and would be extended to other communities in due course and where possible. Focus group consultation with the Adamsons Vley community, the community members acknowledged that the water and solar electricity project was currently underway in their community. They have been provided with a new borehole, pump and storage tanks for water. In addition, solar PV for lighting is being installed on the houses. Should the Production right area extend and result in viable exploration boreholes put into production, there would be further opportunities for SLP upliftment in the long term.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	None of the identified impacts are anticipated to have a high negative impact significance post mitigation. It is therefore not anticipated that this project will result in negative equitable impact distribution in the short- and long-term.
2.5	**In terms of location, describe how the placement of the proposed development will:**	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	The proposed PR extension will promote further employment opportunities (to a limited extent) both locally and regionally. This project is not anticipated to have a material impact on the need for transport of people and goods or impact on access to public transport.
2.5.2	Reduce the need for transport of people and goods.	
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport),	
2.5.4	Compliment other uses in the area,	The incorporation of the two existing ERs will compliment the existing PR area.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.1 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	Not applicable. The proposed project is not located in an urban area.
2.5.7	Optimise the use of existing resources and infrastructure,	The incorporation of the two existing ERs will compliment the existing PR area and therefore will contribute to the existing activities and resources in the area.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	

Ref No.	Question	Answer
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	This project is located in a rural setting and is not anticipated to have an impact on or any control over urban sprawl in the nearby towns.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	Refer to items 2.5.7 – 2.5.9 of this table (above).
2.5.11	Encourage environmentally sustainable land development practices and processes	This project will have a minimal impact on the current land uses in the application area as the exploration drill pads (approximately 0.25 ha each). This will allow for existing land uses to continue while this gas development project is ongoing.
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	The two ERs have been identified as containing helium reserves, the viability of which will be confirmed upon exploration. Incorporating these areas into the Production Right will augment the overall resource base, potentially enhancing the project's economic viability and extending the operational life of the production facility.
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	As mentioned in 2.5.11 above, this project will not sterilise existing land uses and therefore it will in fact result in higher economic returns per land area as both agriculture and gas exploration can occur simultaneously.
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	A detailed Heritage Impact Assessment is included in this assessment which has identified numerous existing cultural and heritage sites which allows for their protection from negative impacts.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The proposed project will indirectly contribute to continued employment in the region, as well as projects implemented from Tetra4s SLP.
2.6	**How was a risk-averse and cautious approach applied in terms of socio-economic impacts:**	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Refer to Section 13 of this report.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is considered low as the project is not expected to have far reaching negative impacts on socio-economic conditions.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	Specific emphasis was placed on the potential socio-economic impacts. Engagements with affected communities and landowners were undertaken to understand the dynamic socio-economic environment and the risks associated with the project. Valuable feedback was received and thereafter specific conditions of the authorisation have been put forward to ensure that pre-emptive attention is given to these impacts at all times. In essence, no development is to take place on a particular property until such time as the landowner has been thoroughly

Ref No.	Question	Answer
		consulted, signed contracts in place and suitable compensation made for any adverse impacts on livelihoods.
2.7	**How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:**	
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the impact assessment in Section 9.12 of this report. Both positive and negative socio-economic impacts have been identified and relevant mitigation measures put forward to reduce negative impacts and enhance positive impacts as far as practicable.
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	The potential impact on existing land uses has been identified from the start of this application process and an assessment of this impact as well as mitigation measures put forward to prevent undue negative impacts in this regard. Refer to the impact assessment in Section 9.12 of this report.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Refer to the impact assessment in Section 9.12 of this report. The BA and EMPr will specify timeframes within which mitigation measures must be implemented.
2.13	**What measures were taken to:**	
2.13.1	Ensure the participation of all interested and affected parties.	

Ref No.	Question	Answer
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Notwithstanding the detailed description of the stakeholder consultation process included in Section 8 of this report, the consultation process has been undertaken in 3 languages (English, Afrikaans and Sesotho), published in newspaper advertisements, erection of 80 site notices (in all three languages), 21 posters, direct emails, faxes, SMSs and registered letters where contact information was available. Furthermore, public and focus group meetings will be undertaken in all 3 languages during the BA phase.
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Workers will be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, adequate measures will be undertaken to ensure that the appropriate personal protective equipment is issued to workers based on the areas that they work and the requirements of their job. Their right to refuse work (if considered dangerous) will be included in the education programme.
2.16	**Describe how the development will impact on job creation in terms of, amongst other aspects:**	
2.16.1	The number of temporary versus permanent jobs that will be created.	The PR extension project does not directly facilitate job-opportunites, however the associated exploration activities will be an opportunity for temporary and to a lesser degree, permanent jobs. Should a exploration well be deemed viable and put into production, it will contribute to the provide further employment opportunities. The exact number of workers to be appointed is not determined at
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	
2.16.3	The distance from where labourers will have to travel.	
2.16.4	The location of jobs opportunities versus the location of impacts.	

Ref No.	Question	Answer
2.16.5	The opportunity costs in terms of job creation.	this stage, however once exploration activities commence the number will be included in the relevant applications.
2.17	**What measures were taken to ensure:**	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The BA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified at various phases of the project by the EAP and any feedback received from government departments is considered where relevant.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Environmental attributes that may be impact by this project have been identified and where relevant, specialist input has been solicited to ensure that a rigorous impact assessment process is undertaken. Where positive impacts on the interests of the public have been identified (e.g. job creation, impact on existing land use, etc.), mitigation measures are put forward to enhance positive impacts and/or reduce negative impacts.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	The current Production Right EMPr construction mitigation measures have been tested in the real world as construction of current production sections has recently been completed. The BA specialist team has assessed these production areas and activities' management measures for adequacy and where relevant made amendments or additions. Furthermore, based on concerns raised by the affected landowners, additional measures have been put forward to strengthen measures and thereby reduce negative impacts.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	Tetra4 provides annual updates of their Production Right financial provisioning to the Competent Authority and the provision will be adjusted to reflect the additional activities associated with the PR extension costs.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 7 wherein a description of the process followed to reach the proposed preferred site.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the impact assessment and mitigation measures in Section 9.12 of this Report.

7 PROJECT ALTERNATIVES

A robust assessment of alternatives is a critical element for a successful Basic Assessment (BA) process. This section explores the concept of alternatives and their role in identifying the most environmentally responsible approach for this project.

The BA process requires the identification and evaluation of all reasonable and feasible alternatives. Screening these alternatives helps determine the course of action that minimizes negative impacts on the receiving environment. However, the identification of feasible alternatives for large-scale projects is not without limitations. Social, environmental, and financial constraints all play a role in shaping the spectrum of viable options.

There are several categories of alternatives commonly considered during a BA and are listed in Table 12 below.

Table 12: Project Alternative categories.

Category	Description
Activity Alternatives	These explore options that achieve the project's objectives through different fundamental activities. For instance, a renewable energy project might consider wind turbines as an alternative to solar panels.
Location Alternatives	This category explores alternative locations for the project that could potentially lessen environmental impacts. For example, siting a power plant away from sensitive ecological zones.
Design and Layout Alternatives	These alternatives focus on modifying the physical design or layout of the project to reduce environmental footprint. This could involve optimizing building footprints, minimizing land disturbance, or incorporating energy-efficient technologies.
Process Alternatives	This category explores different methods for achieving the project's goals. An example could be evaluating alternative construction techniques that minimize noise pollution or waste generation.
No-Go Alternative	This crucial alternative serves as a baseline scenario, representing the environmental conditions if the project does not proceed.

An essential criterion for a considered alternative is its ability to meet the project's core objectives without introducing significantly higher environmental impacts. In essence, alternatives represent various approaches to achieving the project's overall purpose and need. The BA process aims to identify the most suitable and feasible method of development through a comprehensive evaluation of all these alternatives, which will be discussed in detail in subsequent sections.

Alternatives can be further categorized as discrete or incremental. Discrete alternatives represent distinct development options typically identified during early project planning stages (pre-feasibility or feasibility). Incremental alternatives, on the other hand, often emerge during the BA process itself. These alternatives typically address specific environmental concerns identified during the assessment and are often closely linked to the development of mitigation measures. While incremental alternatives are not always presented as separate development options, they play a vital role in refining the project design to minimize environmental impact.

7.1 ACTIVITY ALTERNATIVES

Potential alternative land uses encompass agricultural practices such as crop rotation, pastureland, horticulture, and organic farming. Conservation and environmental objectives include habitat creation, carbon sequestration, recreational opportunities, and water conservation. Furthermore, renewable energy generation, educational initiatives, and research collaborations represent additional possibilities. The land use currently includes farming which provides great value in terms of food security. It is, however, achievable to develop the exploration activities in tandem with the current land-use practices. This can be achieved through the co-design of infrastructure, primarily located underground, allowing above ground activities such as agriculture to continue with minimal to no impact. The footprint of disturbance is small and should not interrupt the ongoing activities. Furthermore, Tetra4 is a production company and doesn't engage in other development activities. As such, no other activity alternatives are considered feasible.

7.2 LOCATION ALTERNATIVES

Location alternatives can apply to the entirety of both ER32 and ER94 study areas (e.g. the strategic decision to locate the proposed exploration development in the Free State within the Lejweleputswa District where there is an existing Production Right held by Tetra4). Tetra4 currently holds an approved PR (12/4/1/07/2/2) which spans approximately 187 000 hectares to develop gas fields around the town of Virginia in the Free State Province. Location alternatives can be considered from a macro- or microscale. From a macro location perspective, the production is driven by the presence of the target resource and therefore this activity cannot be undertaken in other areas due to the absence of the target resource). Microscale alternatives will be determined once consultation feedback from landowners have been received and will be included in the BAR.

In summary, the location of the proposed drilling collars must be within the approved Production Right area, including the ER32 and ER94 (once incorporated). Therefore, an entirely different location within South Africa is not a feasible macro-alternative that can be further interrogated.

7.3 LAYOUT ALTERNATIVES

Design and layout alternatives ensure the consideration of different design and spatial configurations of the proposed development within a specific location, to enhance the positive impacts and to reduce the negative impacts. The proposed exploration activities associated with the Production Right Extension project is foremost guided by the location of existing gas bearing geological fractures/faults (well transects). The layout of surface infrastructure, access roads, and associated surface structures will undergo a micro siting exercise whereby environmental features on site as well as current land-uses, and infrastructure are considered towards ensuring that the proposed project activities avoid areas of high environmental sensitivity and minimise infringement on existing infrastructure and land-use as much as possible.

7.4 PROCESS ALTERNATIVES

Process alternatives imply the investigation of alternative processes or technologies that can be used to achieve the same goal for the proposed gas production development. This includes using environmentally friendly designs or materials and reusing scarce resources like water and non-renewable energy sources. Once exploration activities commence, it is likely that the same processes will be followed as per the exploration within the existing Production Right area.

An alternative to traditional sump-based drilling fluid management is the implementation of pitless drilling systems. Conventional drilling operations involve the circulation of drilling fluids through the wellbore, with subsequent deposition of fluids and cuttings in a reserve pit. In contrast, pitless drilling utilizes closed-loop systems comprising storage tanks, solid-liquid separation equipment (such as screen shakers, hydrocyclones, and centrifuges), and waste collection mechanisms. This approach significantly reduces the volume of drilling waste requiring disposal and maximizes fluid recycling. Generated waste is transported to licensed facilities for appropriate management.

Pitless drilling systems offer several advantages over traditional methods. Primarily, they eliminate the environmental and safety hazards associated with reserve pits. Additionally, they reduce operational costs, minimize land disturbance, and mitigate risks to wildlife and infrastructure. By significantly decreasing water consumption, waste generation, and transportation requirements, pitless drilling systems can enhance community relations and potentially create opportunities for beneficial reuse of drilling byproducts. Where practicable and feasible, Tetra4 will consider the use of pitless drilling during the exploration activities.

7.5 NO-GO ALTERNATIVES

The “No Go” or “No Action” alternative refers to the alternative of not embarking on the proposed project at all. This alternative would imply that the current status quo without the proposed Production Rights Extension project and associated exploration activities would continue (albeit the existing Tetra4 production operation within the Production Rights area would continue). It is important to note that the No Go alternative is the baseline against which all other alternatives and the development proposal are assessed

When considering the No Go alternative, the impacts (both positive and negative) associated with any other specific alternative, or the current project proposal would not occur and in effect the impacts of the No Go alternative are therefore inadvertently assessed by assessing the other alternatives. In addition to the direct implications of retaining the status quo there are certain other indirect impacts, which may occur should the No Go alternative be followed. The No Go alternative as a specific alternative is not considered feasible and has been scoped out at this BA phase assessment.

8 STAKEHOLDER ENGAGEMENT

The Public Participation Process (PPP) is a requirement of several pieces of South African legislation and aims to ensure that all relevant Interested and Affected Parties (I&APs) are consulted, involved and their comments are considered, and a record included in the reports submitted to the Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed project needs to be managed sensitively and according to best practises to ensure and promote:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establishment and management of relationships with key stakeholder groups; and
- Involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed project;
- Explain the authorisations required;
- Explain the environmental studies already completed and yet to be undertaken (where applicable);
- Solicit and record any issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&APs and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

8.1 GENERAL APPROACH TO PUBLIC PARTICIPATION

Following the principles of Integrated Environmental Management (IEM), this Basic Assessment Report incorporates stakeholder engagement throughout the process. IEM emphasizes the importance of integrating environmental considerations into all development stages, aiming for a balance between conservation and development. Stakeholder engagement aligns with this philosophy by fostering informed and inclusive decision-making.

This project will involve various stakeholders whose interests and concerns should be considered. Proactive engagement allows for the identification of potential environmental and social impacts early on, facilitating mitigation measures and fostering project acceptance.

Table 13 provides specific examples of stakeholder engagement opportunities throughout the Basic Assessment process. EIMS and Tetra4 makes use predominantly of public meetings and media engagements (newspaper advertisements etc.). These examples will demonstrate how engagement extends beyond the traditional BA and contributes to a more comprehensive understanding of the project's potential impacts.

By actively engaging stakeholders, this project aims to achieve a balanced approach that considers environmental, social, and economic factors while ensuring transparency and open communication.

Table 13: Examples of stakeholder engagement opportunities.

Public Meetings and Information Sessions	Organize open meetings or information sessions at convenient locations to present the project details, potential impacts, and mitigation measures. This allows for public questions and feedback.
Focus Group Discussions	Facilitate smaller discussions with targeted stakeholder groups (e.g., residents, community leaders, environmental NGOs) to delve deeper into specific concerns and gather in-depth feedback.
One-on-One Meetings	Schedule individual meetings with key stakeholders who may have unique perspectives or require additional project information.
Surveys and Questionnaires	Distribute surveys or questionnaires to gather broader stakeholder input on the project and its potential impacts.
Project Website and Information Hotline	Establish a dedicated project website or hotline to provide ongoing project updates, receive comments, and address stakeholder queries.
Community Liaison Committee	Consider forming a committee with representatives from potentially impacted communities to maintain a continuous dialogue and address concerns throughout the project lifecycle.
Media Engagement	Issue press releases and hold media briefings to keep the broader public informed about the project and its progress.
Social Media Engagement	Utilize social media platforms to share project updates, answer questions, and facilitate online discussions with stakeholders.

An initial I&AP database has been compiled based on known key I&AP's and stakeholder databases available from existing sources. The I&AP database includes amongst others, adjacent landowners, rights holders, communities, regulatory authorities and other special interest groups.

8.1.1 LIST OF PRE-IDENTIFIED ORGANS OF STATE / KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

Pre-identified Key Stakeholders were notified of the proposed project and include:

- Pre-identified and registered landowners and surrounding landowners
- Afgri
- Afgri Agri Services
- African Conservation Trust
- AfriForum
- Agri Free State
- Agri SA
- BirdLife South Africa
- Botanical Society
- Centre for Environmental Rights
- Conservation South Africa (CSA)
- Council of Geoscience
- Endangered Wildlife Trust
- Federation for a Sustainable Environment
- George Heritage Trust
- Greenpeace Africa
- Simon Van De Stel Foundation Southern Cape
- Tara Wildlife SA
- VEJA
- Wildlife and Environment Society of South Africa (WESSA)
- World Wildlife Fund
- Mining Affected Communities United in Action (MACUA)
- Mining and Environmental Justice Community Network of South Africa

Pre-identified authorities were notified of the proposed project and include:

- Free State Department of Agriculture & Rural Development
- Free State Department of Cooperative Governance and Traditional Affairs
- Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs
- Free State Department of Mineral Resources and Energy
- Free State Department of Police, Roads and Transport
- Free State Department of Public Works and Infrastructure
- Free State Department of Water and Sanitation
- Free State Development Corporation
- Free State Heritage Resources Authority
- Free State Provincial Shared Services Centre (PSSC) Offices
- Masilonyana Local Municipality
- Matjhabeng Local Municipality
- National Department of Agriculture Land Reform and Rural Development
- National Department of Forestry, Fisheries and Environment
- National Department of Transport
- National Department of Water and Sanitation
- Regional Department of Water and Sanitation, Bloemfontein, Free State.
- National Energy Regulator of South Africa
- National House of Traditional Leaders

- National Transmission Company of South Africa SOC (Ltd)
- Presidential Climate Change Commission
- Sedibeng Water
- South African Civil Aviation Authority
- South African Heritage Resources Agency (SAHRA)
- South African National Biodiversity Institute
- South African National Parks
- South African National Roads Agency Limited
- Transnet SOC Limited
- Ward Councillors:
    - Nala Ward 10
    - Matjhabeng Wards 36, 10, and 35
    - Masilonyana Ward 6

8.2 INITIAL NOTIFICATION

The PPP commenced on the 4th of June 2024 with an initial notification and call to register for a period of 30 days. This section details the comprehensive stakeholder engagement strategy employed to notify Interested and Affected Parties (I&APs) regarding the proposed project and its associated Basic Assessment (BA) process. A multi-pronged approach was implemented, utilizing various communication channels to reach a wide audience. This included distributing notification letters, newspaper advertisements, and site notices in multiple languages. Additionally, posters were placed at public locations to ensure maximum outreach and opportunity for public participation.

8.2.1.1 REGISTERED LETTERS, FAXES AND EMAILS

Notification letters (English, Sesotho and Afrikaans), faxes, and emails were distributed to all pre-identified key I&APs including government organisations, NGOs, relevant municipalities, ward councillors, landowners and other organisations that might be affected.

The notification letters included the following information to I&APs:

- List of anticipated activities to be authorised;
- Scale and extent of activities to be authorised;
- Information on the intended reconnaissance operation to enable I&APs to assess/surmise what impact the activities will have on them or on the use of their land;
- The purpose of the proposed project;
- Details of the affected properties (including details of where a locality map could be obtained);
- Details of the relevant regulations;
- Initial registration period timeframes; and
- Contact details of the EAP.

The notification letters were sent to existing Tetra4 stakeholders within our database.

8.2.1.2 NEWSPAPER ADVERTISEMENT / GOVERNMENT GAZETTE

Advertisements detailing the proposed project and the associated Basic Assessment (BA) process were placed in newspapers circulated within the project's study area. The initial advertisements were placed in the Vista Newspaper of the Welkom region and its surrounding districts on the 30th of May 2024, as well as the National Gazette on the 14th of June 2024. The adverts included the following information:

- Project name;

- Applicant name;
- Project location;
- Nature of the activity and application; and
- Relevant EIMS contact person for the project.

8.2.1.3 SITE NOTICE AND POSTER PLACEMENT

Eighty (80) A1 Correx site notices and Twenty-one (21) posters (in English, Afrikaans, and Sesotho) were placed at 80 locations along and surrounding the perimeter of the proposed project study area from the 26th to the 29th of May 2024. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Project description;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

Comments/concerns and queries were encouraged to be submitted in either of the following manners:

- Electronically (fax, email);
- Telephonically; and/or
- Written letters.

8.2.1.4 AVAILABILITY OF BA REPORT

Notification regarding the availability of this BA Report for public review will be given in the following manner to all registered I&APs (which includes key stakeholders and landowners):

- Registered letters with details on where the report can be obtained and/or reviewed, public meeting date and time, EIMS contact details as well as the public review comment period;
- Facsimile notifications with information similar to that in the registered letter described above; and/or
- Email notifications with a letter attachment containing the information described above.

The BA report was made available for public review from 30th of July until 31st of August 2024. Hard copies of the report were made available at the following venues:

- Theunissen Library (Corner Leroux and Piensaar Street, Theunissen, Free State, 9410).
- Welkom City Library (Corner Tulbagh & Reinett Streets, Welkom, Free State, 9460).
- Allanridge Public Library (53 Caledon & Lauchan Street, Allanridge, Free State, 9490).

The report was also available for review and download at www.eims.co.za, as well as on a data-free website.

8.3 PUBLIC PARTICIPATION PROGRESS

All comments and/or queries received to date have been addressed in a transparent manner and are included in the Public Participation Report (Appendix 2), the comments received so far involve parties requesting additional information on the project and to be registered on the I&APs database. A list of the comments and/or

queries as well as the responses are provided in the accompanying documents in Appendix 2. Please note that where relevant, personal information was omitted from the public domain due to the restrictions imposed by the Protection of Personal Information Act (Act 4 of 2013 - POPIA).

9 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section of the BA Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area and specialist baseline assessments.

9.1 TOPOGRAPHY

The topography of the ER32 area is generally flat and can be classified as a central interior plain or plateau. The majority of the area consists of Aeolian Sand, prone to erosion, giving rise to the flatter landscape. The topographical elevation averages at 1300 mamsl across the whole area.

The topography of the ER94 area is generally flat and can be classified as slightly less flat with predominantly more gently sloping hills. Large dolerite intrusions are observed throughout the ER94 study area and because of its relative resistance to erosion, the Karoo dolerite sheets generally give rise to very prominent high-standing topographic features. The landscape gradually flattens out towards the lower laying drainage system in the north-west (approximate elevation low of 1280 mamsl), while the southern and south-eastern perimeters are shaped by scattered outcrops with a regional topographical high point recorded as 1470 mamsl.

The lowest topographical elevation on-site is recorded as ~1390 mamsl which is situated towards the western border where the Schoemanspruit enters and exists the ER94 boundary and form part of the on-site drainage system. The highest topographical point recorded on site is approximately 1470 mamsl and forms part of the quaternary catchment boundary and groundwater/ surface water divide to the southern and south-western portion of the study area. On-site gradients are variable, but generally gentle with the average slope calculated at ~0.9 % and an elevation loss of 134 m over a lateral distance of 17 km in a northeastern-southwestern direction.

Figure 11 below shows the topography of the application area, as can be seen the topography becomes more prominent towards the south. The topography to the north, however, becomes more homogenous, both areas' topography dips downwards toward the Sand River that runs across the PR area.

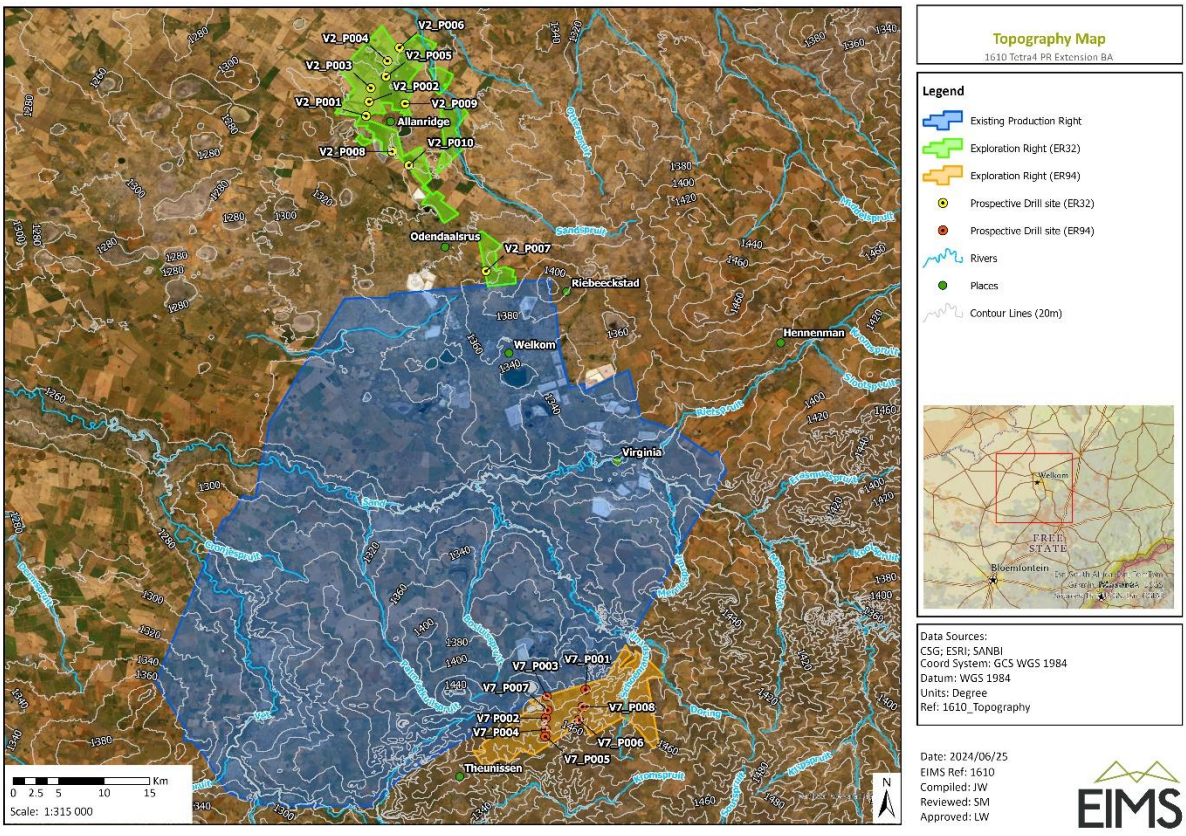

Figure 11: Topography of Application Area.

9.2 DRAINAGE AND CATCHMENT

ER32 and ER94 are both situated in primary catchment (C) of the Vaal River drainage system which covers a total area of approximately 246 674.5 km^2. The resource management falls under the Vaal Water Management Area (WMA5) which spans portions of the North West Province, northern Free State as well northern sections of the Northern Cape.

The application area is situated within quaternary catchments C25B (nett surface area of 1891.0 km^2), C41G (nett surface area of 272 km^2), and C42K (nett surface area of 669 km^2) and falls within hydrological zone E and has an estimated mean annual runoff (MAR) of between 10 to 13 mcm (million cubic metres) (WR, 2012). The hydrology of the region is characterised by predominately perennial watercourses with the regional drainage occurring in a general west to north-western direction via the Sandspruit river (traversing ER32 and ER94) and Doring river (traversing ER94). Major surface water features being fed by the drainage system(s) of this quaternary catchment include the Bloemhof Dam situated <100 km to the northwest of Welkom.

9.3 CLIMATE

The study area's rainfall is strongly seasonal, and the weather pattern reflects a typical summer rainfall region, with > 80 % of precipitation occurring as convective thunderstorms from October to March. Patched rainfall and evaporation data were sourced from the WR2012 database (Rainfall zone 4C4) and span a period of some 90 years (1920 – 2009). The calculated mean annual precipitation (MAP) for this rainfall zone is 521 mm/a, with the 5th percentile of the data set (roughly equivalent to a 1:20 year drought period) calculated at 343.38 mm/a while the 95th percentile (representing a 1:20 flood period) is calculated at 752.43 mm/a. The highest MAP for the 90 years of rainfall data was recorded as 860.3 mm (1942) while the lowest MAP of 264 mm was recorded during 2006.

Both catchment areas are categorised under evaporation zone 19C which have a mean annual evaporation (s-pan) ranging between 1600 mm/a to 1680 mm/a. The highest evaporation is usually experienced in December

(215 mm) while the lowest evaporation is in June (61 mm). The peak rainfall months are December and January, and the annual evaporation volumes are more than threefold the annual precipitation.

9.4 CLIMATE CHANGE

Greenhouse gas (GHG) emissions are categorized into three scopes to provide an overview of an organization's carbon footprint.

- Scope 1 emissions are direct GHG emissions from owned or controlled sources within an organization's operations. This includes emissions from on-site combustion, vehicle fleets, and fugitive emissions from equipment.
- Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling consumed by an organization. These emissions occur at the source of energy generation.
- Scope 3 emissions encompass all other indirect GHG emissions that occur in the value chain of the organization, both upstream and downstream. These emissions can arise from various activities such as transportation and distribution, waste disposal, and the production of purchased goods and services.

This section will focus on Scope 1 emissions, as these represent the predominant greenhouse gas emissions associated with the exploration phase. While Scope 2 emissions are more relevant to the gas production phase. Scope 3 data is currently insufficient for analysis, a comprehensive evaluation of these categories will be considered for future assessments.

9.4.1 PHYSICAL RISKS OF CLIMATE CHANGE ON THE REGION

In 2017 the South African Weather Service (SAWS) published an updated Climate Change Reference Atlas (CCRA) based on Global Climate Change Models (GCMs) projections (SAWS, 2017). It must be noted that as with all atmospheric models there is the possibility of inaccuracies in the results as a result of the model's physics and accuracy of input data; for this reason, an ensemble of models' projections is used to determine the potential change in near-surface temperatures and rainfall depicted in the CCRA. The projections are for 30-year periods described as the near future (2036 to 2065) and the far future (2066 to 2095). Projected changes are defined relative to a historical 30-year period (1976 to 2005). The Rossby Centre regional model (RCA4) was used in the predictions for the CCRA which included the input of nine GCMs results. The RCA4 model was used to improve the spatial resolution to 0.44° x 0.44°- the finest resolution GCMs in the ensemble were run at resolutions of 1.4° x 1.4° and 1.8° x 1.2°.

Two trajectories are included based on the four Representative Concentration Pathways (RCPs) discussed in the IPCC's fifth assessment report (AR5) (IPCC, 2013). RCPs are defined by their influence on atmospheric radiative forcing in the year 2100. RCP4.5 represents an addition to the radiation budget of 4.5 W/m2 as a result of an increase in GHGs. The two RCPs selected were RCP4.5 representing the medium-to-low pathway and RCP8.5 representing the high pathway. RCP4.5 is based on a CO2 concentration of 560 ppm and RCP8.5 on 950 ppm by 2100. RCP4.5 is based on the expectation that current interventions will reduce GHG emissions and that it will be sustained (after 2100 the concentration is expected to stabilise or even decrease). RCP8.5 is based on no interventions implemented to reduce GHG emissions (then after 2100 the concentration is expected to continue to increase).

9.4.1.1 **RCP4.5 TRAJECTORY**

Based on the median, for the region in which the proposed facility and communities are situated, the annual average near surface temperatures (2 m above ground) are expected to increase by between 1.5°C and 2.0°C for the near future and between 2.0°C and 2.5°C for the far future. The seasonal average temperatures are expected to increase for all seasons, in the same order as the annual average increases, with slightly larger temperature increases in autumn (March to May) and larger increases in spring (September to November). The total annual rainfall is expected to increase by between 5 mm and 10 mm for the near future and decrease by up to 20 mm in the far future. Seasonal rainfall is expected to increase in summer (December to February) up to 30mm in the near- and far future, while other seasons are likely to show decreases between 5 and 10 mm.

9.4.1.2 **RCP8.5 TRAJECTORY**

Based on the median, the region in which the proposed facility and communities are situated, the annual average near surface temperatures (2 m above ground) are expected to increase by between 2.0°C and 2.5°C for the near future and between 5.0°C and 5.5°C for the far future. The seasonal average temperatures are expected to increase for all seasons in similar ranges to the annual average temperature, with higher increases in spring, summer, and autumn. The total annual rainfall change is likely to increase by between 20 and 30 mm, while it is more uncertain for the far future with potential decrease up to 5 mm. Seasonal rainfall changes could see an increase of 5 mm in spring and summer in the near future with decreased up to 10 mm in autumn and winter. In the far future, the seasonal the rainfall changes are similar to the near future, except in summer where increased rainfall could be up to 50 mm.

9.4.2 WATER STRESS AND EXTREME EVENTS

South Africa is known to be a water stressed country (Kusangaya, 2017), but Welkom/Virginia falls within a low water- stress and depletion zone. It falls in a Low-Medium interannual variability but with a Medium-High seasonal variability, leading to a Medium-High drought risk. Climate change, through elevated temperatures, is likely to increase evaporation rates and decrease water volumes available for dryland and irrigated agriculture (Davis-Reddy, 2017). Commercial agriculture (crop and livestock farming) is the predominant agricultural land-use in the vicinity of Welkom, Allanridge and Theunissen.

Extreme weather events affecting southern Africa, including heat waves, flooding due to intensified rainfall due to large storms and drought, have been shown to increase in number since 1980 (Davis-Reddy, 2017). Projections indicate (Davis-Reddy, 2017):

- With high confidence, that heat wave and warm spell duration are likely to increase while cold extremes are likely to decrease, where up to 80 days above 35°C are projected by the end of the century under the RCP4.5 scenario;
- With medium confidence, that droughts are likely to intensify due to reduced rainfall and/or an increase in evapotranspiration; and
- With low confidence, that heavy rainfall events (more than 20 mm per 24 hours) will increase.

9.4.3 SOUTH AFRICA CONTRIBUTION TO GREENHOUSE GASES

South Africa's heavy reliance on coal for electricity generation positions it as one of the world's top 15 greenhouse gas (GHG) emitters. Net emissions in 2021 were calculated at 392 Mt of CO2-e. The energy sector accounts for approximately 83% of total emissions, with energy industries and transportation identified as the primary sources (IEA, 2024). South Africa contributes approximately 1.2% to global greenhouse gas (GHG) emissions (IEA, 2024). While this might seem relatively small, it's important to note that the country is a significant emitter on a per capita basis, and its reliance on coal for electricity generation makes it a key player in the global climate change discourse. Figure 12 shows the trends of CO_2 produced by burning coal, oil and Natural gas within South Africa.

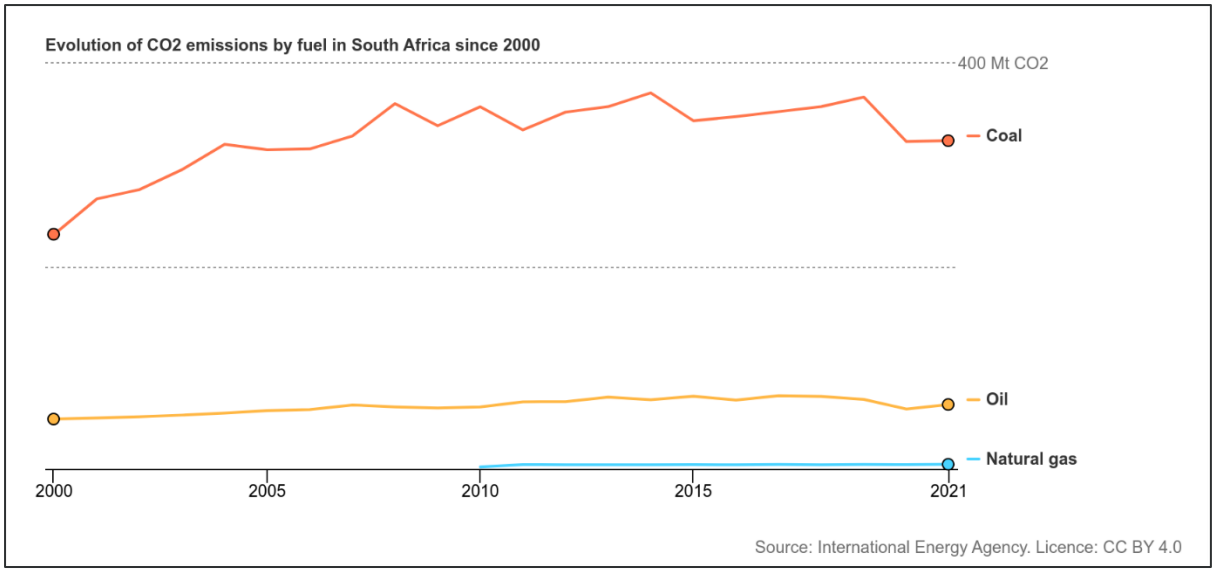

Figure 12: Evolution of CO_2 emissions by fuel in SA since 2000.

While South Africa contributes approximately 2% to global GHG emissions, it is imperative to recognize that unilateral reduction of these emissions is insufficient to prevent the 1.5°C temperature increase. Climate change is a global challenge necessitating a collective response. Although every nation's contribution is significant, the scale of the issue demands concerted efforts from all major emitters. GHG emissions are a global externality, with emissions in any region contributing to overall atmospheric concentrations. Furthermore, the cumulative impact of GHG, rather than emission rates at specific points in time, determines the overall climate effect. Other factors, such as deforestation, land use changes, and industrial processes, also contribute to climate change. While South Africa can play a vital role in mitigating climate change, international collaboration is indispensable to achieve the ambitious target of limiting global warming to 1.5°C.

9.4.4 CLEARING AND REHABILITATION – CARBON SEQUESTRATION AND CARBON SINK

The process of accounting for carbon absorbed by plants, soils, and water bodies is termed carbon sequestration, with these entities collectively referred to as carbon sinks. However, quantifying the rate of carbon sequestration is a complex endeavour that requires comprehensive data on geographical location, climatic conditions (specifically temperature and humidity), and predominant plant species (Ravin & Raine, 2007). It is essential to acknowledge that the carbon sequestration potential of agricultural lands, characterized by monocropping and livestock grazing, is considerably lower than that of natural grasslands.

Photosynthesis constitutes the primary carbon sequestration process within forest and soil ecosystems. Carbon is assimilated and stored in plant tissues, including roots, trunks, branches, and leaves. While a portion of this carbon is released through leaf litter and biomass decomposition, forests serve as significant carbon sinks. The capacity of trees to sequester carbon is influenced by several factors, such as species, size, and age. Notably, mature trees exhibit higher carbon absorption rates compared to saplings (Ravin & Raine, 2007).

Calculating changes in carbon stocks requires considering factors such as climate, vegetation types, land management practices, and soil properties. While the carbon losses associated with clearing undisturbed grassland for infrastructure development can be estimated using methodologies such as "decomposition of soil organic matter in drained inland grassland", these estimates may overestimate carbon losses for agricultural lands. It is crucial to recognize that the project involves the clearing of predominantly agricultural land, rather than pristine grassland, and to employ appropriate methodologies for assessing carbon impacts. It should be noted that carbon losses apply to the replacement of vegetation with built infrastructure, except where temporary clearing activities could have long-term impacts on water resources, including rivers, aquifers, streams, and wetlands, or water infrastructure (for example dams and storm water systems) (Government Gazette No. 44761, Notice 559, 25 June 2021), where in this case, vegetation is likely to recover over the drill

pad areas during rehabilitation. The areas to be cleared include the 18 drill pads with an area of 2 500 m^2 for each drill pad site, therefore 45 000 m^2 in total will be cleared.

9.4.5 CONSTRUCTION FUEL COMBUSTION

There will be an initial carbon sink loss due to the vegetation removal for the proposed drilling locations and Production Right expansion. GHG will also be emitted through operating diesel-powered mobile and stationary equipment to power the equipment used in the exploration / drilling activities.

9.4.6 OPERATIONS

The main sources of GHG due to the proposed operations are the mobile (trucking) and stationary equipment (generators). Emissions from the gas processing (fugitives, flaring and raw CO^2 venting) are also included as a source, and although it is applicable to both exploration and production phases, it will have lesser / shorter impacts in the exploration phase.

9.4.7 DECOMMISSIONING

As operations progress, the previously cleared areas that form part of the project will be rehabilitated resulting in a carbon sink gain. Even assuming rehabilitation uses the same indigenous vegetation, the carbon balance will not be completely restored. There may also be potential soil degradation due to stockpiling. However, there is insufficient data at this point to determine the decommissioning GHG emissions. This is likely to be equivalent or less than the construction phase, with the reestablishment of a carbon sink in the revegetation of the site.

9.5 SOCIO-ECONOMIC

According to NEMA, environment refers to the surroundings in which humans exist. When viewing the environment from a socio-economic perspective the question can be asked what exactly the social environment is. Different definitions for social environment exist, but a clear and comprehensive definition that is widely accepted remains elusive. (E & A, 2001) offers the following definition of human social environment:

“Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labour markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community. The social environment subsumes many aspects of the physical environment, given that contemporary landscapes, water resources, and other natural resources have been at least partially configured by human social processes. Embedded within contemporary social environments are historical social and power relations that have become institutionalized over time. Social environments can be experienced at multiple scales, often simultaneously, including households, kin networks, neighbourhoods, towns and cities, and regions. Social environments are dynamic and change over time as the result of both internal and external forces. There are relationships of dependency among the social environments of different local areas, because these areas are connected through larger regional, national, and international social and economic processes and power relations.”

Environment-behaviour relationships are interrelationships (Bell, 1996). The environment influences and constrains the behaviour of people, but behaviour also leads to changes in the environment. The impacts of a project on people can only be truly understood if their environmental context is understood. The baseline description of the social environment includes a description of the area within a provincial, district and local context that will focus on the identity and history of the area as well as a description of the population of the area based on a number of demographic, social and economic variables.

9.5.1 DESCRIPTION OF THE AREA

The proposed project area is located near the town Welkom in the Free State Province, South Africa. The Exploration Right (ER32), located north of the Production Right, is approximately 7.2 km Northwest of Welkom and the Exploration Right (ER94), located to the south of the Production Right, is approximately 19.2 km South

of Virginia. The locality of the project area is shown in Figure 3. ER32 is situated within the Matjhabeng local municipality and ER94 is located within the Masilonyana local municipality.

9.5.2 LEJWELEPUTSWA DISTRICT MUNICIPALITY

The Lejweleputswa District Municipality (LDM) is situated in the north western part of the Free State and borders the North West Province to the north; the Fezile Dabi and Thabo Mofutsanyane District Municipalities to the north-east and east respectively; the Xhariep District Municipality and Mangaung Metropolitan Municipality to the south; and the Northern Cape Province to the west. The LDM is accessible from Johannesburg, Cape Town, Klerksdorp and Kimberley through one of South Africa's main national roads, the N1. The district covers an area of 32 286 km^2 and make up almost a third of the Free State province. It consists of the Masilonyana, Matjhabeng, Nala, Tokologo and Tswelopele Local Municipalities.

The economy of the district relies heavily on the gold mining sector which is dominant in the Matjhabeng and Masilonyana Local Municipalities (Lejweleputswa District Municipality, 2017-2022). The mining sector is on a downward trend and many businesses that have traditionally depended on the mining sector have either closed down are in the process of closing down. The other municipalities are dominated by agriculture.

9.5.3 MATJHABENG LOCAL MUNICIPALITY

The main towns in the Matjhabeng Local Municipality are Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg (www.matjhabeng.fs.gov.za). The economy of the municipality is centred on mining activities in and around Welkom, Allanridge, Odendaalsrus and Virginia. Manufacturing aimed at the mining sector exists to a limited extent in the aforementioned towns, with other activities being limited. Other main economic sectors include manufacturing, tourism, agriculture, gold jewellery, transportation (logistics), and retail (Matjhabeng Local Municipality, 2022/2023).

9.5.4 MASILONYANA LOCAL MUNICIPALITY

The main towns in the Masilonyana Local Municipality are Theunissen, Brandfort, Winburg, Verkeerdevlei and Soutpan (www.masilonyana.fs.gov.za). It is a semi-rural municipality that is dependent on agriculture and mining as the key drivers of its economy (Masilonyana Local municipality, 2019/2020). In 2016 the mining sector contributed about 52.4 % to the municipality's economic output, but only about 8 % of the employment in the municipality. With the decline in the mining sector the municipality plans to turn its focus on tourism. The municipality prides itself on its tourism destinations.

9.5.5 DESCRIPTION OF THE POPULATION

The baseline description of the population will take place on three levels, namely provincial, district and local. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the Matjhabeng Local Municipality and the Masilonyana Local Municipality in the Lejweleputswa District Municipality in the Free State Province (referred to in the text as the study area), as these are the areas that will be most affected by the proposed project. The data used for the socio-economic description was sourced from Census 2022. Census 2022 was a de facto census (a census in which people are enumerated according to where they stay on census night). The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

The following points regarding Census 2022 must be kept in mind (www.statssa.co.za):

- Comparisons of the results of labour market indicators in the post-apartheid population censuses over time have been a cause for concern. Improvements to key questions over the years mean that the labour market outcomes based on the post-apartheid censuses must be analysed with caution. The differences in the results over the years may be partly attributable to improvements in the questionnaire since 1996 rather than to actual developments in the labour market. The numbers published for the 1996–2022 censuses are therefore not comparable over time and are different from those published by Statistics South Africa in the surveys designed specifically for capturing official labour market results.

- For purposes of comparison over the period 1996–2022, certain categories of answers to questions in the censuses of 1996–2022, have either been merged or separated.
- The tenure status question for 1996 has been dropped since the question asked was totally unrelated to that asked thereafter. Comparisons for 2011-2022 do however remain.
- All household variables are controlled for housing units only and hence exclude all collective living arrangements as well as transient populations.
- When making comparisons of any indicator it must be considered that the time period between the first two censuses is five years and that between the second and third census is ten years, and finally between that latest two is 11 years. Although Census captures information at one given point in time, the period available for an indicator to change is different.

9.5.6 POPULATION AND HOUSEHOLD SIZES

According to the Community Survey 2016, the population of South Africa is approximately 55,7 million and has shown an increase of about 7.5 % since 2011. The household density for the country is estimated on approximately 3.29 people per household, indicating an average household size of 3-4 people (leaning towards 3) for most households, which is down from the 2011 average household size of 3.58 people per household. Smaller household sizes are in general associated with higher levels of urbanisation.

The greatest increase in population since 2011 has been on local level (Table 14), but still lower than the national average. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km^2 in 2011 to 45.63 people per km^2 in 2016. In the study area the population density has increased since 2011 with the highest density in the Matjabeng LM.

Table 14: Population Densities within Municipalities.

Area	Size in km^2	Population (2011)	Population (2016)	Population density (2011)	Population density (2016)	Growth in population (%)
Free State Province	129,825	2,745,590	2,834,714	21,15	21,83	3,25
Lejweleputswa DM	31,930	627,626	649,964	19,66	20,36	3,56
Matjhabeng LM	5,155	406,461	428,843	78,85	83,19	5,51
Masilonyana LM	6,796	63,334	66,084	9,32	9,72	4,32

The number of households in the study area has increased on all levels (Table 15). The proportionate increase in households were greater than the increase in population on all levels and exceeded the growth in households of 12.3 % on a national level. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 15: Household sizes within Municipalities.

Area	Households (2011)	Households (2016)	Average household size (2011)	Average household size (2016)	Growth in households (%)
Free State Province	823,316	946,639	3.33	2.99	14.98
Lejweleputswa DM	183,163	219,014	3.43	2.97	19.57
Matjhabeng LM	123,195	149,021	3.30	2.88	20.96
Masilonyana LM	17,575	22,802	3.60	2.90	29.74

The total dependency ratio is used to measure the pressure on the productive population and refer to the proportion of dependents per 100 working-age population. As the ratio increases, there may be an increased burden on the productive part of the population to maintain the upbringing and pensions of the economically dependent. A high dependency ratio can cause serious problems for a country as the largest proportion of a government's expenditure is on health, social grants and education that are most used by the old and young population.

The total dependency ratio in the Masilonyana LM is higher than on district or provincial level (Table 16), while in the Matjhaneng LM the total dependency ratio is lower that on district or provincial level. The same trend applies to the youth, aged and employment dependency ratios. Employed dependency ratio refers to the proportion of people dependent on the people who are employed, and not only those of working age. The employed dependency ratio for the Matjhabeng LM is lower than on district and provincial level, while for the Masilonyana LM it is higher. This suggests high levels of poverty in the Masilonyana area.

Table 16: Dependencies with the Municipalities.

Area	Total dependency	Youth dependency	Aged dependency	Employed dependency
Free State Province	52.88	44.48	8.39	76.34
Lejweleputswa DM	51.33	43.71	7.61	77.16
Matjhabeng LM	46.93	40.09	6.85	75.46
Masilonyana LM	54.99	45.99	9.00	82.14

Poverty is a complex issue that manifests itself in economic, social and political ways. To define poverty by a unidimensional measure such as income or expenditure would be an oversimplification of the matter. Poor people themselves describe their experience of poverty as multidimensional. The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting and cooking, water access, sanitation, dwelling type, asset ownership and unemployment.

The poverty headcount refers to the proportion of households that can be defined as multi-dimensionally poor by using the SAMPI's poverty cut-offs (Statistics South Africa, 2014). The poverty headcount has increased on all levels since 2011 (Table 17), indicating an increase in the number of multi-dimensionally poor households.

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score has increased in the Masilonyana LM area, indicating that households in this area might be getting poorer. In the Matjhabeng LM area the SAMPI score has decreased, suggesting an improvement in some respects relating to poverty in this area.

Table 17: Poverty headcount within Municipalities.

Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Free State Province	5.	42.2	0.023	5.5	41.7	0.023
Lejweleputswa DM	5.6	42.8	0.024	4.8	42.2	0.020
Matjhabeng LM	5.5	43.0	0.024	4.3	41.8	0.018
Masilonyana LM	5.3	41.8	0.022	6.5	41.8	0.027

9.5.7 POPULATION COMPOSITION AND AGE

In all the areas under investigation, the majority of the population belongs to the Black population group (Figure 13).

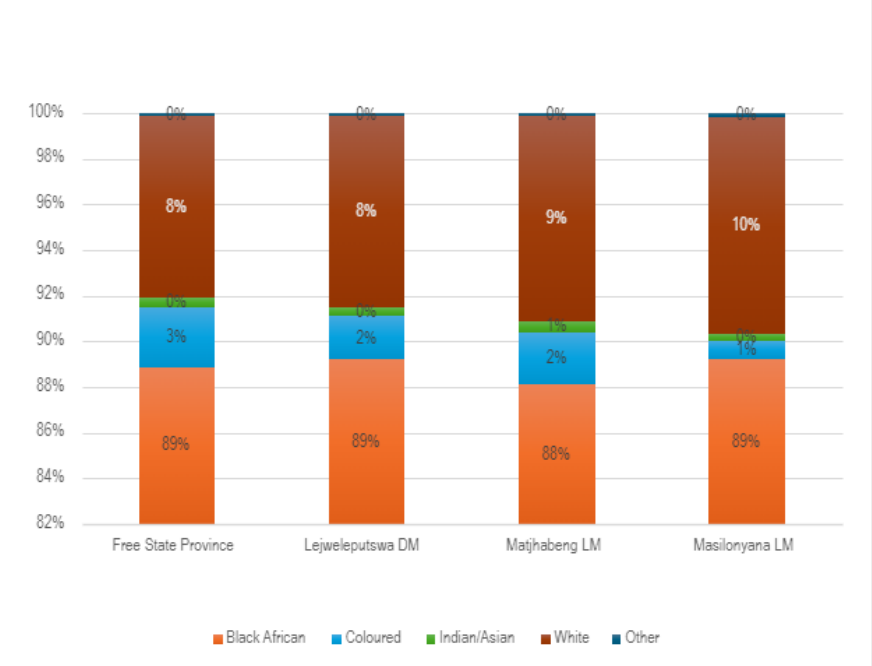

Figure 13: Population distribution (shown in percentage, source: Census 2022).

The average age on local level for Matjhabong LM and Masilonyana LM is higher than on district and provincial level (Table 18). The highest average age is in the Matjhabeng LM. The age distribution of the areas under investigation shows that the population in on a ward level tend to be older than on district or provincial level, with a greater proportion of people aged between 35 years to 64 years (Figure 14).

Table 18: Average age (source: Census 2022).

Area	Average Age (in years)
Free State Province	28.38
Lejweleputswa DM	28.52
Matjhabeng LM	28.89
Masilonyana LM	28.73

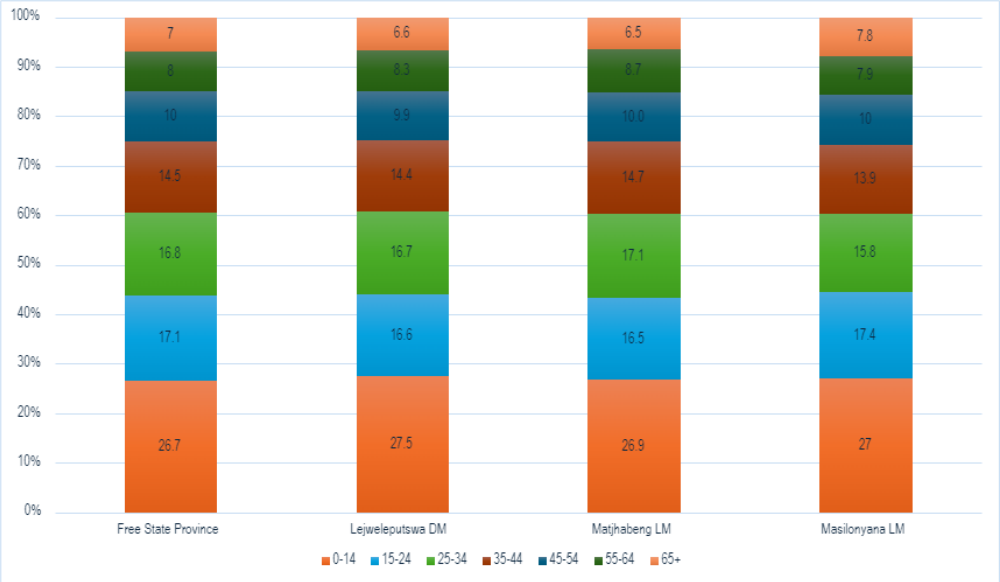

Figure 14: Age distribution (shown in percentage, source: Census 2022).

9.5.8 GENDER

The gender distribution on provincial, district and local level is balanced (Figure 15).

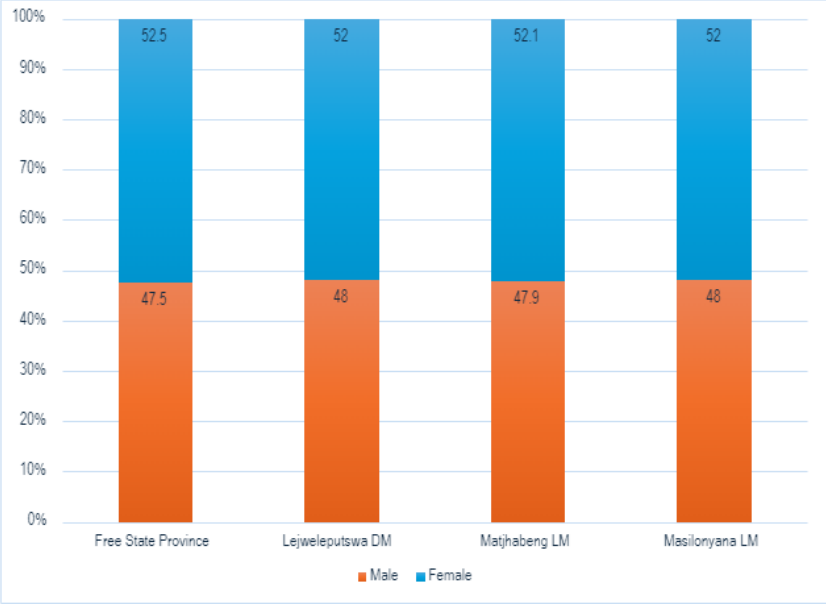

Figure 15: Gender distribution (shown in percentage, source: Census 2022).

9.5.9 EDUCATION

Figure 16 shows the education profiles for the areas under investigation for those aged 20 years or older. Matjhabeng Local Municipality has the highest proportion of people who completed Grade 12 or higher, while approximately 17% of the population in Masilonyana Local Municipality did not complete primary education.

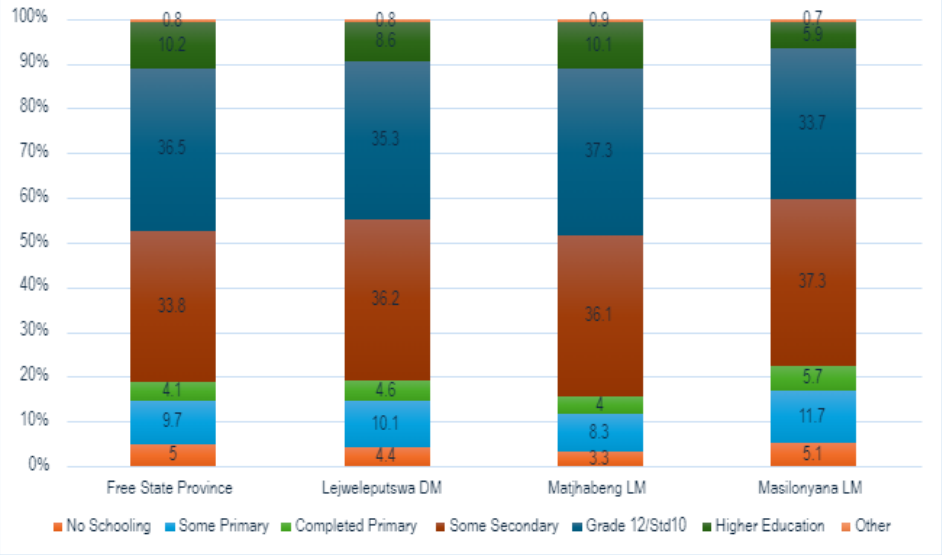

Figure 16: Education profiles (those aged 20 years or older, shown in percentage, source: Census 2022).

9.5.10 EMPLOYMENT

Matjhabeng Local Municipality has the lowest proportion of people of economically active age (aged between 15 years and 65 years) that are employed (Figure 17), whilst Masilonyana has the highest proportions. Since 2010 employment in the gold mining industry showed a steady decline from 157,019 in 2010 to 93,841 in 2022 (www.mineralscouncil.org.za). As such the proportion unemployed people in the area are likely to have increased since 2011. The Matjhabeng LM has the highest ratio of employed people, as well as the highest ratio of unemployed people, whereas Masilonyana has the lowest ratio employed and unemployed people.

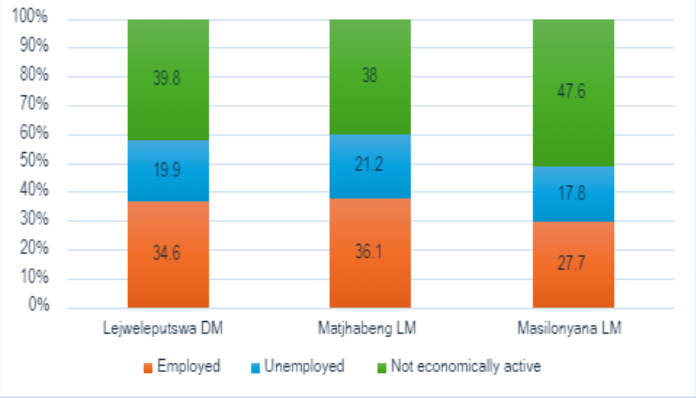

Figure 17: Labour status (those aged between 15 - 65 years, shown in percentage, source: Census 2022).

Most of the employed people in the areas under investigation work in the formal sector (Census, 2022). Matjhabeng Local Municipality has the highest proportion of people working in the Manufacturing sector while Masilonyana Local Municipality has the highest proportion of people working in the Mining sector (Figure 18).

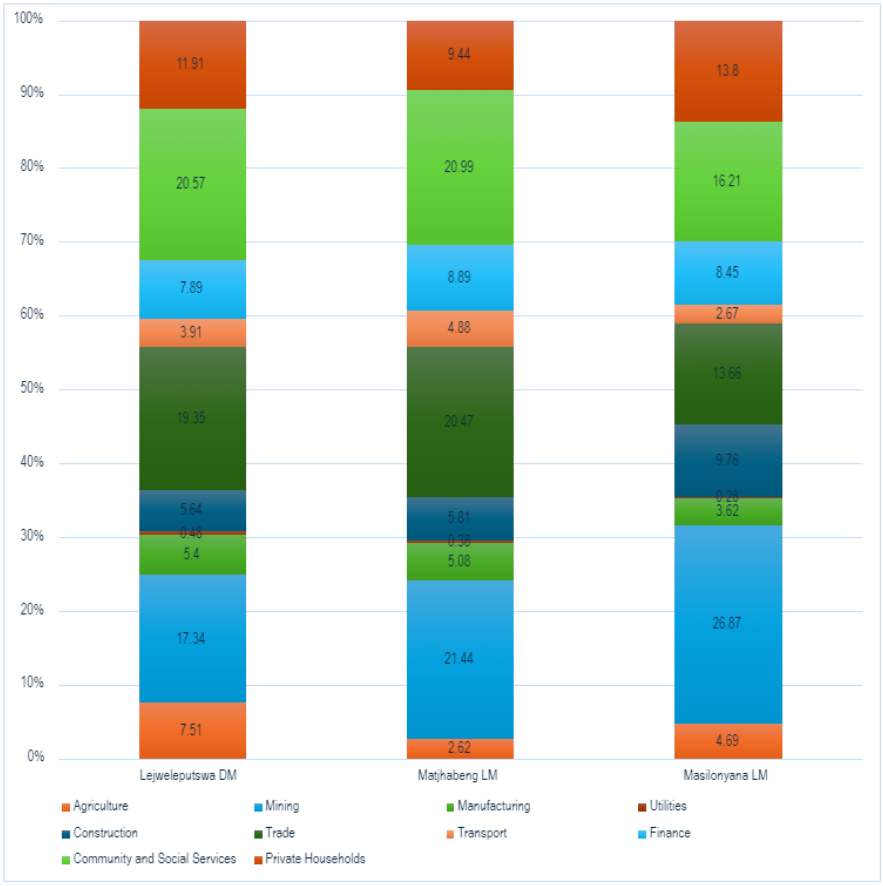

Figure 18: Employment sector (those aged between 15 - 65 years, shown in percentage, source: Census 2022).

9.5.11 LAND USE

Regions are defined as geographical areas sharing common characteristics and typically associated with a specific land use. These areas, often encompassing substantial portions of the spatial environment, may accommodate agricultural or human settlement activities. A total of six SPCs have been provided for land use classification at this level. The SPCs category A and B refer to the natural landscape, while categories C, D, E and F refer to the human – made environment (Lejweleputswa District Municipality, 2017-2022).

Environmental Regions are characterized by distinct ecological attributes. The Lejweleputswa district's SPC A and B areas constitute a unified environmental region, as detailed in Section 11 of the Lejweleputswa Environmental Vision.

Tourism Regions are distinguished by exceptional environmental quality or cultural heritage and are characterized by tourist attractions. Supporting infrastructure, such as retail outlets, accommodation, and dining establishments, should be strategically located within these regions. In Lejweleputswa, a tourism region has been identified northwest of Hoopstad, encompassing the Vaal River, Bloemhof Dam, and Sandveld Nature Reserve. This area presents opportunities for weekend getaways and the development of rural guesthouses, which could stimulate employment growth.

Commercial Agriculture Regions are extensive agricultural areas supporting diverse commercial production. Typically situated around urban centers, these regions' agricultural potential is determined by soil quality and water availability. To safeguard agricultural productivity and prevent urban encroachment, it is essential to conduct thorough assessments considering soil suitability, land capability, and water resources before permitting any development.

The predominant land use specifically within the ER32 area, consist of agriculture activities ranging from commercial to small-scale annual crops. ER94 also contains similar agriculture activities as well as a few areas with fallow land and old fields, however the land use is predominantly used as grazing areas for livestock,

consisting of natural grassland. Figure 19 shows the land cover and relevant land uses for the areas of interest, Appendix 5 includes a higher definition of the map provided in the figure below.

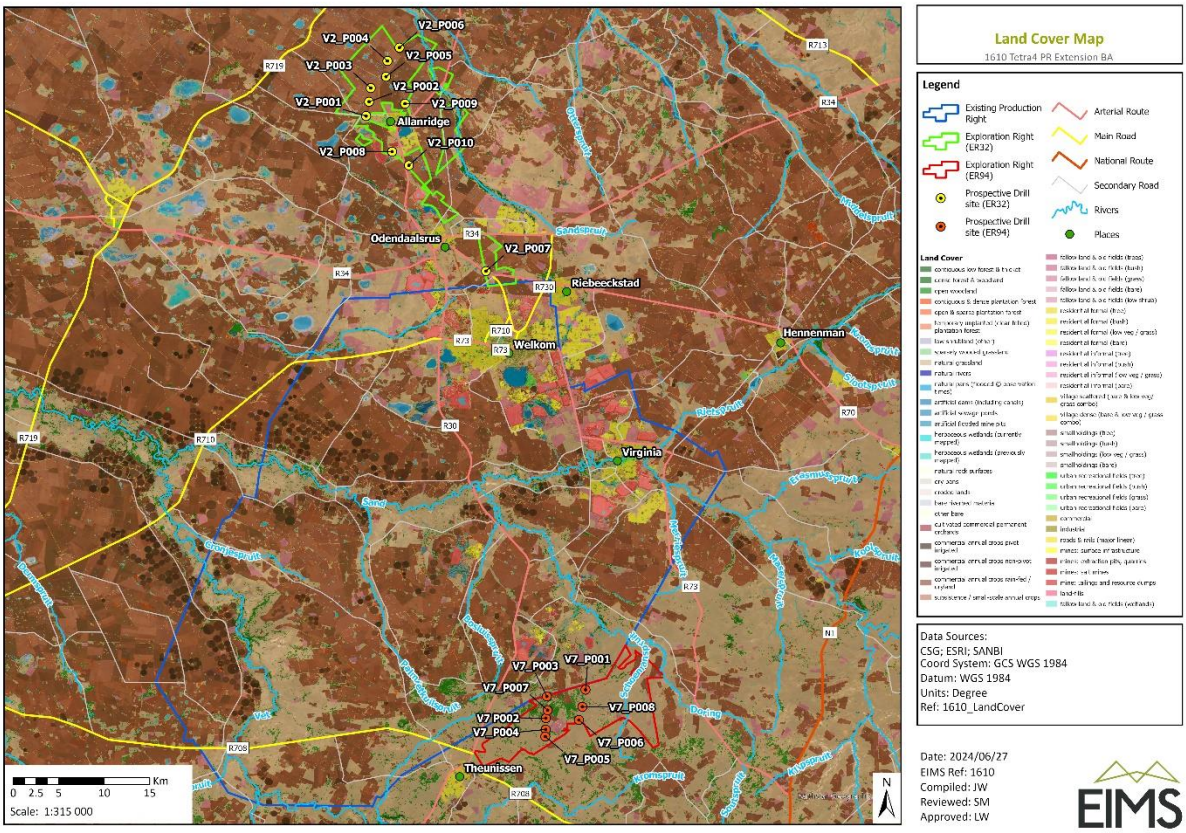

Figure 19: Land cover map.

9.5.12 HOUSING

Most households within the Local and District Municipalities under investigation are classified as formal dwellings (Figure 20), with Masilonyana having the highest proportion of formal dwelling and Matjhabeng has the highest proportion of informal dwellings.

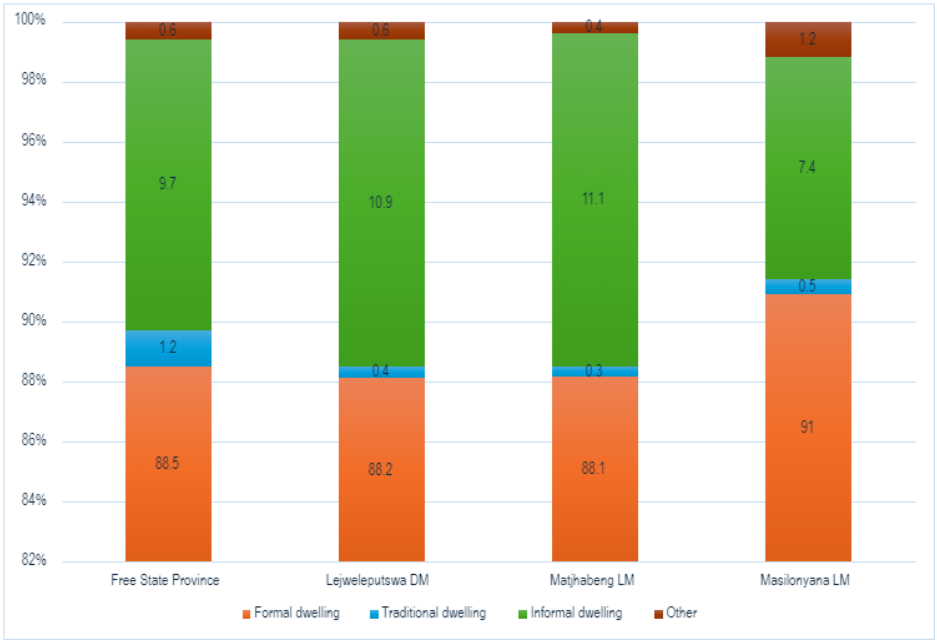

Figure 20: Geotypes (source: Census 2022, households).

9.5.13 WATER AND SANITATION

Matjhabeng has the highest proportion of access to piped water within dwellings, whilst Masilonyana has the highest proportion of access to piped water within the yards of their dwellings (Figure 21). The majority of households have access to sanitation services, however Matjhabeng had the highest proportion of bucket and pit toilets (Figure 22).

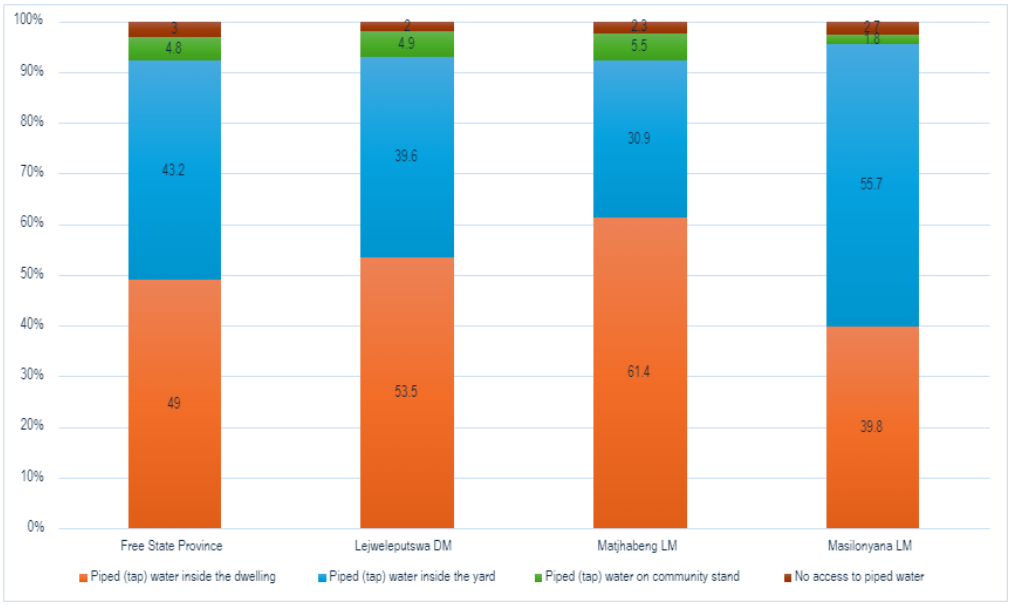

Figure 21: Access to piped water sources (shown in percentage, source: Census 2022).

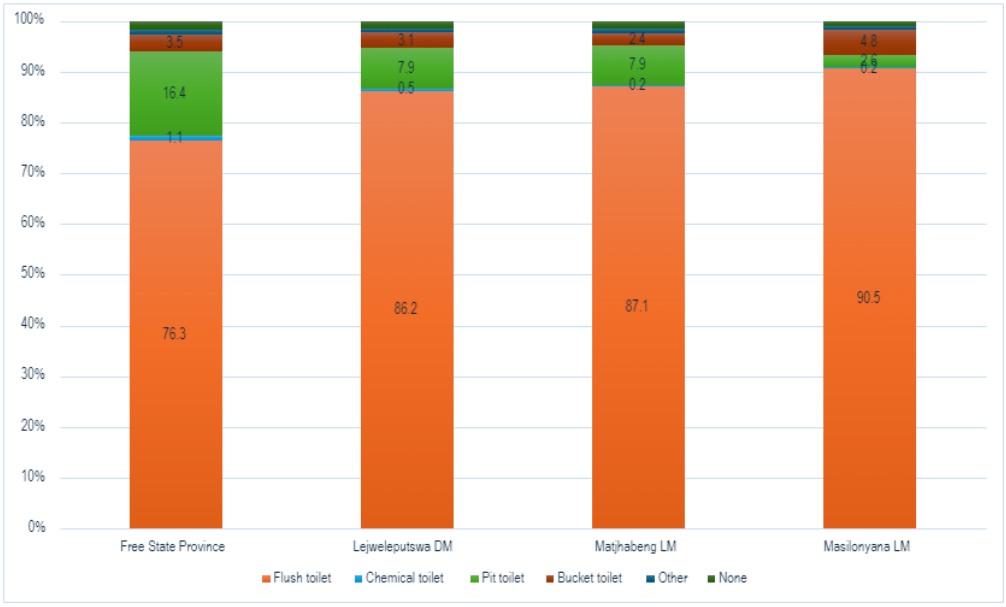

Figure 22: Sanitation (shown in percentage, source: Census 2022).

9.5.14 ENERGY

Electricity is seen as the preferred lighting and cooking source (Noble et al, 2006) and the lack thereof should thus be considered a deprivation. Even though electricity as an energy source may be available, the choice of energy for cooking may be dependent on other factors such as cost. More than 80 % of households have access to electricity as energy source for lighting (Figure 24), with candles the second most used source. More than 90% of households have access to electricity as energy sources for cooking (Figure 23), with gas the second most used source.

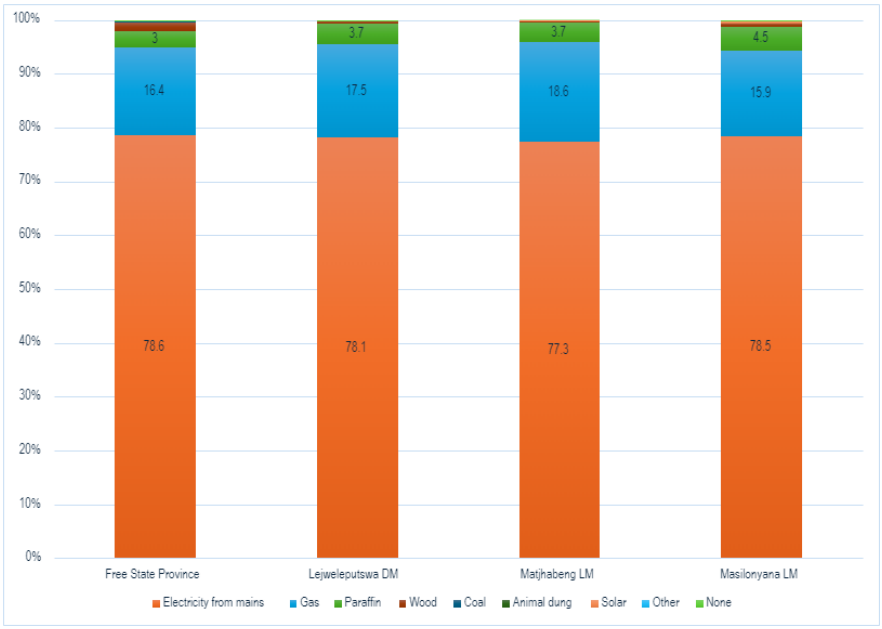

Figure 23: Energy source for cooking (shown in percentage, source: Census 2022).

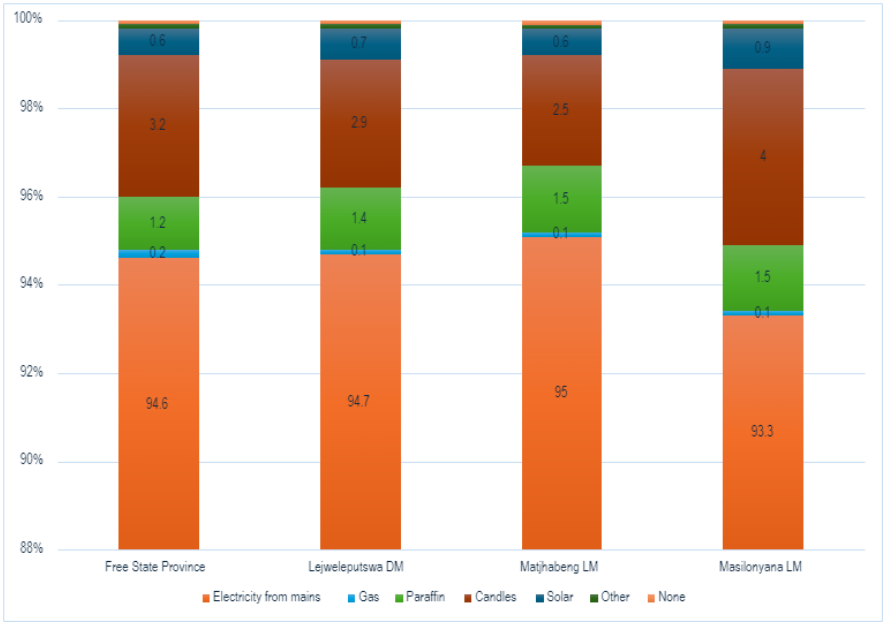

Figure 24: Energy source for lighting (shown in percentage, source: Census 2022).

9.5.15 REFUSE REMOVAL

The majority of the households have their refuse removed by the local authority at least once a week (Figure 25). Matjhabeng has the highest incident of refuse that is not disposed and has a higher proportion of households with their own refuse dump.

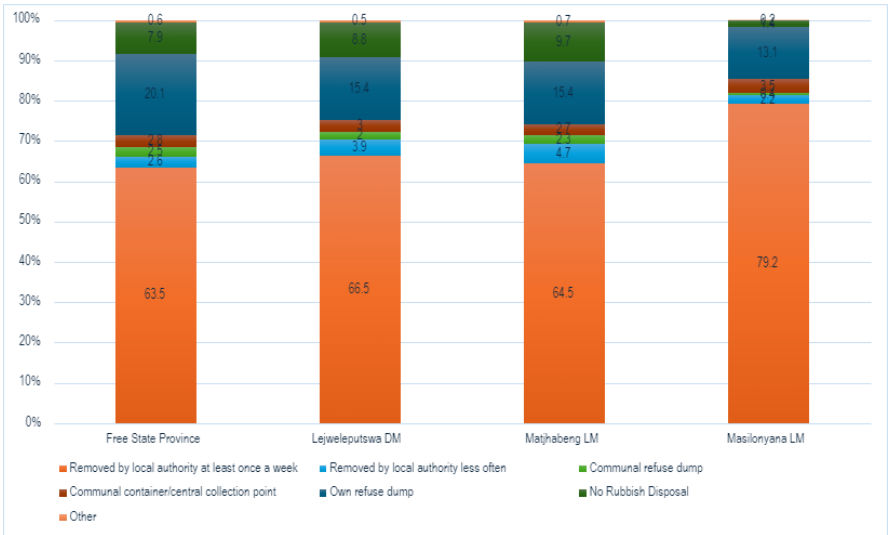

Figure 25: Refuse removal (shown in percentage, source: Census 2022).

9.6 CULTURAL AND HERITAGE RESOURCES

A Specialist Heritage and Palaeontology Impact Assessment study has been undertaken to inform this application and the final report included in Appendix 3. Based on the historical and archaeological overview, the previous assessments undertaken in the area as well as the fieldwork undertaken as part of this application, the heritage assessment findings are summarised below:

- The fieldwork identified eight (8) heritage features and resources. These consist of -
    - four (4) cemeteries or possible grave sites (T4-002, T4-007 and T4-008 with a possible grave at T4-004); and

- five (5) foundation remains of historical homesteads/kraals (T4-001, T4-003, T4-004, T4-005 and T4-006), and are to be provisionally graded as Grade IIIA.

- The assessment recommends burial grounds and graves be retained and avoided with a buffer zone of 30m as per SAHRA guidelines. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, adhering to the requirements of S36 of the NHRA and its regulations as well as the National Health Act and its regulations.

- Historical structures older than 77 years are protected under S34 and S35 of the NHRA and must be avoided with a buffer of 30m. If avoidance is not possible, an application for a mitigation permit must be obtained from SAHRA. Phase 2 test excavations with the backing of a S34 permit from SAHRA will be required before an application for destruction can be lodged with SAHRA.

- The findings indicate that drilling collar V7 P006 poses the greatest risk to heritage resources with a medium to high significance rating. Mitigation measures will be necessary to minimize the potential impact.

- Drilling collars V7 P002 and V7 P008 are located in proximity to heritage resources. However, with the successful implementation of appropriate mitigation strategies, direct impact on these sites is considered unlikely. These measures are anticipated to reduce the overall impact to a low significance level.

- All remaining drilling collars are deemed acceptable from a heritage standpoint based on the current assessment.

Figure 26, Figure 27 and Figure 28 respectively show the Heritage sensitivities for the southern section of ER32, the northern section of ER32 and ER94.

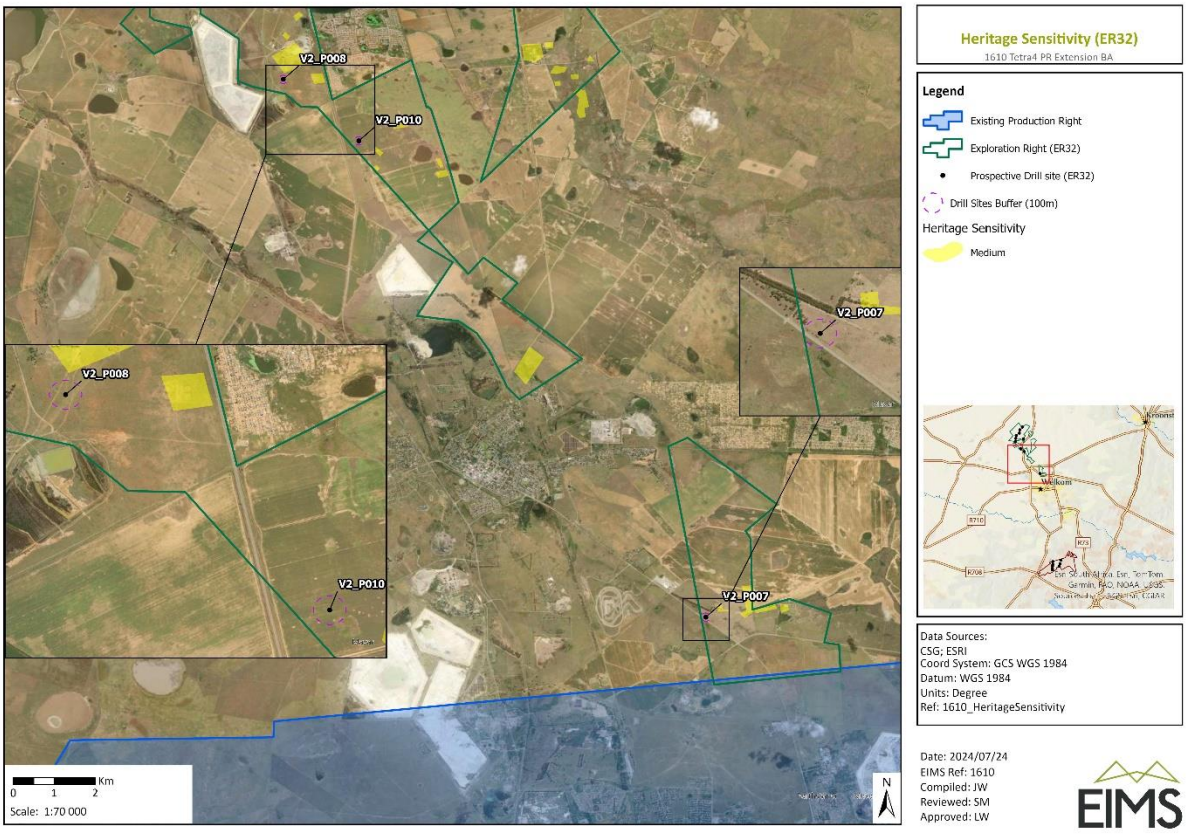

Figure 26: Heritage sensitivity map for the southern section of ER32.

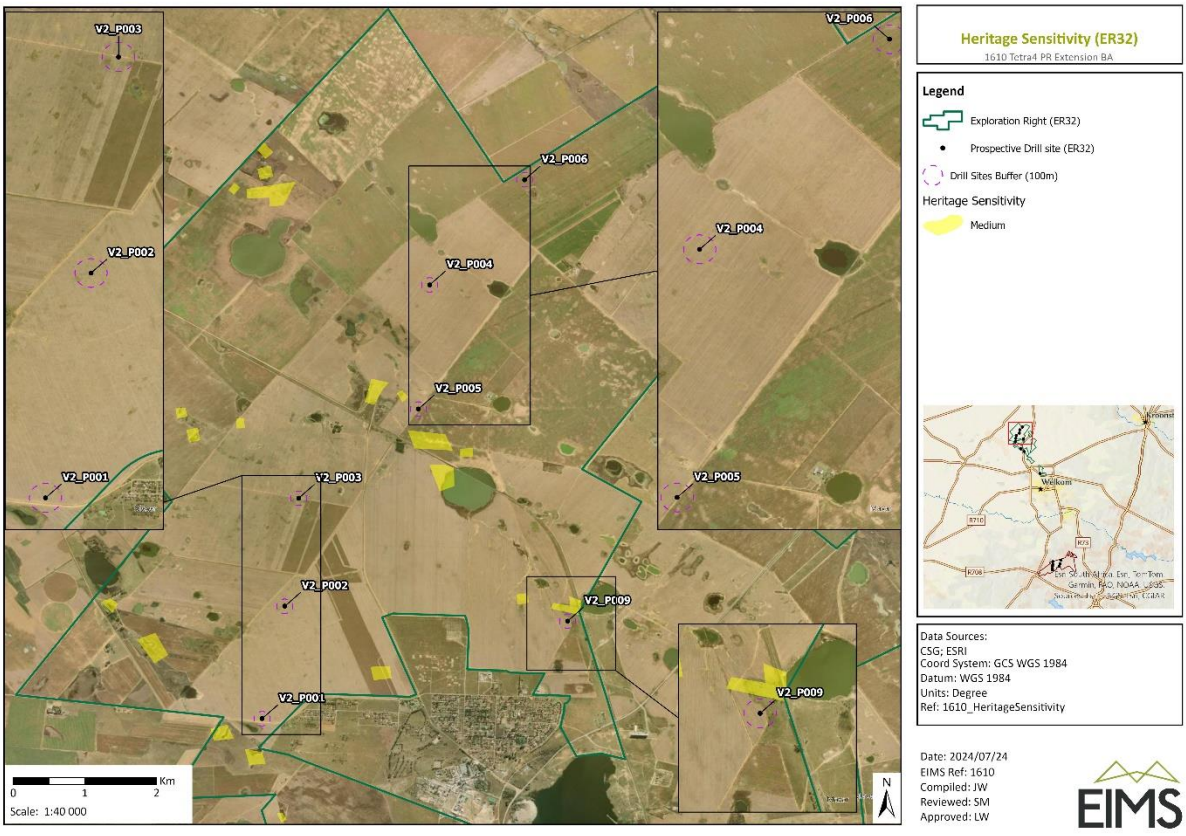

Figure 27: Heritage sensitivity map for the northern section of ER32.

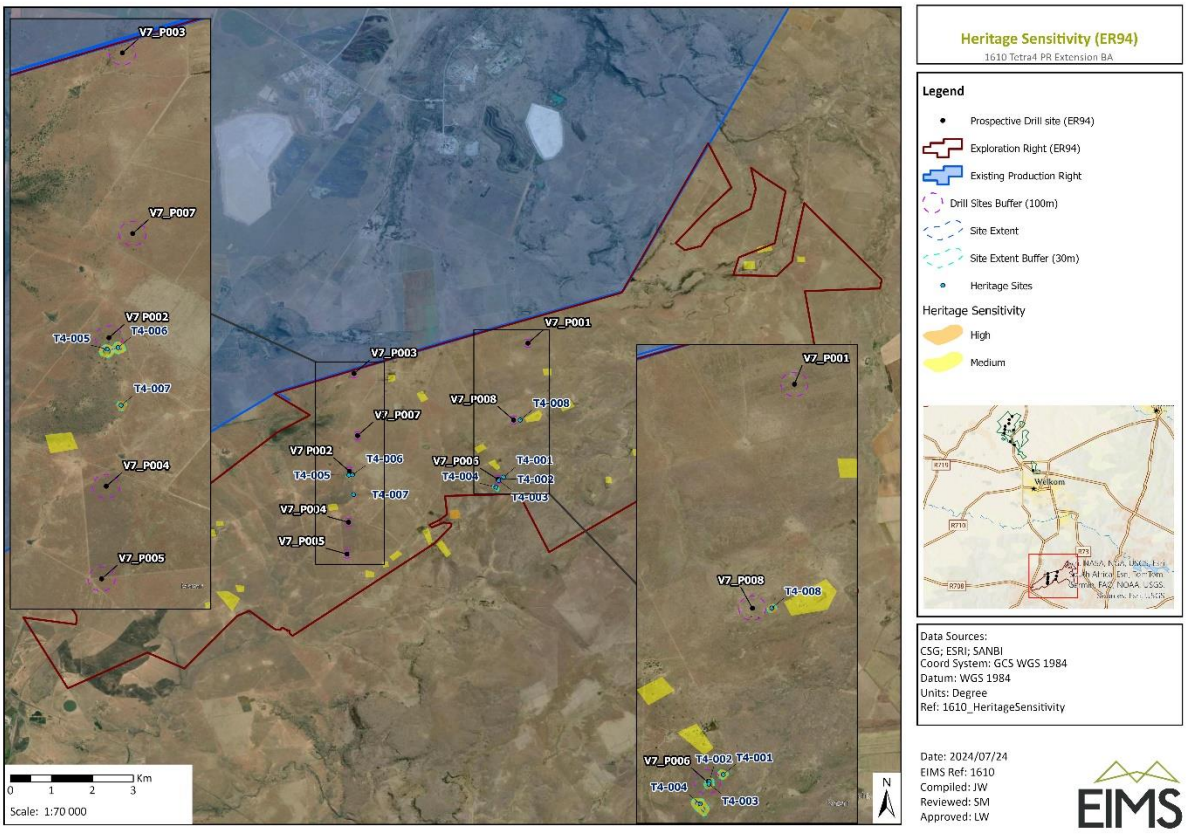

Figure 28: Heritage sensitivity map for ER94.

9.7 SOILS AND LAND CAPABILITY

A review of the land type database (Land Type Survey Staff, 1972-2006) revealed that the primary land types within the assessment area are Ae 40, Bd 18, Dc 9, Dc 12, and Ea 41.

- Ae 40: This land type is predominantly comprised of Hutton, Mispah, Katspruit, and Rensburg soil forms (Soil Classification Working Group, 1991). The landscape may also include other minor soil types. Notably, Ae 40 is characterized by red-yellow, freely drained soils with a red coloring and high base status exceeding 300 mm depth (excluding dunes).

- Bd 18: This land type is characterized by a plinthic catena, with upland and margaritic soils being uncommon. The dominant soils are Avalon, Oakleaf, and Dundee Rensburg forms (Soil Classification Working Group, 1991), with the potential presence of other minor soil types. Bd 18 is further distinguished by the presence of eutrophic soils and a limited distribution of red soils.

- Dc 9 and Dc 12: These land types share a dominance of prismacutanic and/or pedocutanic diagnostic horizons. Additionally, they may exhibit one or more of the following diagnostic horizons: vertic, melanic, or red structured. The primary soil forms within Dc 9 include Hutton, Swartland, Katspruit, and Willowbrook (Soil Classification Working Group, 1991), with the possibility of encountering other minor soil types. Dc 12 is characterized by the presence of Mispah, Swartland, Bonheim, and Oakleaf soil forms, along with rocky areas (Soil Classification Working Group, 1991). Similar to Dc 9, other minor soil types may be present.

- Ea 41: This land type is characterized by the presence of one or more of the following diagnostic horizons: vertic, melanic, or red structured, and is considered undifferentiated. The dominant soil forms include Mispah, Glenrosa, and Bonheim (Soil Classification Working Group, 1991), with the potential for encountering other minor soil types within the landscape.

A simplified soils map is provided in Figure 29 below and is representative of the baseline conditions. Detailed descriptions of the land terrain units associated with each featured land type are provided in the subsequent tables and figures. Appendix 5 includes a higher definition version of all the maps provided in the following figures.

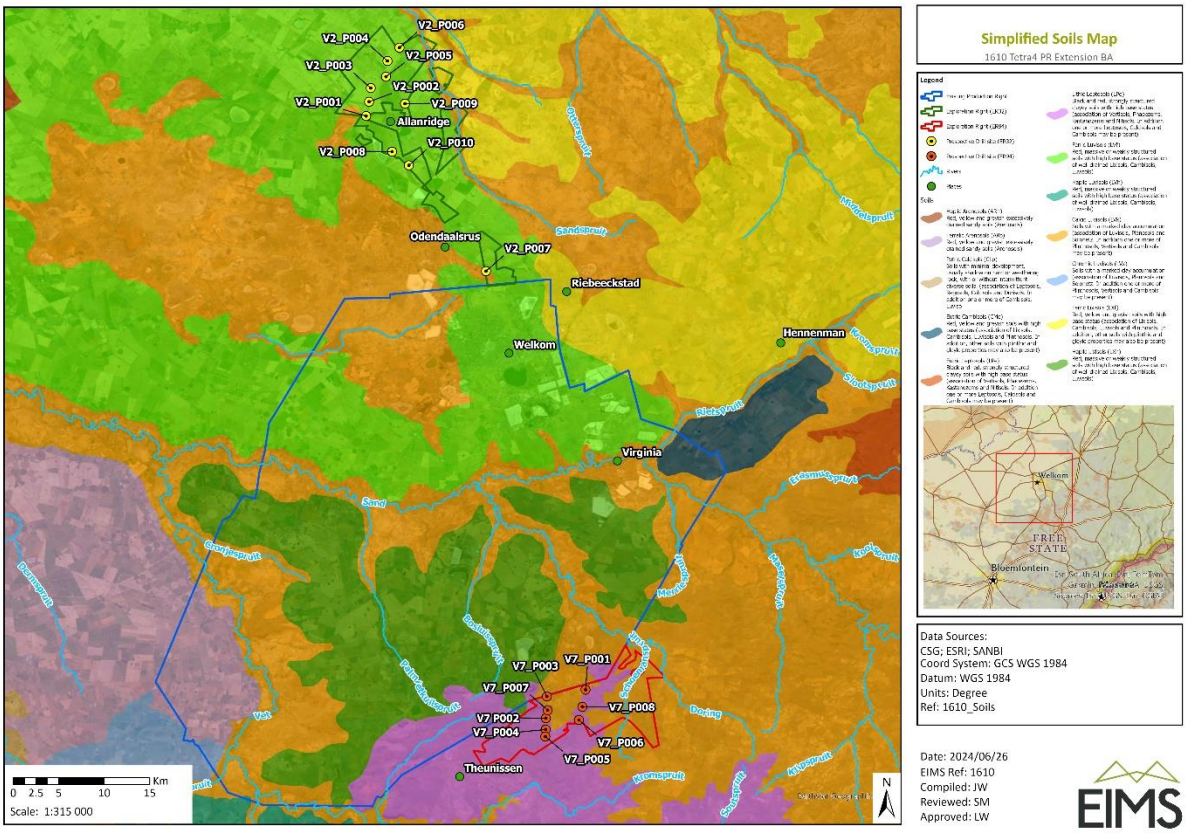

Figure 29: Baseline simplified soils map.

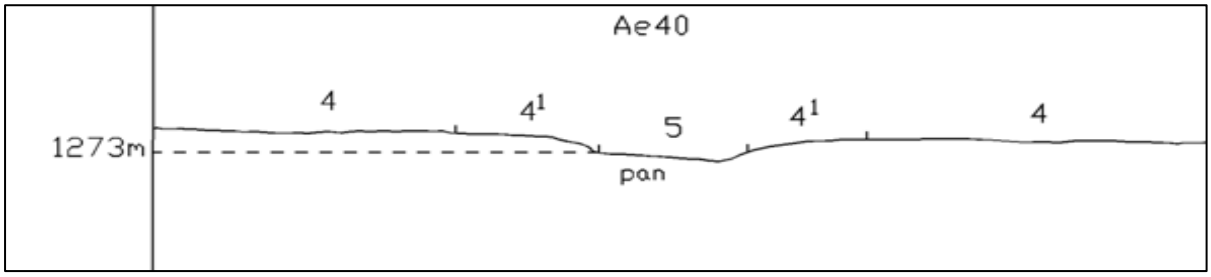

Figure 30: Illustration of land types of Ae 40 terrain units (Land type Survey Staff, 1972-2006).

Table 19: Soils expected at the respective terrain units within the Ae 40 land type (Land type Survey Staff, 1972-2006).

Terrain Units					
4 (92%)		**4 (1) (4%)**		**5 (4%)**	
Hutton	89%	Mispah	50%	Katspruit, Rensburg	75%
Clovelly	6%	Swartland	25%	Swartland	25%
Bainsvlei	2%	Oakleaf	25%		

Terrain Units					
Avalon	3%				

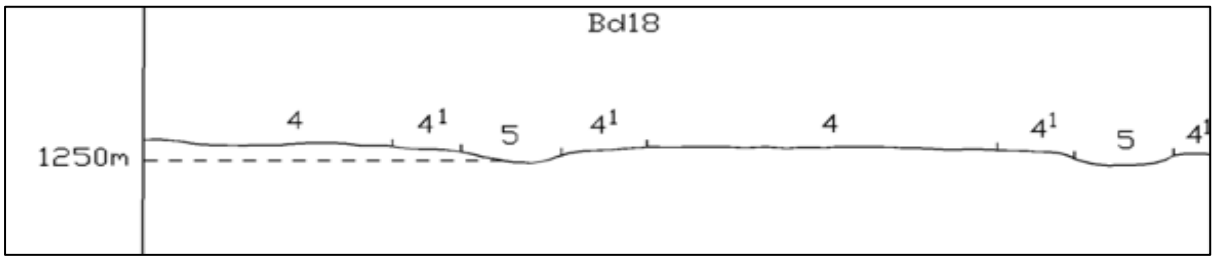

Figure 31 Illustration of land types of Bd 18 terrain units (Land type Survey Staff, 1972-2006).

Table 20: Soils expected at the respective terrain units within the Bd 18 land type (Land type survey staff, 1972 - 2006).

Terrain Units					
4 (84%)		**4 (1) (12%)**		**5 (4%)**	
Avalon	72%	Oakleaf	42%	Dundee	75%
Hutton	10%	Sterkspruit	29%	Sterkspruit	13%
Clovelly	8%	Valsrivier	29%	Valsrivier	12%
Westleigh	4%				
Longlands, Kroonstad	2%				
Glenrosa	2%				
Mispah	1%				
Bare Rocks	1%				

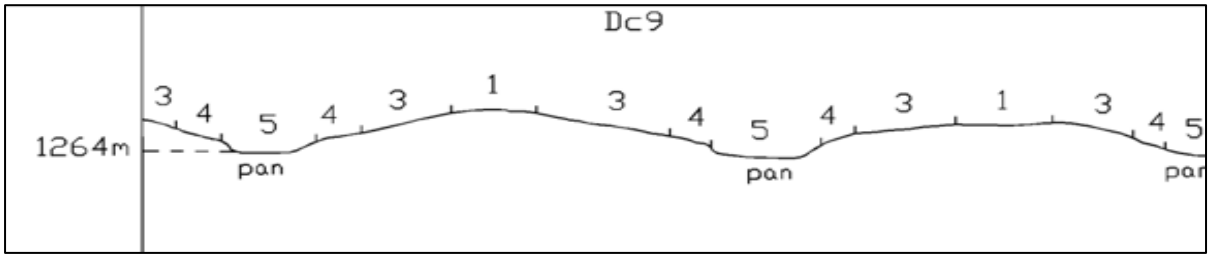

Figure 32: Illustration of land types of Dc 9 terrain units (Land type Survey Staff, 1972-2006).

Table 21: Soils expected at the respective terrain units within the Dc 9 land type (Land type survey staff, 1972 - 2006).

Terrain Units							
1 (10%)		**3 (27%)**		**4 (41%)**		**5 (22%)**	
Hutton	100%	Hutton	88%	Swartland	28%	Katspruit, Willowbrook	91%
		Clovelly	11%	Valsrivier	24%	Valsrivier	5%
		Oakleaf	1%	Oakleaf	23%	Arcadia	2%
				Sterkspruit	17%		
				Arcadia	4%		
				Estcourt	3%		
				Mispah	1%		

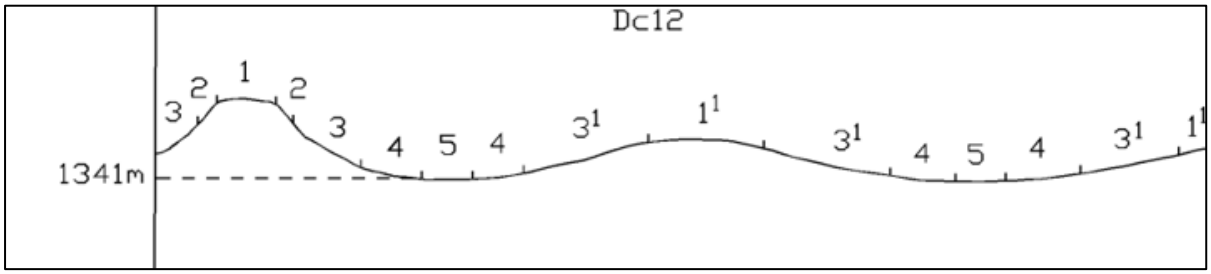

Figure 33: Illustration of land types of Dc 12 terrain units (Land type Survey Staff, 1972-2006).

Table 22: Soils expected at the respective terrain units within the Dc 12 land type (Land type Survey Staff, 1972-2006).

Terrain Units												
1 (3%)		**3 (1) (20%)**		**2 (1%)**		**3 (6%)**		**3 (1) (38%)**		**4 (24%)**		**5 (8)**	
Bare Rocks	33%	Mispah	37%	Bare Rocks	60%	Bare Rocks	33%	Swartland	34%	Bonheim	29%	Oakleaf	41%
Mayo	23%	Swartland	19%	Mispah	30%	Mayo	25%	Mispah	18%	Swartland	27%	Katspruit	27%
Mispah	21%	Glenrosa	13%	Glenrosa	10%	Swartland	17%	Bonheim	14%	Valsrivier	15%	Stream Beds	13%
Glenrosa	13%	Westleigh	12%			Mispah	17%	Valsrivier	9%	Arcadia	15%	Valsrivier	6%
Swartland	10%	Mayo	6%			Glenrosa	8%	Glenrosa	7%	Mispah	4%	Bonheim	5%
		Bonheim	5%				Arcadia	7%	Sterkspruit	4%	Arcadia	4%	
		Bare Rocks	3%				Westleigh	5%	Mayo	3%	Mayo	4%	

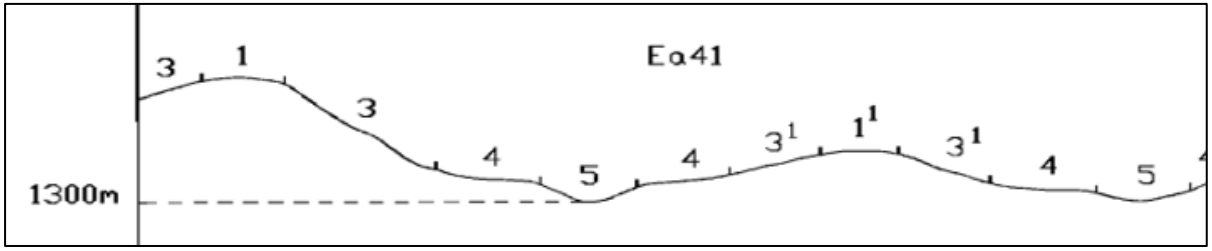

Figure 34: Illustration of land types of Ea41 terrain units (Land type Survey Staff, 1972-2006).

Table 23: Soils expected at the respective terrain units within the Ea 41 land type (Land type Survey Staff, 1972-2006).

Terrain Units											
1 (16%)		**1 (1) (5%)**		**3 (40%)**		**3 (1) (15%)**		**4 (15%)**		**5 (9%)**	
Bare Rocks	70%	Mispah, Glenrosa	45%	Bare Rocks	65%	Bonheim	57%	Bonheim	85%	Bonheim	50%
Hutton	20%	Milkwood	35%	Hutton	20%	Milkwood	25%	Mispah, Glenrosa	5%	Dundee, Oakleaf	25%
Milkwood, Shortlands	10%	Hutton	5%	Milkwood, Shortlands	15%	Arcadia	10%	Mayo	4%	Milkwood	10%
		Arcadia	5%			Mispah, Glenrosa	5%	Milkwood	3%	Stram Beds	10%
						Hutton	2%	Arcadia	2%	Arcadia	5%
						Mayo	1%	Hutton	1%		

Within the designated 50-meter buffer zone, a field assessment identified nine distinct soil forms: Ermelo, Pinedene, Tukulu, Swartland, Glen, Arcadia, Glenrosa, Mispah, and Witbank. The dominant soil type observed is a yellow-brown apedal soil with a gleyic subsoil. Other identified forms exhibit duplex characteristics, featuring increased clay content in the subsoil horizon, shallow profiles, or the presence of transported anthropogenic material.

9.7.1 SOIL SENSITIVITY AND CROP PRODUCTION POTENTIAL

The Ermelo and Pinedene soil forms are considered the most sensitive within the project area due to their high suitability for crop production. These soils feature an orthic topsoil layer above a thick yellow-brown apedal horizon (Ermelo) or a gleyic horizon (Pinedene). This composition offers favourable fertility due to moderate nutrient and water retention. Additionally, the deep gleyic horizon in the Pinedene form promotes moisture storage, mitigating the impact of water stress conditions common in rainfed agriculture.

Other soil forms, including Tukulu, Swartland, Glen, and Arcadia, exhibit moderate to low sensitivity and crop production potential. Limitations arise from restricted water availability, aeration, and root penetration due to increased clay content in the subsoil horizons. These forms consist of an orthic topsoil layer overlying a neocutanic or pedocutanic horizon, with Tukulu and Swartland possessing a gleyic or lithic horizon below, respectively. The Glen and Arcadia forms feature a vertic topsoil layer above a thick pedocutanic or lithic horizon.

The least sensitive soils in the project area are Glenrosa, Mispah, and Witbank. Glenrosa has an orthic topsoil layer overlying a lithic horizon, limiting its overall profile water storage capacity. Similarly, the Mispah form possesses a shallow profile with a hard rock substratum. The Witbank form, classified as a transported Technosol, consists of anthropogenic material potentially containing high concentrations of elements toxic to crops. These factors significantly reduce their suitability for crop production.

9.7.2 LAND CAPABILITY CLASSIFICATION AND POTENTIAL

Based on the identified soil types and Smith's classification system (2006), the land capability within the project area ranges from Class II to Class VIII.

- Class II: This class signifies slight limitations and high arable potential, suitable for annual cropping with specific tillage practices or a 25% ley rotation.
- Class IV: Characterized by severe limitations, low arable potential, and a high erosion hazard. This class is best suited for long-term ley rotations (75%).
- Class VI: These lands have very severe limitations and are suitable for natural veld or afforestation.
- Class VIII: Considered unsuitable for grazing or afforestation due to extreme limitations.

Furthermore, a climate capability level of 8 (L8) has been assigned due to the low Mean Annual Precipitation (MAP) and high Mean Annual Potential Evapotranspiration (MAPE) rates. Combining the determined land capability classes with the climate capability level yields land potential classes L5 to L8 according to Smith (2006).

- Land Potential L5: Characterized by restricted potential due to regular or severe limitations arising from soil characteristics, slope, temperature, or rainfall.
- Land Potential L6: Very restricted potential with similar limitations as L5.
- Land Potential L7: Represents low potential with severe limitations.
- Land Potential L8: Denotes very low potential due to extreme limitations.

Within the ER32 portion, the land is predominantly classified as "Moderate High" sensitivity, with some areas designated as "Moderate Low to Moderate" and isolated areas categorized as "Very Low to Low" (Figure 35 and Figure 36). The ER94 portion primarily falls within the "Moderate Low to Moderate" sensitivity range, with some areas classified as "Very Low to Low."

Furthermore, the agricultural theme tool (DFFE, 2024) identified highly sensitive field crop boundaries within the project area (Figure 36). However, site verification revealed active crop fields under rainfed conditions only within the ER32 portion, specifically associated with drilling collars V2_P001, V2_P002, V2_P003, V2_P004, V2_P005, V2_P006, V2_P009, and V2_P010. The land capability assessment of the proposed project area indicates a classification ranging from low to medium. Correspondingly, the agricultural potential of the region is evaluated as low to medium. Landowner consent is necessary before exploration or development activities can proceed on these active crop fields.

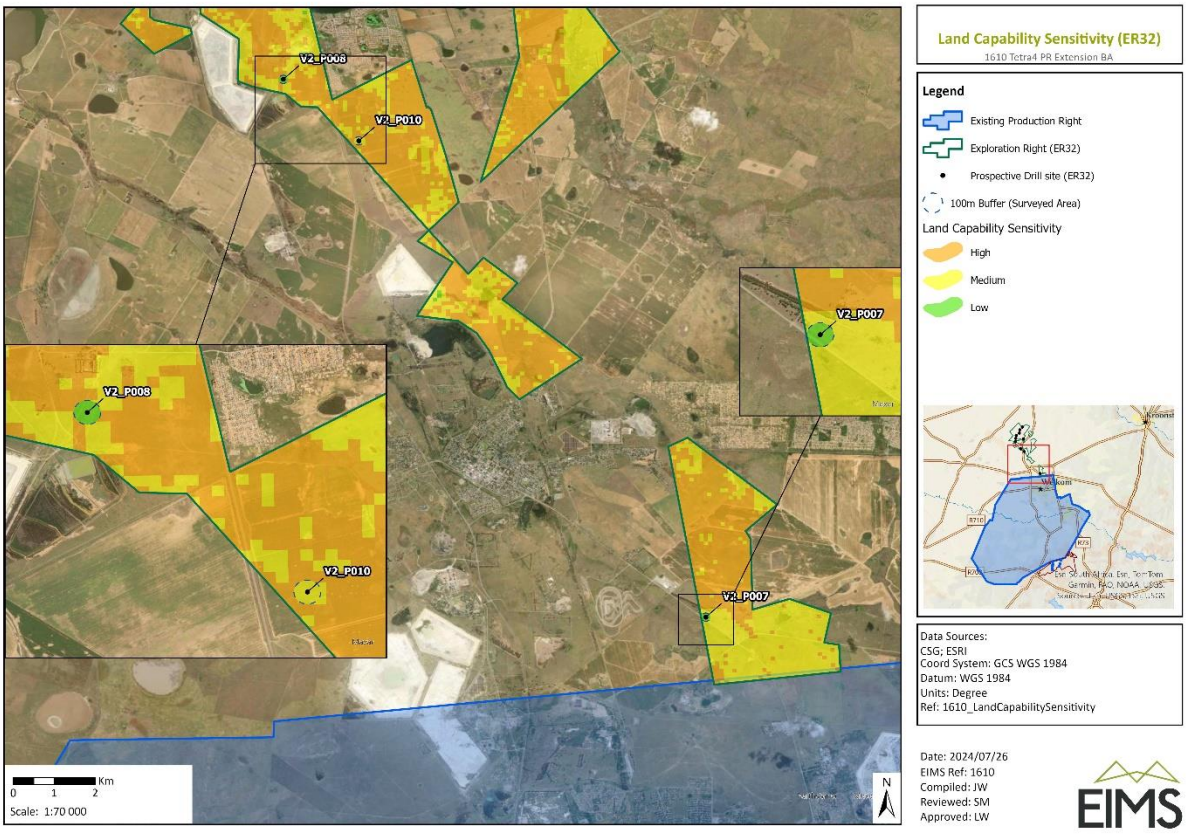

Figure 35: Land Capability Sensitivity Map for southern section of ER32.

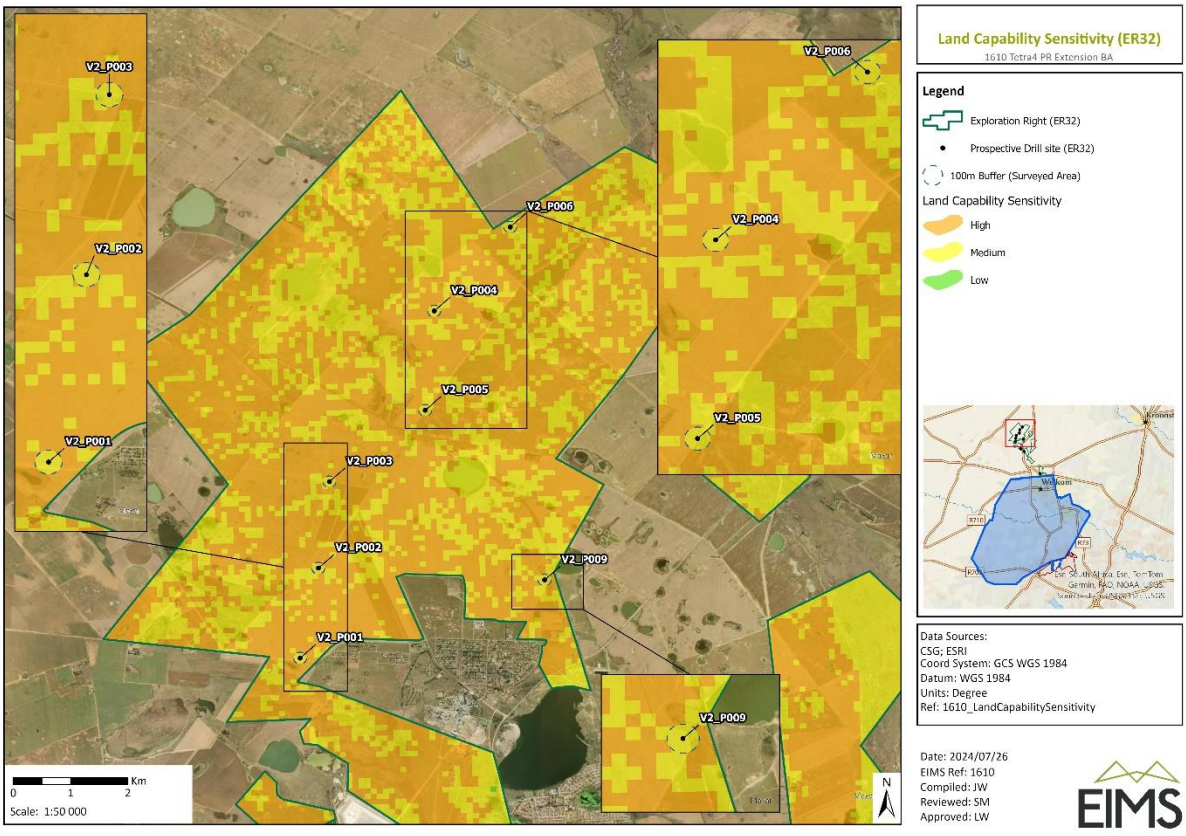

Figure 36: Land Capability Sensitivity Map for northern section of ER32.

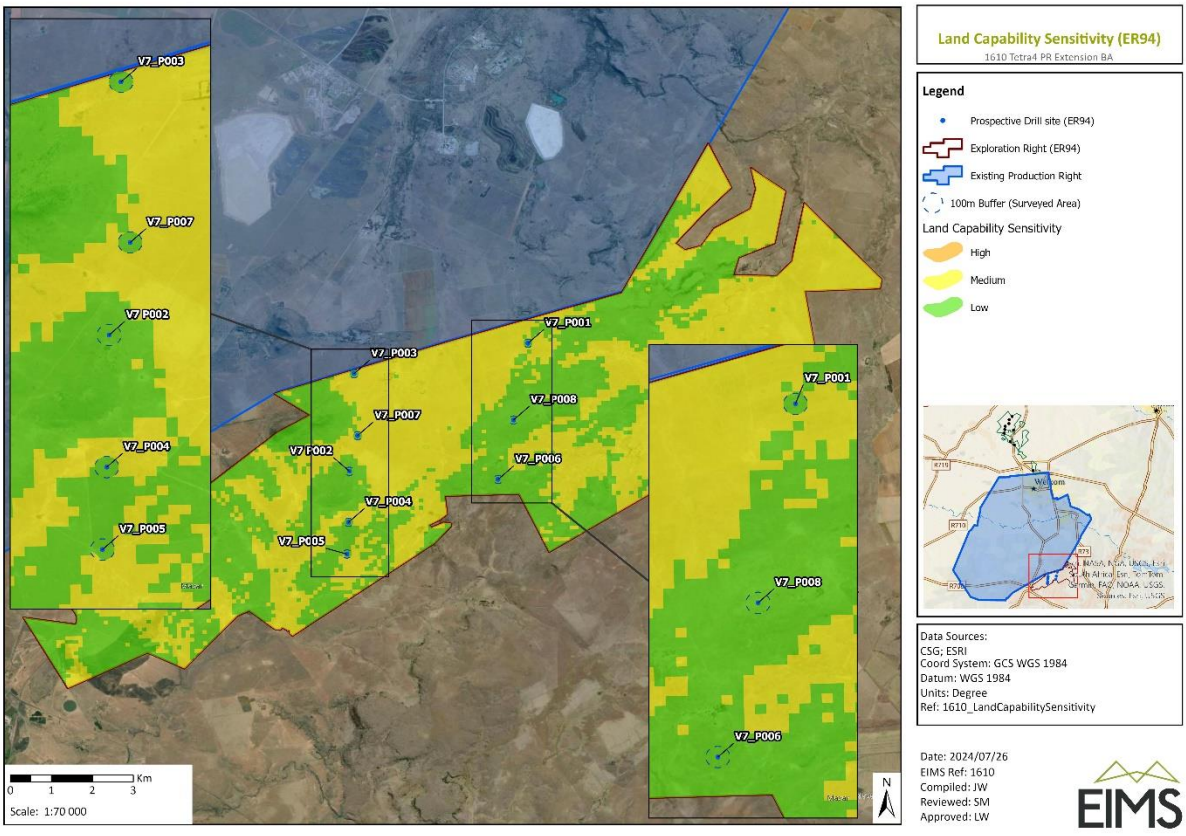

Figure 37: Land Capability Sensitivity Map for ER94.

9.8 GEOLOGY AND PALAEONTOLOGY

The simplified geology of the Exploration Rights areas (ER32 and ER94) is depicted in Figure 40. Appendix 5 includes a higher definition version of all the maps provided in the following figures. The Tetra4 footprint is underlain by Quaternary sands, unfossiliferous Jurassic dolerite (Karoo dolerite), the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), the Volksrust Formation and the Allanridge Formation (Ventersdorp Supergroup). However, the drilling collars is only located in the Quaternary sediments, Jurassic (Karoo) dolerite and the Adelaide Subgroup.

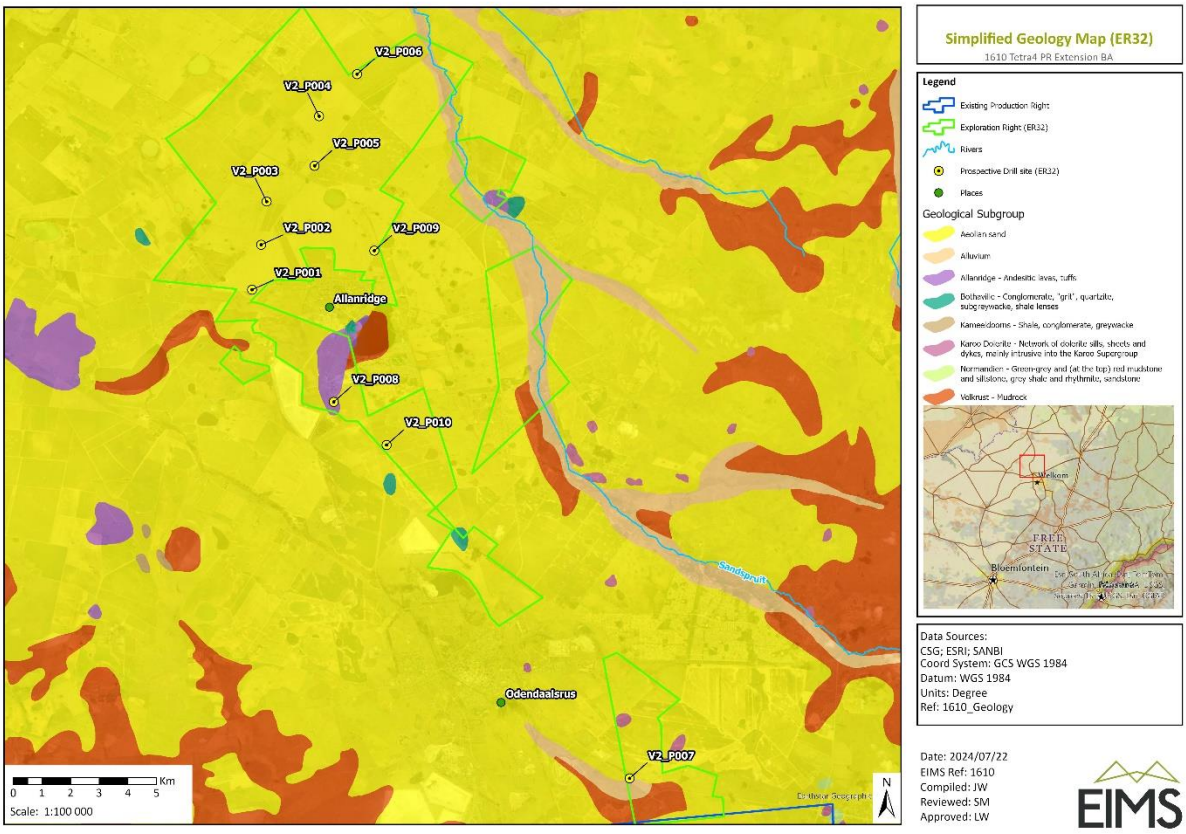

Figure 38: Simplified geology map of ER32.

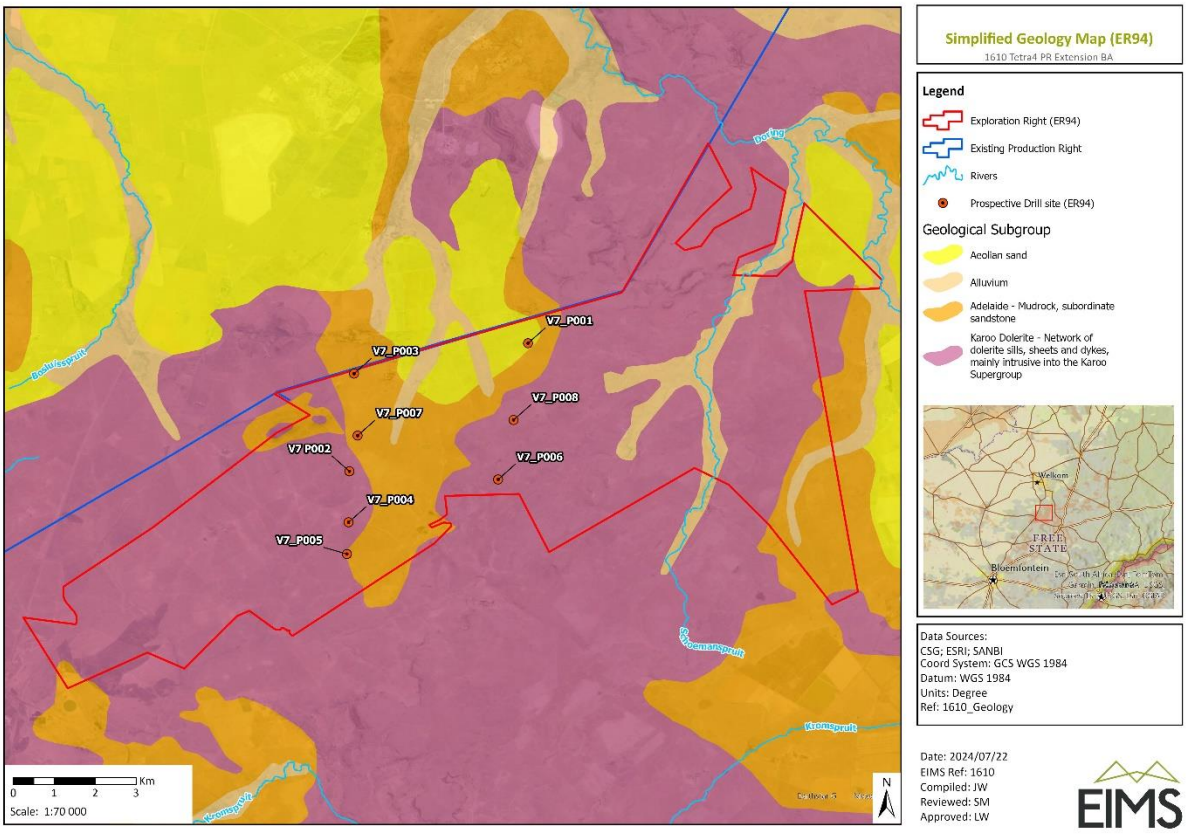

Figure 39: Simplified geology map of ER94.

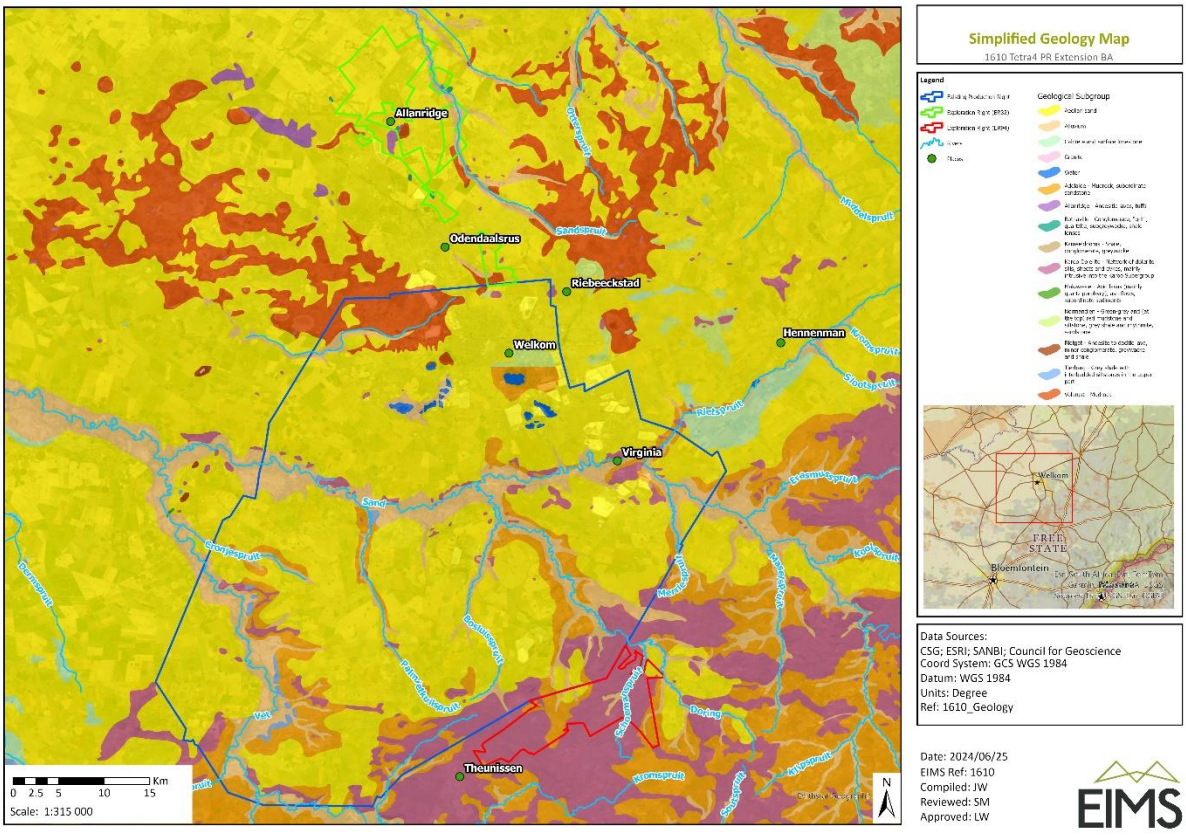

Figure 40: Simplified geology map.

The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Adelaide Subgroup is Very High, that of the Volksrust Formation is High, and that of the Quaternary sediments is Moderate, while the Palaeontological Sensitivity of the Allanridge Formation is Low. and that of the that of the Jurassic Dolerite is Zero. The suggested location is classified as having a Medium Palaeontology Theme Sensitivity in the DFFE Screening Report (Appendix 4). Updated Geology (Council of Geosciences, 2014) refined the geological map and indicates that the proposed development is underlain by alluvium, colluvium, eluvium and gravel as well as Karoo dolerite.

The Quaternary superficial deposits are unconsolidated sediments formed during the Pleistocene to recent epoch. These deposits include alluvium (river sediments), surface gravels, pedocretes (soil horizons), and sandy soils. While generally considered to have low paleontological significance, they may contain fossils of mammals (teeth, bones, horn corns), reptiles (skeletons), ostrich eggshells, microfossils, non-marine mollusk shells, plant material (foliage, wood, pollen, peats), and trace fossils (vertebrate tracks, burrows, termite mounds, and root casts). Reworked Stone Age artifacts have also been found in these deposits. These sediments primarily consist of clay, gravel, sand, and silt, forming thin, discontinuous patches or larger spreads onshore. They represent channel, floodplain, and stream deposits, talus gravels, and glacial drift sediments.

The Quaternary Era, also known as the "Age of Mammals," is preserved in coastal plains (Langebaanweg), cave systems (Makapan), and river gravel terraces (Cornelia). These deposits are subdivided into six African Land Mammal Ages. The best-known Quaternary localities in the Free State are Florisbad and Cornelia (MacRae, 1999). Fossils recovered from these sites include teeth and bones of mammals, fish, reptiles, freshwater mollusks, trace fossils, wood, root casts, and diatom floras (Groenewald G.H., 2014).

The Virginia/Welkom District is known for its fluvial deposits containing diatomite (diatom deposits), calcareous tufa, pedocretes, peats, spring deposits, and various calcrete deposits. These are crucial for understanding the Early and Late Pliocene period in the region (De Ruiter, et al., 2010). Plio-Pleistocene floodplain deposits (overbank sediments) found near rivers contain confined but abundant mammal vertebrate fossil sites. Notably, a proboscidean fossil (mammoth) comprising a lower molar, a large portion of a tusk, and an ulna was discovered

from the Sand River near Virginia. Later investigations revealed a diverse fauna including amphibians, birds, fish, reptiles, and various mammals from the same site (De Ruiter, et al., 2010).

Terrace gravels above the Vet River have yielded Pliocene fossils, while surveys along other rivers have produced moderately fossiliferous overbank sediments and erosional gullies containing a variety of Quaternary-aged mammals. Ancient pan sites have also proven to be rich sources of Quaternary mammal fossils. Typically, Quaternary fossils are rare but may include mammalian teeth and bones, ostrich eggshells, tortoise remains, ostracods, diatoms, reptile skeletons, trace fossils (burrows, vertebrate tracks, root casts, calcretized termite mounds), and plant remains (foliage, pear, wood, pollen). Microfossils and vertebrate remains are often concentrated near water courses and drainage lines (Brink, 1999).

The Karoo Igneous Province is a large continental flood basalt province consisting of intrusive and extrusive rocks (Duncan, 1997). These flood basalts do not form prominent volcanic structures but rather comprise successive eruptions from fissures that formed sub-horizontal lava flows (sills and dykes) varying in thickness. These lava flows capped the underlying landscape. Today, the Karoo province is preserved as remnants of a more extensive lava cap that once covered much of southern Africa. Estimates suggest that the current Karoo lava outcrop covers at least 140,000 km², with a past extent of approximately 2,000,000 km² (Eales, 1984). The province includes a large volume of flood basalts alongside silicic volcanic rocks composed of rhyodacite and rhyolitic magma. These rocks crop out along the Lebombo monocline and can reach up to 60 km in individual units. Some units display massive pyroclastic structures, classified as rheoignimbrites. The basal lavas generally lie conformably on the Clarens Formation, although localized sandstone erosion occurred before volcanic eruptions in certain areas.

The proposed development area is situated within the Karoo Basin, underlain by the Beaufort Group, a subdivision of the Karoo Supergroup. The Beaufort Group, deposited during the Middle Permian to early Middle Triassic periods, consists primarily of sandstones and shales deposited in fluvial environments. These continental deposits, with a total coverage of approximately 200,000 km² in South Africa, represent the first fully terrestrial sequence within the Karoo Supergroup.

The Beaufort Group is further subdivided into the Adelaide Subgroup and the overlying Tarkastad Subgroup. The Adelaide Subgroup, interpreted to have been deposited under a humid climate with wet floodplains (fluvio-lacustrine sediments), reaches a maximum thickness of approximately 5,000 meters in the southeast, thinning towards the north. The Adelaide Subgroup is characterized by alternating mudrocks, grey lithofeldspathic sandstones, and internal features like horizontal lamination and ripple lamination. The mudrocks display blocky weathering and sometimes contain desiccation cracks and raindrop impressions. Calcareous nodules and concretions are also found throughout the mudstones.

The Adelaide Subgroup is globally recognized for showcasing the early diversification of land vertebrates. Biostratigraphic subdivision of the Beaufort Group is based on its faunal content. The development area is underlain by the Balfour Formation, which can be further divided into the Daptocephalus Assemblage Zone (DAZ). The DAZ itself is further subdivided into the Lystrosaurus maccaigi-Moschorhinus Subzone (upper) and the Dicynodon-Theriognathus Subzone (lower).

The defining fossils of the DAZ include the *dicynodont Daptocephalus leoniceps*, the *therocephalian Theriognathus microps*, and the *cynodont Procynosuchus delaharpeae*. The DAZ exhibits the greatest vertebrate diversity within the Beaufort Group and encompasses numerous well-preserved genera and species of various therapsid groups. Trace fossils of vertebrates and invertebrates, alongside Glossopteris flora plants, have also been documented within this zone. The DAZ extends into the lower Palingkloof Member of the Upper Balfour Formation, followed by the *Lystrosaurus declivis* Assemblage Zone within the Katberg Formation. This latter zone is characterized by a significant reduction in fauna and flora due to the Permo-Triassic Extinction Event (Pia A Viglietti, 2016).

The Volksrust Formation, primarily consisting of argillite overlying the Vryheid Formation of the Beaufort Group, is roughly 150-270 meters thick. This Formation correlates with formations in the south and is composed of grey to black silty shales with interbedded siltstone or sandstone lenses. These deposits may have been lacustrine or lagoonal in origin. Fossils within this formation are rare but may include temnospondyl amphibian remains,

invertebrates, petrified wood, and low-diversity trace fossils. Minor coal deposits with plant remains have also been documented (Snyman, 1996).

The Tetra4 development footprint is underlain by geological formations with varying degrees of palaeontological sensitivity according to the SAHRIS Palaeontological Sensitivity Map. These formations include Quaternary sands, Jurassic dolerite, Adelaide Subgroup (Very High), Volksrust Formation (High), and Allanridge Formation (Low). Drilling activities will only be conducted in the Quaternary sediments (Moderate), Jurassic dolerite (Zero), and Adelaide Subgroup (Very High) formations.

A site visit was conducted to assess the specific palaeontological sensitivity of the Balfour Formation (within the Adelaide Subgroup) which is exposed within the development area. Despite the high sensitivity rating by SAHRIS, the site visit did not identify any fossiliferous outcrops. Based on the site visit and desktop research, the potential for encountering fossils with scientific or conservation value is considered low within the development footprint. Fossil occurrences in the area are thought to be rare, sporadic, and unpredictable. Consequently, the potential impact on palaeontological heritage is considered low. This assessment contradicts the Very High Palaeontological Sensitivity classification assigned by SAHRIS due to the absence of identified fossils during the site visit.

The construction phase of the project is considered to have a medium palaeontological significance pre-mitigation, but this is reduced to low significance with mitigation measures in place. The drilling phase is the only activity with the potential to impact fossils. The operational and decommissioning phases are not expected to have any significant impacts.

The No-Go Alternative (maintaining the status quo) would have a neutral impact on palaeontological heritage. The project's cumulative impacts are considered medium pre-mitigation and low post-mitigation, falling within acceptable limits.

Overall, the proposed development is not expected to negatively impact the area's palaeontological resources. The development footprint is considered to have low palaeontological sensitivity. Therefore, no further palaeontological studies or mitigation are recommended unless new fossils are discovered during construction

9.9 GROUNDWATER (GEOHYDROLOGY)

The Department has categorized South African aquifers according to their host-rock formations and their capacity to transmit water to boreholes drilled within these formations. The hydrogeological properties of these formations have been classified into four aquifer classes, each further subdivided into groups based on aquifer transmissivity, typically measured in litres per second. These groups correspond to varying ranges of borehole yields.

- Class A: Intergranular Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.
- Class B: Fractured Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.
- Class C: Karst Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.
- Class D: Intergranular and fractured Aquifers that represent a combination of Class A and B aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water are stored in the intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into it.

Based on the DWS Hydrogeological Map Series 2726 Kroonstad, the site is primarily underlain by an aquifer system characterized by both intergranular and fractured properties. The aquifer media predominantly consists of compacted argillaceous strata exhibiting varying degrees of fracturing and weathering. In accordance with Vegter's groundwater region delineated (Vegter, 2006), the study area is classified within the North-eastern Pan

Belt region. The majority of hard-rock aquifers in this area are secondary in nature, with groundwater occurrences primarily associated with fracture networks, fault zones, and contact zones related to dolerite intrusions.

The complex geometry of argillaceous rock aquifers is further compounded by the lateral movement of meandering rivers across floodplains. As a result, Beaufort Group aquifers exhibit multi-layered and multi-porous characteristics with varying thicknesses. The contact plane between distinct sedimentary layers introduces discontinuities in the hydraulic properties of the composite aquifer system.

Ecca Group aquifers primarily comprise shales and sandstones characterized by low permeability due to poorly sorted matrix materials. Consequently, these aquifers possess limited development potential (Botha JF, 1998), with borehole yields typically ranging from 0.1 to 0.5 liters per second. Nevertheless, higher yielding boreholes, exceeding 5.0 liters per second, may be encountered in proximity to intrusive dyke contact zones and other structural features such as fault zones (Barnard, 2000).

The shallow, intergranular aquifer system exhibits a maximum thickness of 20 meters. Water within this aquifer is primarily stored in weathered or partially weathered rock formations. Water-bearing fractures are predominantly confined to a shallow zone beneath the static groundwater table (Mostert, 2022).

Four primary aquifer systems are relevant to the area of interest, namely:

- Shallow Alluvial Aquifer:
    - This unconfined aquifer is formed from alluvium deposited in river floodplains. It is characterized by high permeability and is highly susceptible to contamination due to direct connectivity with surface water bodies.
- Shallow Intergranular Aquifer:
    - This unconfined to semi-confined aquifer is located within weathered bedrock formations of the Karoo Supergroup. Groundwater flow follows topography and discharges as springs. Despite being susceptible to contamination due to high effective porosity, it is a significant water source for the region.
- Intermediate Fractured Aquifer:
    - This semi-confined to confined aquifer is situated within the Karoo Supergroup. Groundwater flow is controlled by fractures within the rock formation. While generally low yielding, this aquifer is crucial as the sole water supply for many in the area.
- Deep Fractured Aquifer:
    - This semi-confined to confined aquifer is located within the Ventersdorp and Witwatersrand Supergroups. Groundwater flow is also controlled by fractures. While potentially higher yielding than the shallower fractured aquifer, the water is typically saline and unsuitable for consumption due to depth and deteriorating water quality.

A dolerite sill and Dwyka Tillite formation act as barriers between the shallow and deep aquifers, limiting hydraulic connectivity. These aquifer systems vary in terms of depth, water quality, vulnerability to contamination, and importance as a water resource (Mostert, 2022).

The deep aquifer systems exhibit naturally saline water conditions due to their marine sedimentary origins. It is important to note that these deep formations, associated with the Ventersdorp and Witwatersrand Supergroups, are separated from the shallower potable Karoo aquifers by a 30 m thick dolerite sill, which may function as an aquitard, and a 65-meter thick Dwyka Tillite sedimentary deposit, acting as an aquiclude. Under natural conditions, hydraulic connectivity between the deep, fractured aquifers and the shallow, intergranular aquifers is minimal (Mostert, 2022).

The hydraulic conductivity of sedimentary formations present within the study area exhibits a wide range, spanning from 10^{-6} to 10^{-2} m/d. Historical aquifer testing data corroborate the exceptionally low permeability of shale formations, with values approximating 9 x 10^{-4} m/d. Fractured igneous rocks, such as dolerite, demonstrate hydraulic conductivity values between 10^{-6} and 10^{-1} m/d. In contrast, unfractured igneous rocks, exemplified by the fresh dolerite sill, exhibit significantly lower conductivities ranging from 10^{-9} to 10^{-6} m/d. Quaternary deposits and alluvial formations associated with the drainage system, including riverbed aquifers, are characterized by substantially higher hydraulic conductivities, varying between 10^{-2} and 10 m/d. An approximation of recharge for the study area is estimated at ~4.0% of Mean Annual Precipitation (MAP) i.e., ~21.69mm/a (Mostert, 2022).

It is anticipated that groundwater flow will follow a downward gradient in the areas of interest, towards the lower-lying drainage systems, ultimately discharging as baseflow. Within the ER94 area, groundwater is expected to flow predominantly northward. Conversely, groundwater flow in the northern ER32 area is anticipated to exhibit a predominantly southward to south-westerly direction (Mostert, 2022).

9.10 TERRESTRIAL BIODIVERSITY

Terrestrial Biodiversity has been assessed by The Biodiversity Company (TBC) and the specialist report is included in Appendix 3. The baseline terrestrial biodiversity (flora and fauna) findings are presented in the subsections below.

9.10.1 ECOLOGICALLY IMPORTANT LANDSCAPE FEATURES

The following features describe the general area and habitat, this assessment is based on spatial data that was available from various sources such as the provincial environmental authority and SANBI. The findings of the desktop analysis into sensitive areas and the relevance to this project are listed in Table 24.

Table 24: List of sensitive ecological areas relevant to the project area.

Desktop Information Considered	Relevance	Reasoning
Ecosystem Threat Status (RLE 2021)	Relevant	ER32 PAOI: Overlaps with 'Endangered' and 'Least Concern' ecosystems ER94 PAOI: Overlaps with a 'Least Concern' ecosystem
Ecosystem Protection Level	Relevant	ER32 PAOI: Overlaps with 'Not Protected' and 'Poorly Protected' Ecosystems ER94 PAOI: Overlaps with a 'Poorly Protected' Ecosystem
Provincial Conservation Plan	Relevant	ER32 PAOI: Overlaps with CBA 1, ESA1, ESA 2, Other Natural Areas and Degraded Areas ER94 PAOI: Overlaps with ESA1 and Other Natural Areas
National Protected Areas Expansion Strategy	Relevant	ER32 PAOI: Does not overlap with any relevant areas ER94 PAOI: Overlaps with NPAES Priority Focus Areas
SAPAD & SACAD	Relevant	ER32 PAOI: Does not occur within range of any protected areas ER94 PAOI: Occurs within 5 km of the H.J. Joel Private Nature Reserve
Important Bird & Biodiversity Areas (IBA)	Irrelevant	Not within range of any relevant areas

Desktop Information Considered	Relevance	Reasoning
South African Inventory of Inland Aquatic Ecosystems (SAIIAE)	Relevant	ER32 PAOI: Overlaps with 'Least Concern' wetlands ER94 PAOI: Does not overlap with any relevant areas
National Freshwater Ecosystem Priority Area (NFEPA)	Relevant	ER32 PAOI: Overlaps with non-priority wetlands ER94 PAOI: Does not overlap with any relevant areas
Strategic Water Source Areas (SWSA)	Irrelevant	Does not overlap with any relevant areas

The concept of Ecosystem Threat Status serves as an indicator of an ecosystem's overall health. It is determined by evaluating the degree of change within an ecosystem's structure, function, or composition. Ecosystem types are categorized based on their remaining extent in good ecological condition, using classifications such as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Least Concern (LC).

The Red List of Ecosystems dataset (Skowno & Monyeki, 2021) was consulted to assess the ecosystem threat status within the project area. The findings indicate that the ER32 PAOI (Project Area of Interest) overlaps with two distinct ecosystem types:

- One ecosystem type is classified as Endangered (EN) (Figure 41 and Figure 42).
- The other ecosystem type is categorized as Least Concern (LC) (Figure 41 and Figure 42).

The ER94 PAOI, on the other hand, is shown to solely overlap with an ecosystem type classified as Least Concern (LC) (Figure 42)

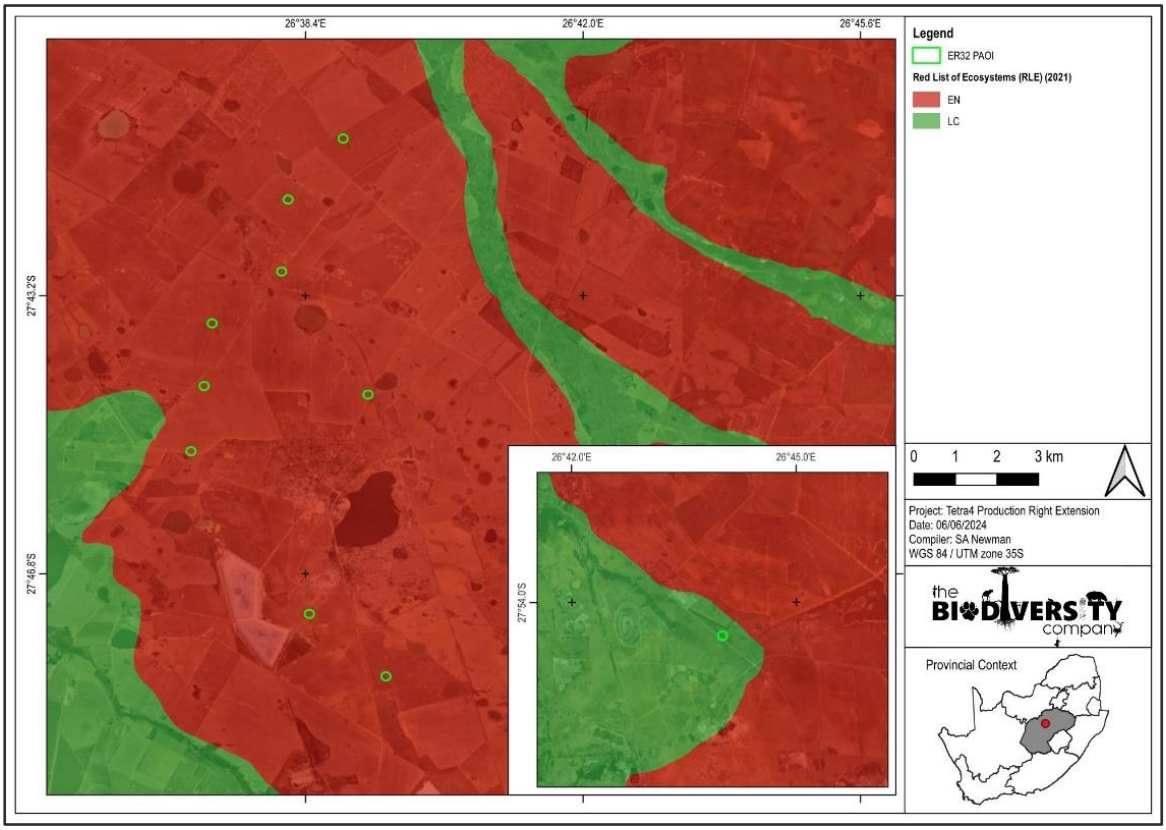

Figure 41: Ecosystem types and sensitivity map for ER23.

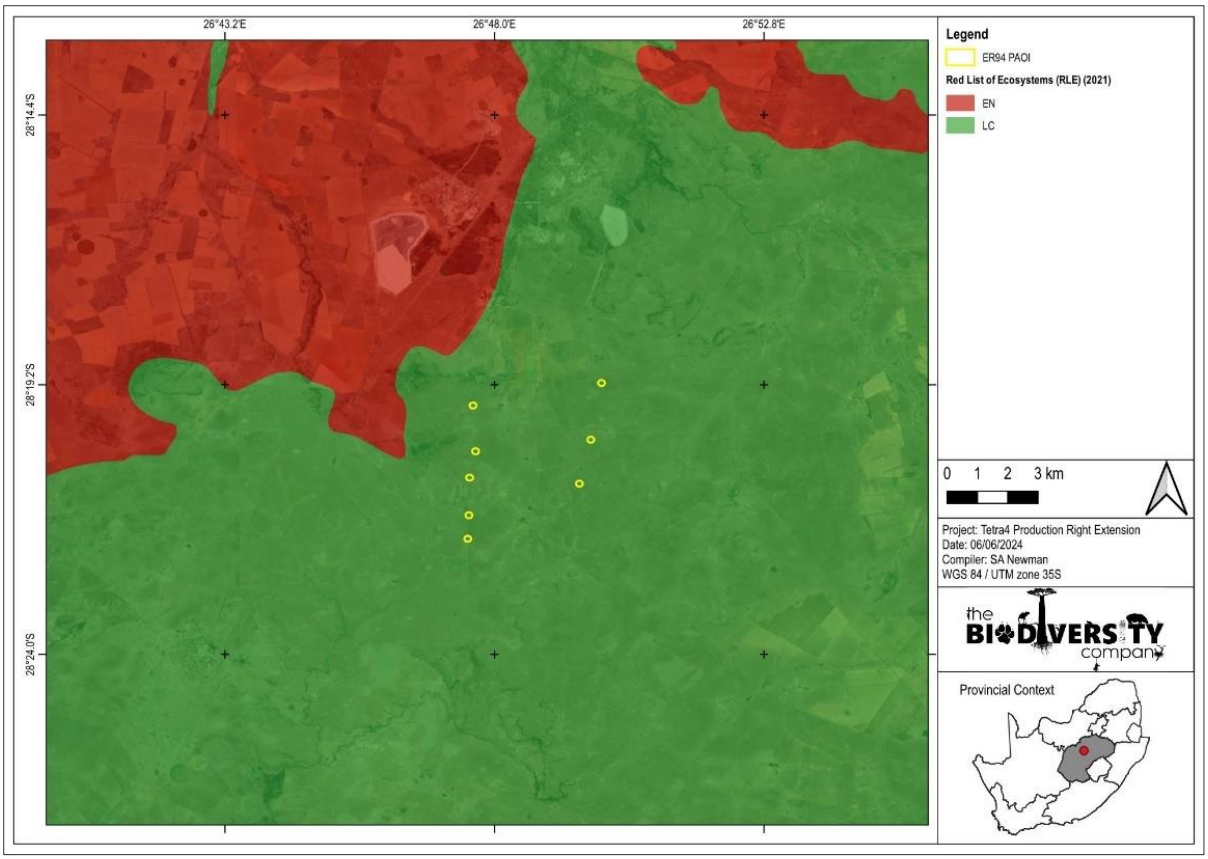

Figure 42: Ecosystem types and sensitivity map for ER94.

The extent to which existing protected areas safeguard the ecosystems within the project area was evaluated and the indicator used for this assessment is the Conservation Status of Ecosystems. Ecosystem types are categorized based on the proportion of their biodiversity target area that falls within formally protected areas. The categories used are:

- Well Protected (WP): A significant portion of the biodiversity target for the ecosystem type is included within protected areas.
- Moderately Protected (MP): A moderate portion of the biodiversity target for the ecosystem type is included within protected areas.
- Poorly Protected (PP): A limited portion of the biodiversity target for the ecosystem type is included within protected areas.
- Not Protected (NP): No portion of the biodiversity target for the ecosystem type is included within protected areas.

Ecosystems classified as Not Protected (NP), Poorly Protected (PP), or Moderately Protected (MP) are collectively referred to as under-protected ecosystems.

The analysis of the Conservation Status data reveals that the ER32 Project Area of Interest (PAOI) overlaps with two ecosystem types with varying protection statuses:

- One ecosystem type is classified as Not Protected (NP) (Figure 43 and Figure 44).
- The other ecosystem type is categorized as Poorly Protected (PP) (Figure 43 and Figure 44).

The ER94 PAOI, on the other hand, overlaps with a single ecosystem type classified as Poorly Protected (PP) (Figure 44). This information highlights the potential need for additional conservation measures to ensure the long-term viability of these ecosystems within the project area.

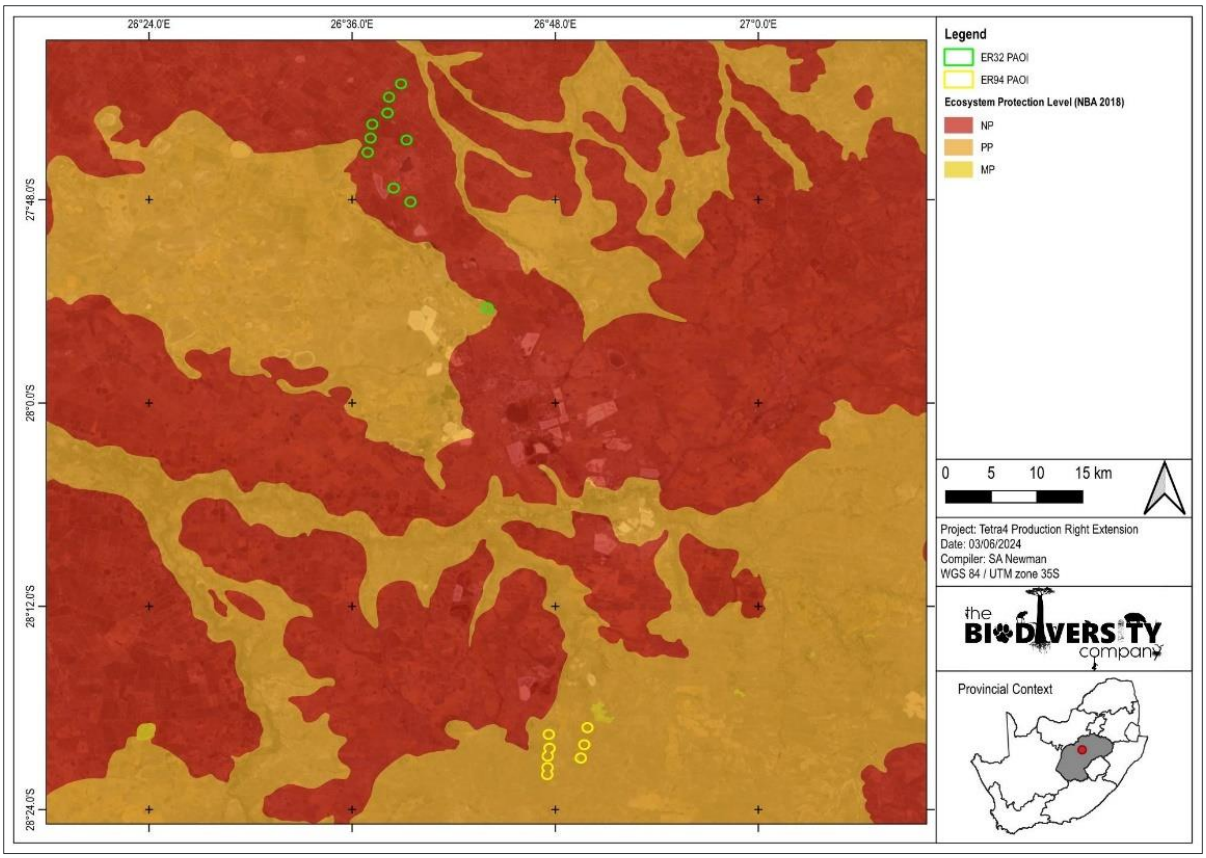

Figure 43: Ecosystem protection levels for ER32.

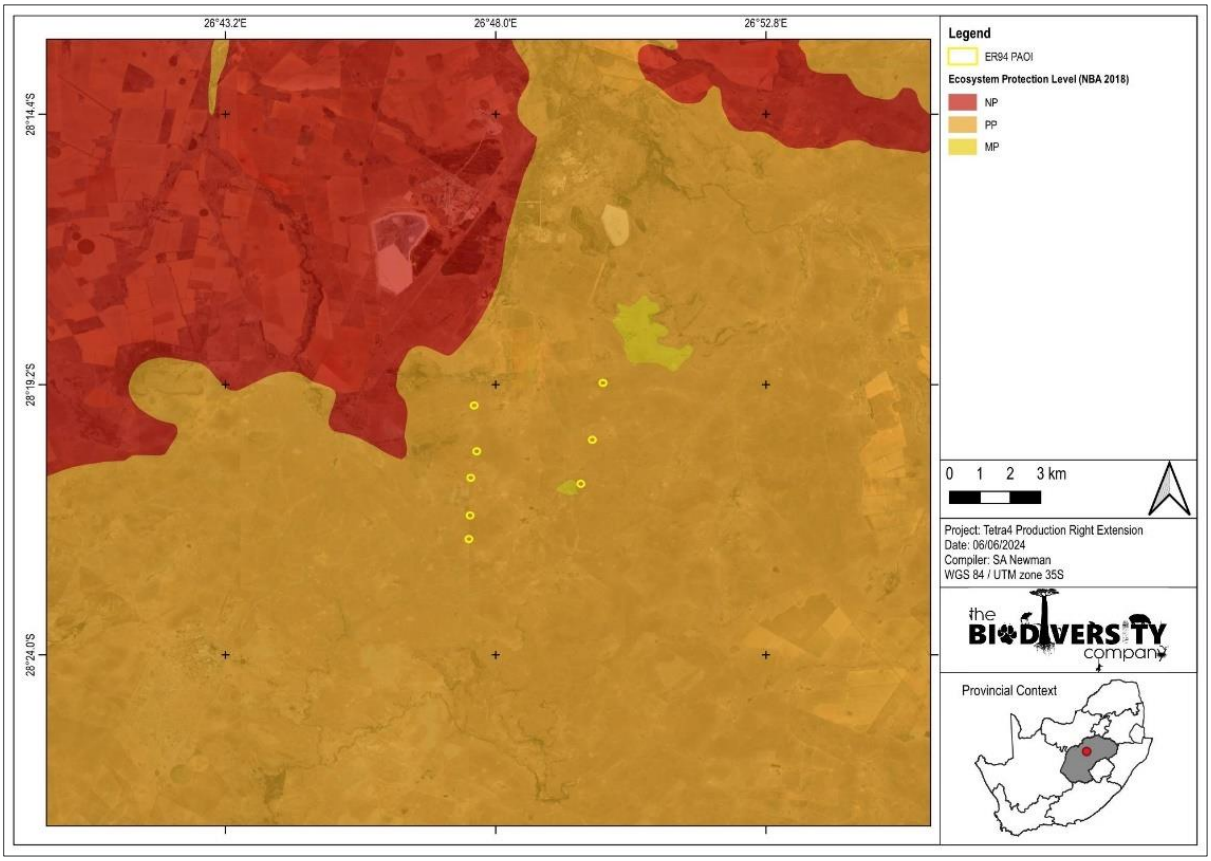

Figure 44: Ecosystem protection levels for ER94.

The Free State Department of Environment and Nature Conservation has established the Critical Biodiversity Areas (CBAs) Map, which identifies priority areas for biodiversity conservation within the province. These areas, along with Ecological Support Areas (ESAs) and protected areas, play a crucial role in maintaining a viable and representative sample of the province's ecosystems and species. Additionally, they ensure the long-term ecological functioning of the landscape.

The identification of CBAs employed a Systematic Conservation Planning (SCP) approach. This method involved collating available data on various aspects of biodiversity. The data encompassed both pattern and process elements, covering both terrestrial and inland aquatic ecosystems. Additionally, information on the condition of these features, existing protected and conservation areas, and potential opportunities and constraints for effective conservation was considered.

The CBA Map serves as an update and replaces all previous systematic biodiversity plans and associated products for the Free State. An analysis of the CBA Map reveals that the ER32 Project Area of Interest (PAOI) overlaps with several biodiversity priority areas (Figure 45):

- Critical Biodiversity Area 1 (CBA 1)
- Ecological Support Area 1 (ESA 1)
- Ecological Support Area 2 (ESA 2)
- Other Natural Areas (ONAs)
- Degraded Areas

The ER94 PAOI, on the other hand, overlaps with the following biodiversity priority areas (Figure 46):

- Ecological Support Area 1 (ESA 1)
- Other Natural Areas (ONAs)
- Degraded Areas

This information highlights the significance of the project area for biodiversity conservation within the Free State province. The presence of CBAs and ESAs necessitates careful consideration of potential project impacts on biodiversity during the planning and implementation phases.

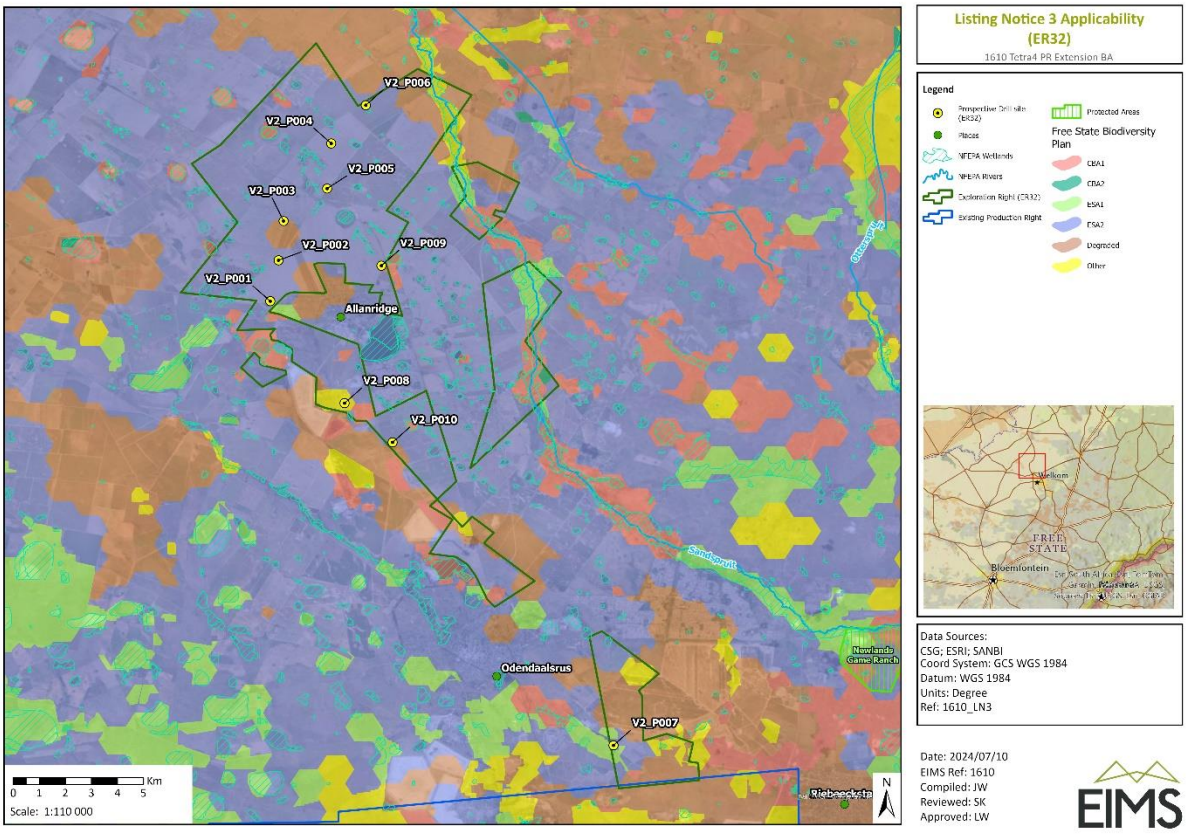

Figure 45: Terrestrial Critical Biodiversity Areas for ER32.

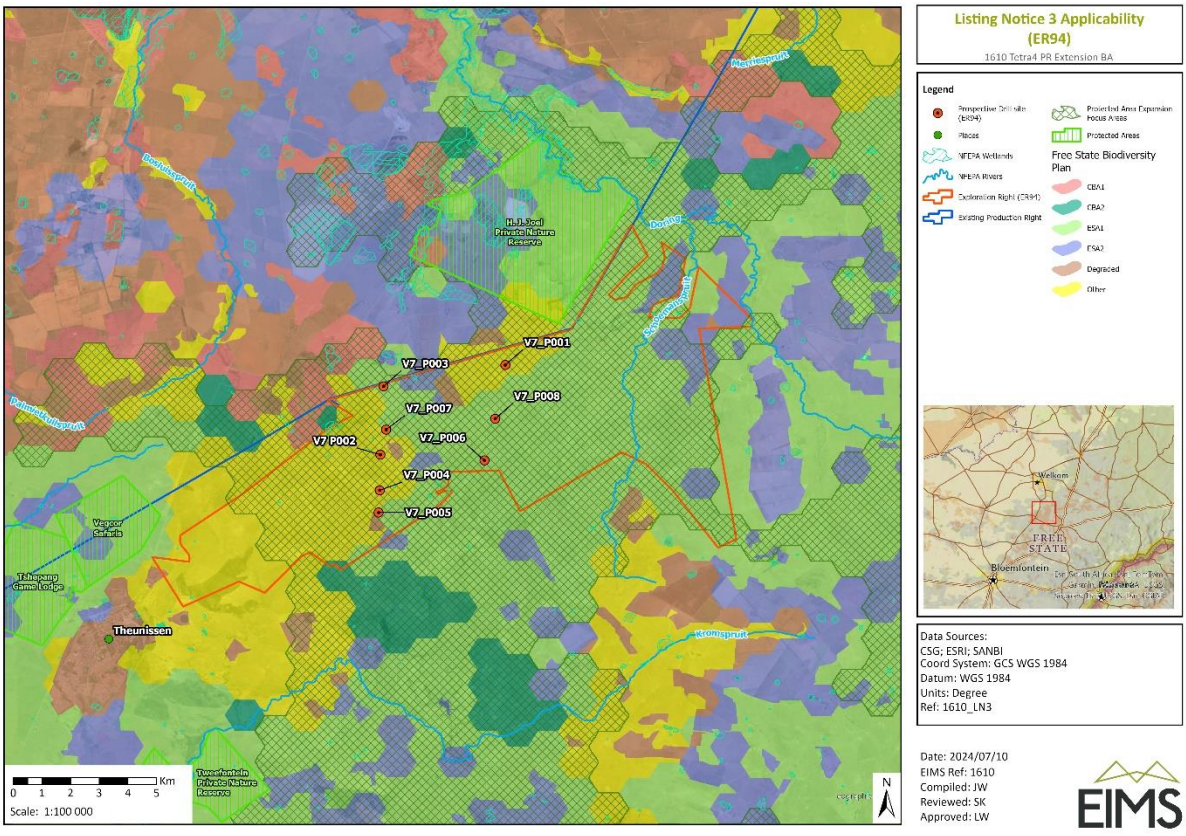

Figure 46: Terrestrial Critical Biodiversity Areas for ER94.

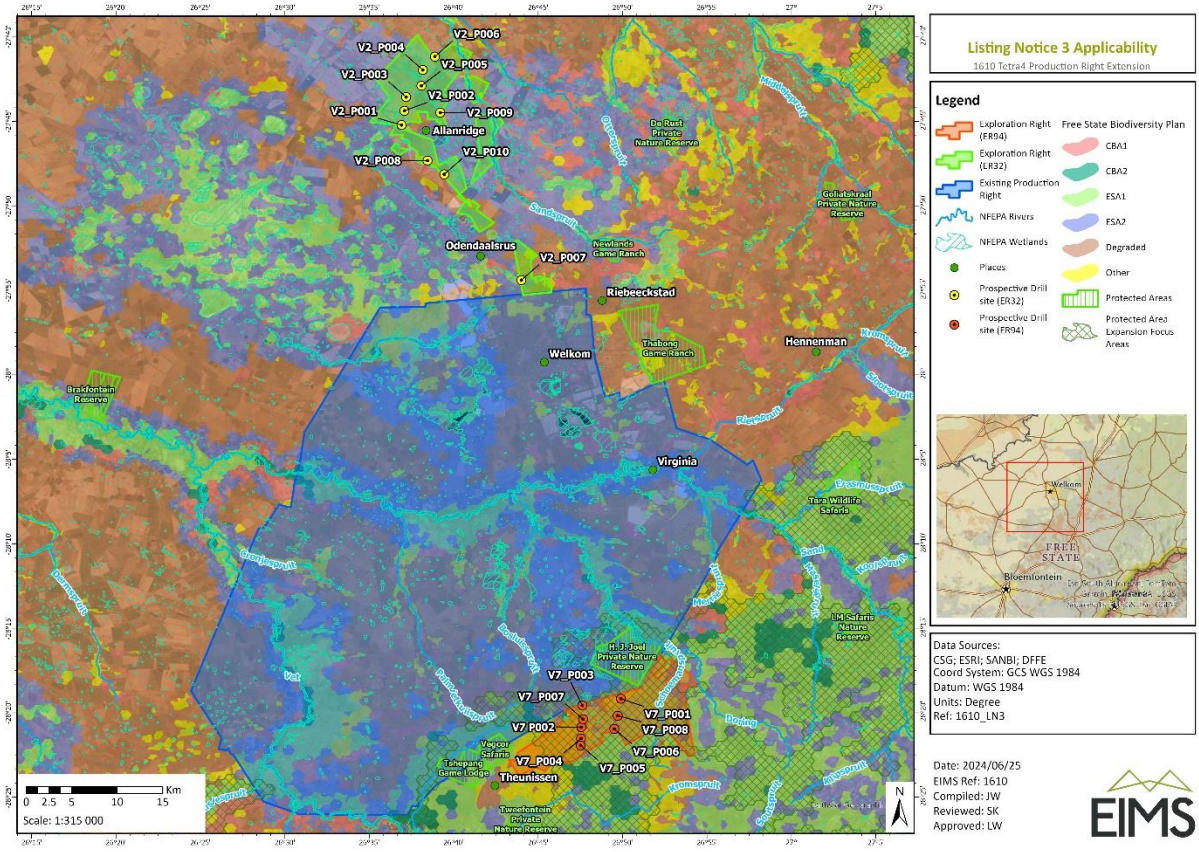

Figure 47: Terrestrial Critical Biodiversity Areas.

The Department of Environmental Affairs (now the Department of Forestry, Fisheries and the Environment, DFFE) spearheaded the development of the National Protected Areas Expansion Strategy (NPAES) in collaboration with protected area agencies and other key stakeholders from both the private and public sector (DFFE, 2022). The need for this strategy was established in the 2009 National Biodiversity Framework.

South Africa's existing network of protected areas falls short of fully representing all ecosystems and ensuring their healthy function within ecological processes. To address this gap, the NPAES aims to achieve cost-effective expansion of protected areas, resulting in improved representation of ecosystems, enhanced ecological sustainability, and greater resilience in the face of climate change.

The NPAES relies on a comprehensive set of priority areas identified by provincial agencies and other relevant bodies in their respective protected area expansion strategies. These focus areas are typically large, intact, and unfragmented landscapes, thereby holding significant value for biodiversity conservation, climate resilience, and freshwater protection (DFFE, 2022).

An analysis of the 2018 NPAES dataset reveals that the ER32 Project Area of Interest (PAOI) does not overlap with any designated priority areas for expansion (Figure 48). However, the ER94 PAOI falls within a priority focus area for expansion according to the same dataset (Figure 49)

This information highlights the potential implications of the project on biodiversity conservation within the ER94 PAOI, considering its location within an area identified as crucial for future protected area expansion.

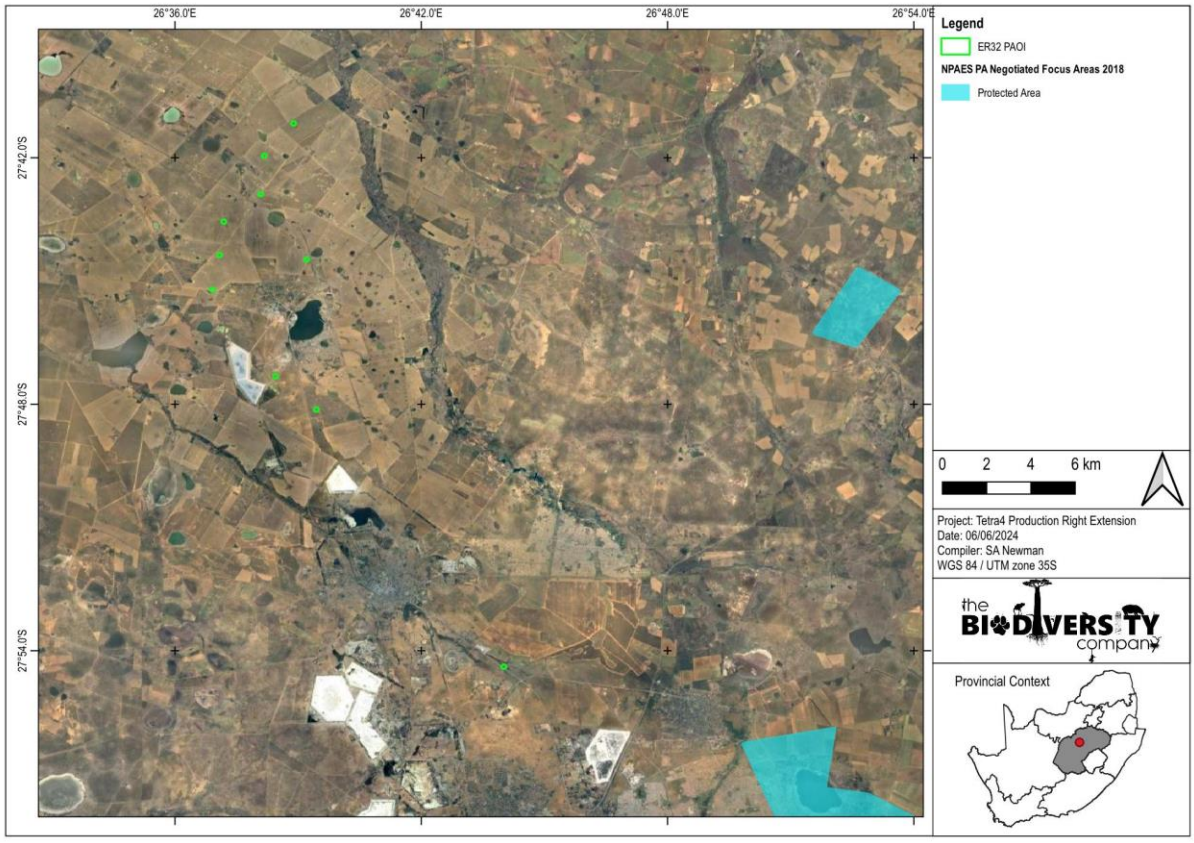

Figure 48: NPAES PA Negotiated Focus Areas for ER32.

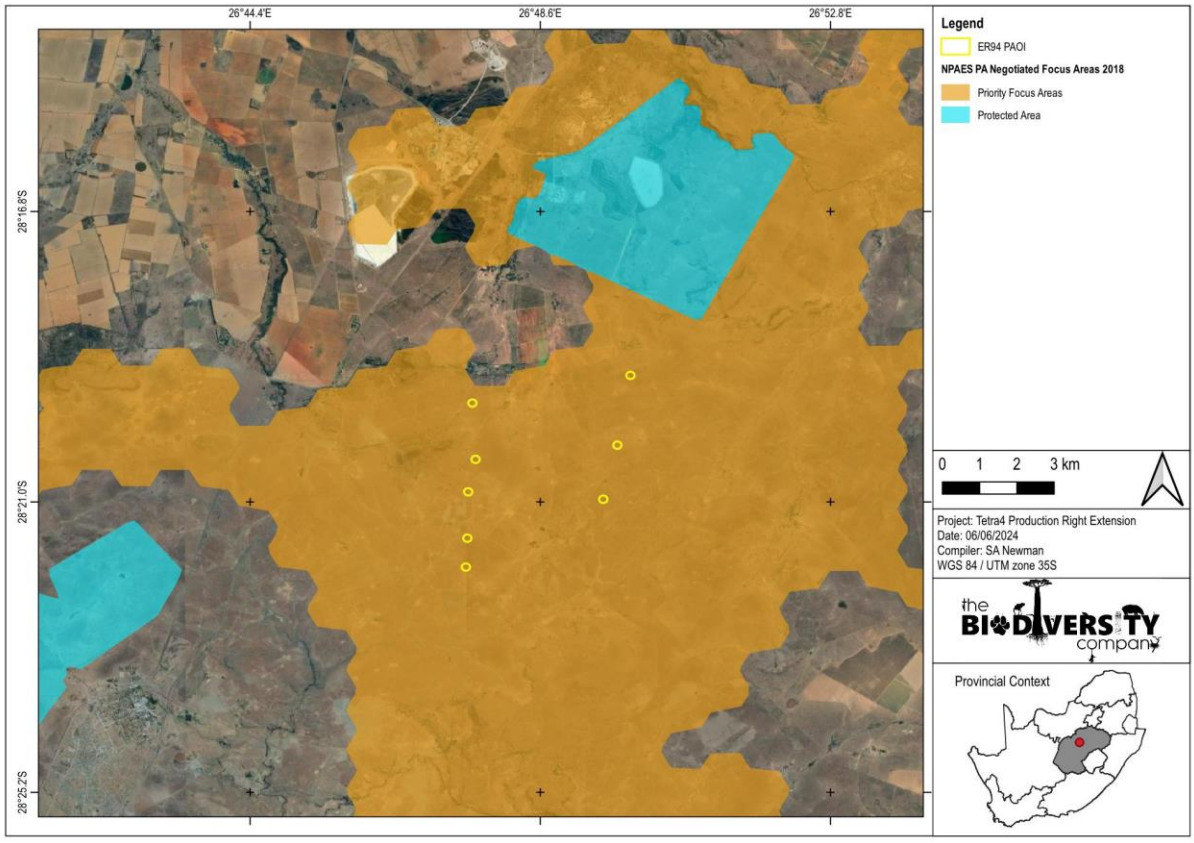

Figure 49: NPAES PA Negotiated Focus Areas for ER94.

An analysis of protected area spatial datasets from SAPAD (2023) and SACAD (2023) revealed that the ER32 Project Area of Interest (PAOI) is not located within the immediate vicinity of any protected areas (Figure 50).

However, for the ER94 PAOI, the situation is different. Two drilling collars, V7_P001 and V7_P003, are situated within the 5 km buffer zone surrounding the H.J. Joel Private Nature Reserve (Figure 51). Specifically:

- Drilling collar V7_P001 is approximately 1.9 km from the H.J. Joel Private Nature Reserve.
- Drilling collar V7_P003 is approximately 4.5 km from the H.J. Joel Private Nature Reserve.

This information necessitates a closer examination of potential project impacts on the H.J. Joel Private Nature Reserve during the environmental assessment process

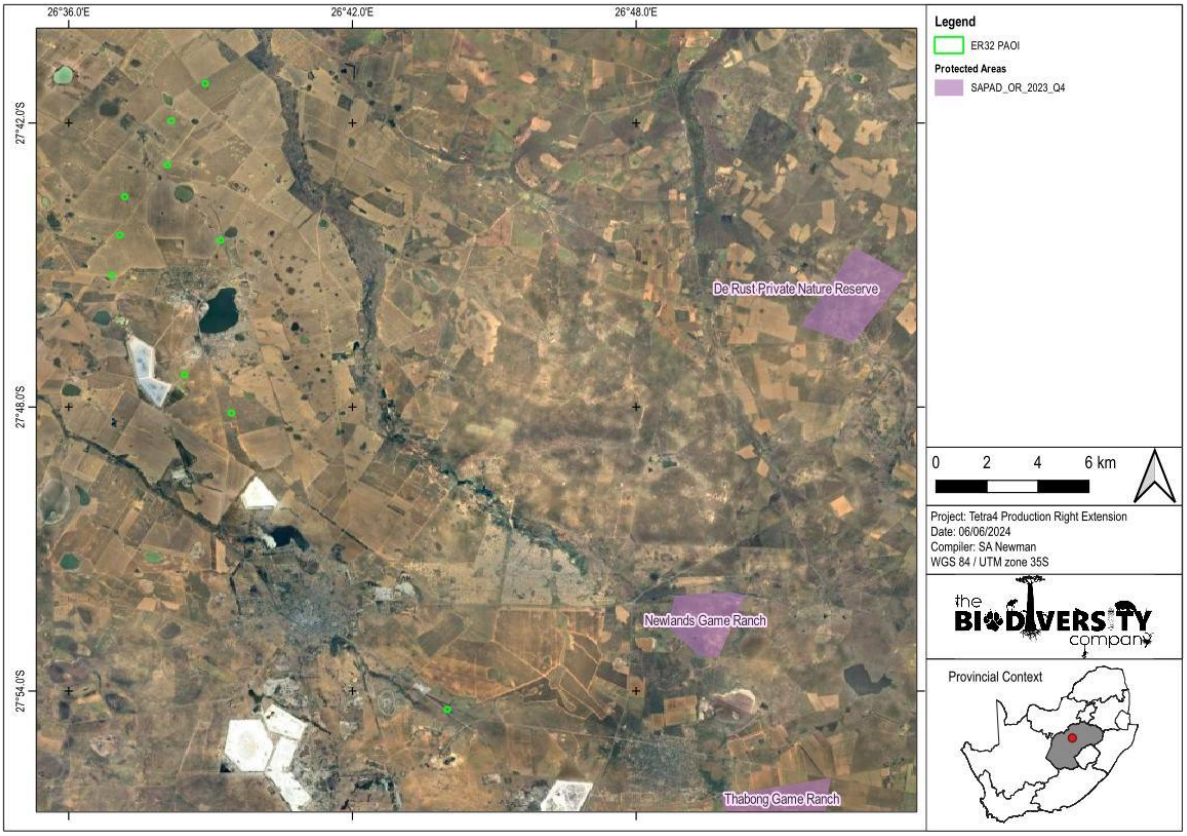

Figure 50: Protected Areas with relation to ER32.

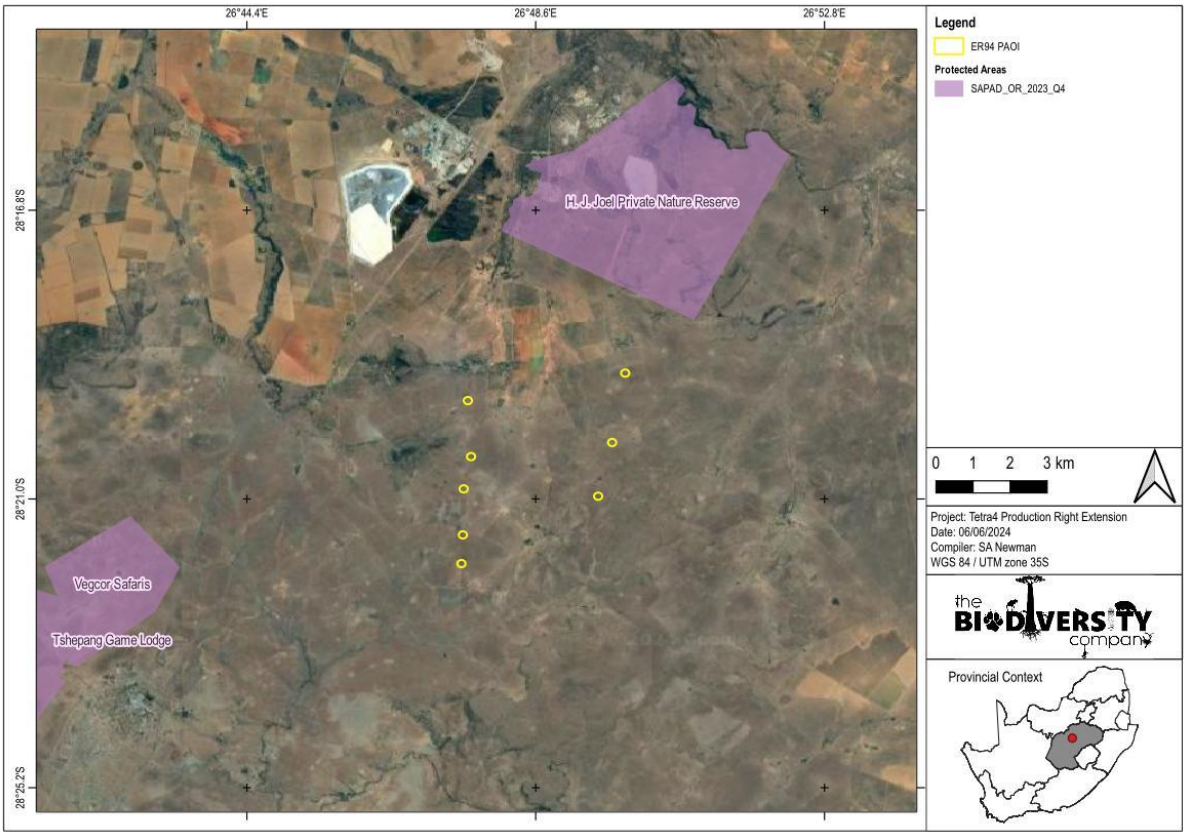

Figure 51: Protected Areas with relation to ER94.

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE), released alongside the National Biodiversity Assessment (NBA) in 2018, provides a valuable tool for assessing the health of inland aquatic ecosystems. This assessment focuses on the Ecosystem Threat Status (ETS) of river and wetland ecosystems within the project area.

The ETS classification is based on the degree of alteration each river ecosystem type has undergone compared to its natural state. Ecosystem types are categorized as:

- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)
- Least Concern (LC)

Ecosystems classified as Critically Endangered, Endangered, or Vulnerable are collectively referred to as "threatened" (Van Deventer et al., 2019; Skowno et al., 2019).

An analysis of the SAIIAE data reveals that the ER32 Project Area of Interest (PAOI) overlaps with wetlands classified as Least Concern (LC) (Figure 52). This indicates that these wetlands are considered to be in a relatively unaltered state. The ER94 PAOI, on the other hand, does not overlap with any rivers or wetlands according to the SAIIAE data (Figure 53).

This information suggests that the project is unlikely to have significant negative impacts on threatened inland aquatic ecosystems within the ER32 PAOI. However, given the absence of data for the larger ER94 PAOI, further investigation may be necessary to confirm the presence or absence of inland aquatic ecosystems in this area.

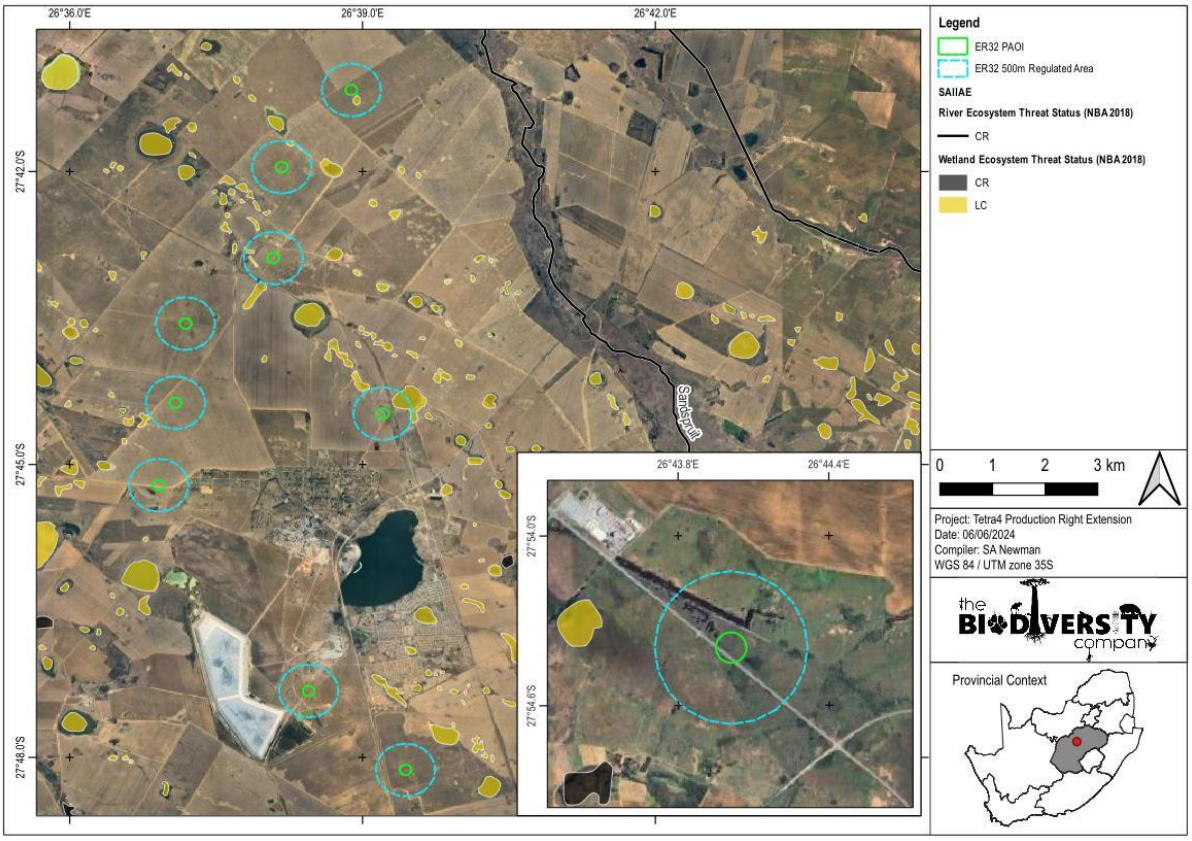

Figure 52: River and wetland ecosystem threat status for ER32.

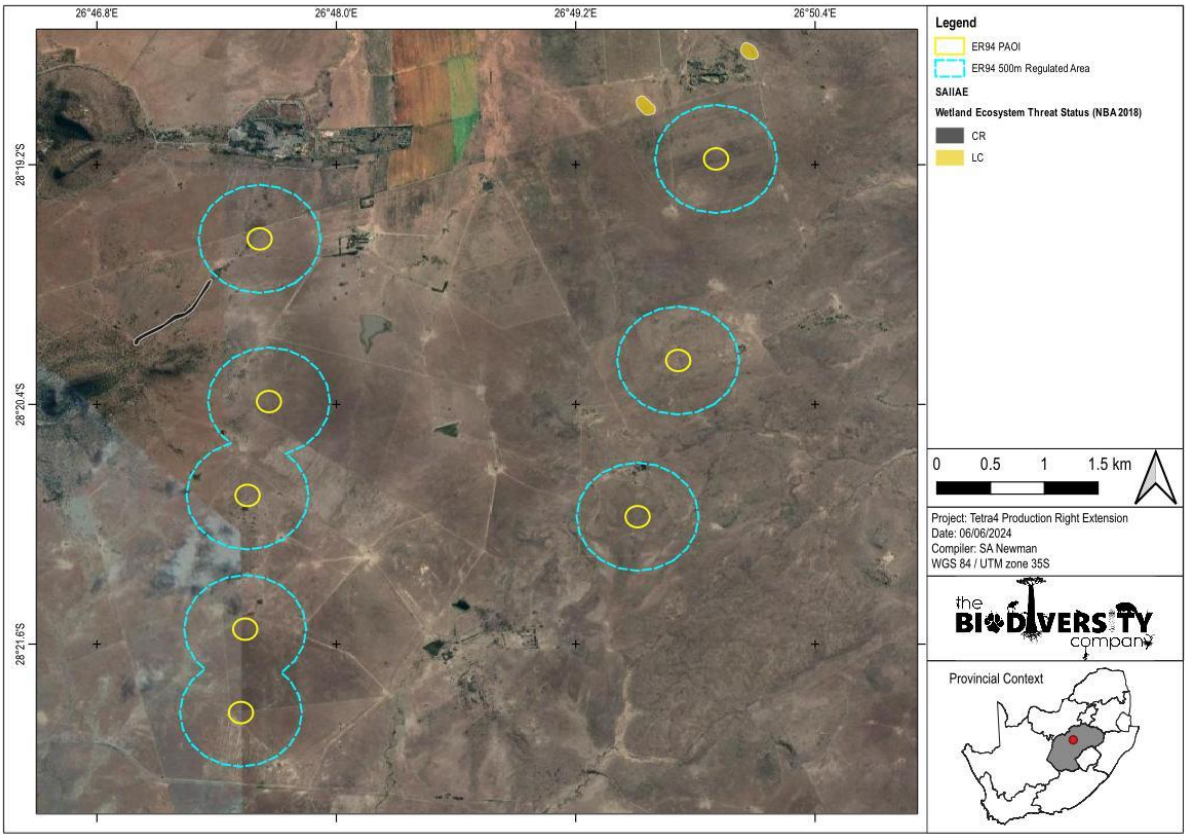

Figure 53: River and wetland ecosystem threat status for ER94.

South Africa has established Freshwater Ecosystem Priority Areas (FEPAs) to prioritize conservation efforts for aquatic ecosystems. These areas are identified based on ecological criteria such as ecosystem representation, water yield, connectivity, unique features, and the presence of threatened species (Driver et al., 2011). FEPAs serve as conservation support tools, aiming to guide effective implementation of measures aligned with the National Environment Management: Biodiversity Act's (NEM:BA) biodiversity goals (Nel et al., 2011).

An analysis of FEPAs data reveals that the ER32 Project Area of Interest (PAOI) overlaps with wetlands classified as non-priority (Figure 54). This indicates that these wetlands are not considered critical for national biodiversity conservation efforts under the FEPAs framework. Similarly, the ER94 PAOI also overlaps with non-priority wetlands according to the FEPAs data (Figure 55).

While the project area does not encompass any FEPAs, the presence of wetlands necessitates careful consideration of potential project impacts on these ecosystems during the planning and implementation phases.

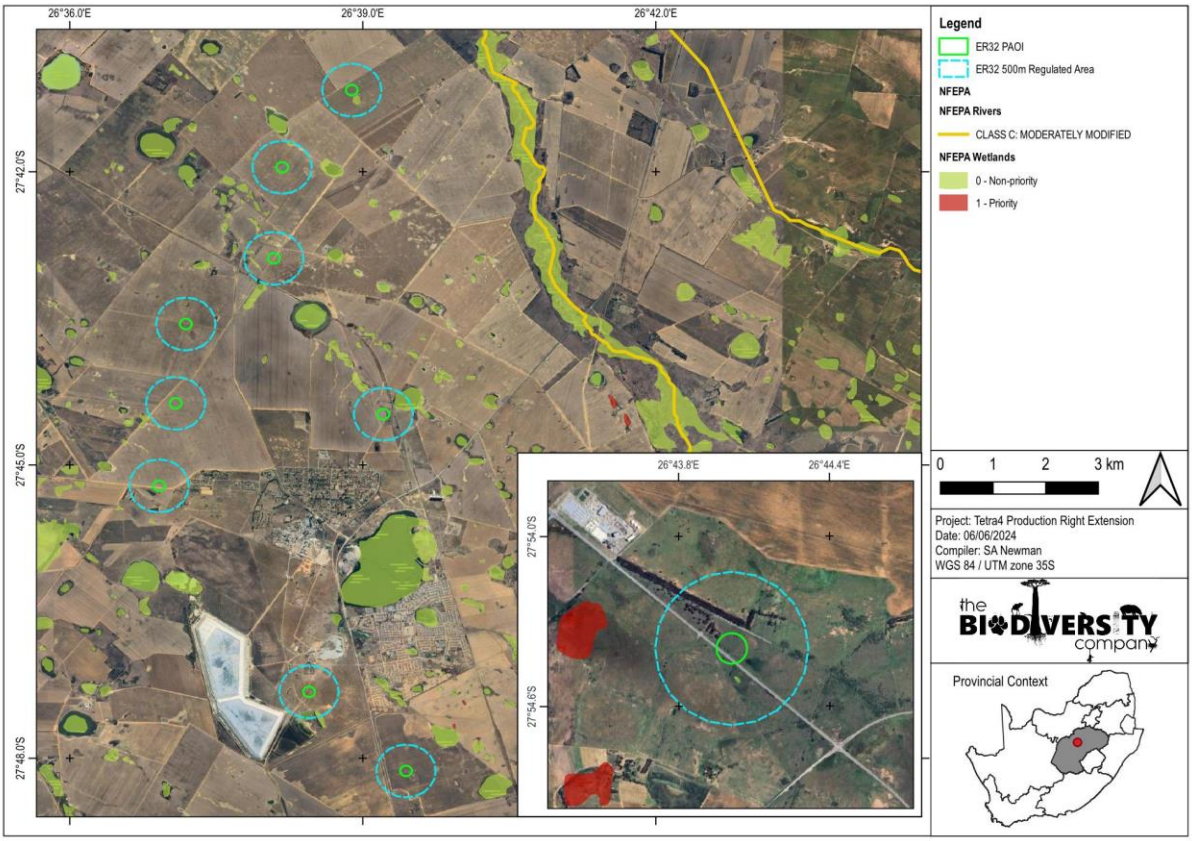

Figure 54: NFEPA rivers and wetlands for ER32.

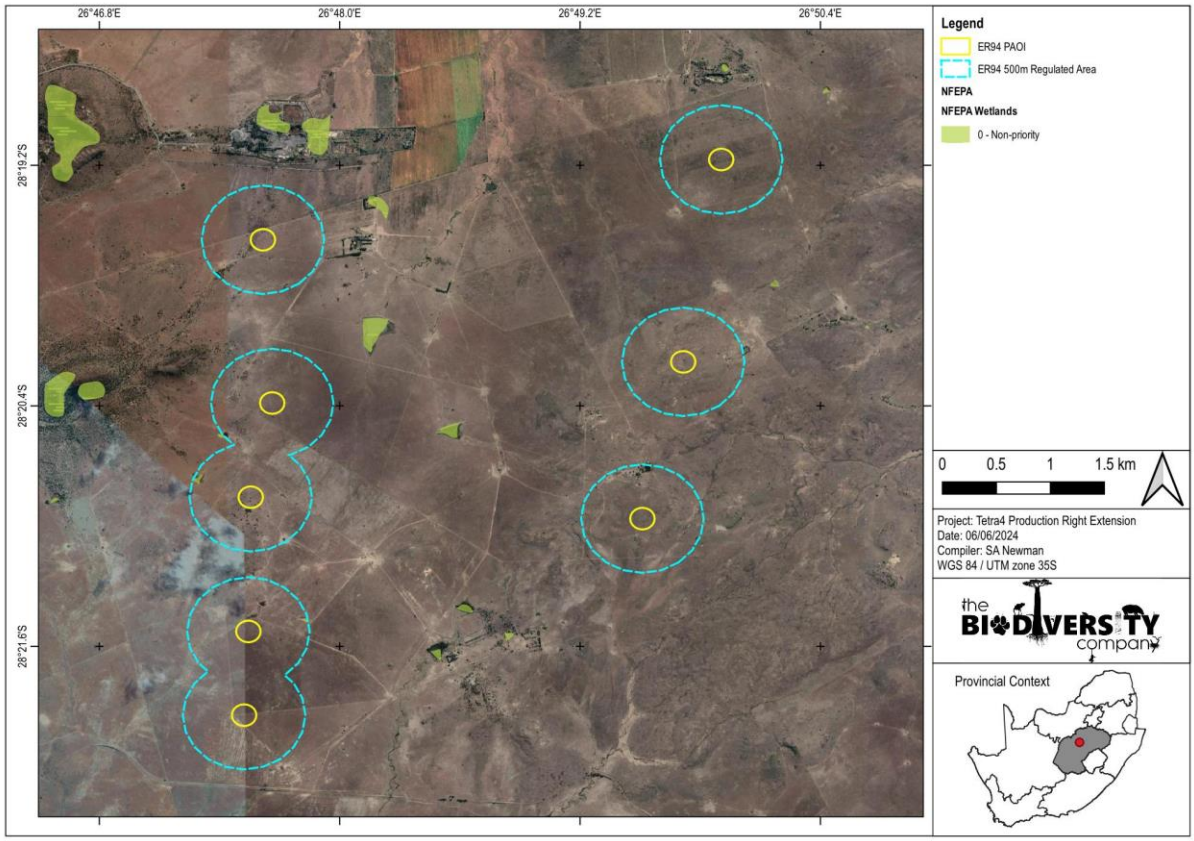

Figure 55: NFEPA rivers and wetlands for ER94.

9.10.2 FLORA ASSESSMENT

The project area of interest (PAOI) is situated within the grassland biome, which occupies a central location in southern Africa, bordering all other biomes except the desert, fynbos, and succulent Karoo (Mucuna & Rutherford, 2006). Key macroclimatic features defining this biome include:

- Seasonal Precipitation: Rainfall patterns exhibit distinct wet and dry seasons.
- Winter Minimum Temperatures: The biome experiences cold winters with minimum temperatures that play a significant role in shaping plant communities.

Grasslands are predominantly distributed across the high central plateau of South Africa, extending into inland areas of KwaZulu-Natal and the Eastern Cape. The topography varies from flat plains to rolling hills, also encompassing escarpments. Altitude ranges from near sea level to a maximum of 2,850 meters above sea level.

The grassland biome is characterized by a single dominant layer of grasses. The density and species composition of this grass layer are primarily influenced by rainfall patterns and grazing pressure. Summer rainfall and dry winters with frost (and frequent fires) create conditions that limit tree growth. Consequently, trees are largely absent except in specific localized habitats. Notably, geophytes (plants with underground storage organs) are often abundant within these grasslands. The interplay of frost, fire, and grazing maintains the dominance of grasses and hinders tree establishment.

According to the South African National Biodiversity Institute (SANBI, 2018), the ER32 PAOI falls within two distinct vegetation types:

- Vaal-Vet Sandy Grassland; and
- Western Free State Clay Grassland.

The ER94 PAOI, on the other hand, is situated within the Central Free State Grassland vegetation type (Figure 56). All three vegetation types belong to the Dry Highveld Grassland Bioregion.

A total of 283 species were identified within the study areas. Of these, 161 were classified as Least Concern, while the following were categorized as Endangered or Near Threatened.

- *Aloe braamvanwykii,* Endangered.
- *Drimia sanguinea*, Near Threatened.

Further details regarding the specific plant communities and their conservation status within each vegetation type is provided in the Terrestrial Biodiversity Specialist Report (Appendix 3).

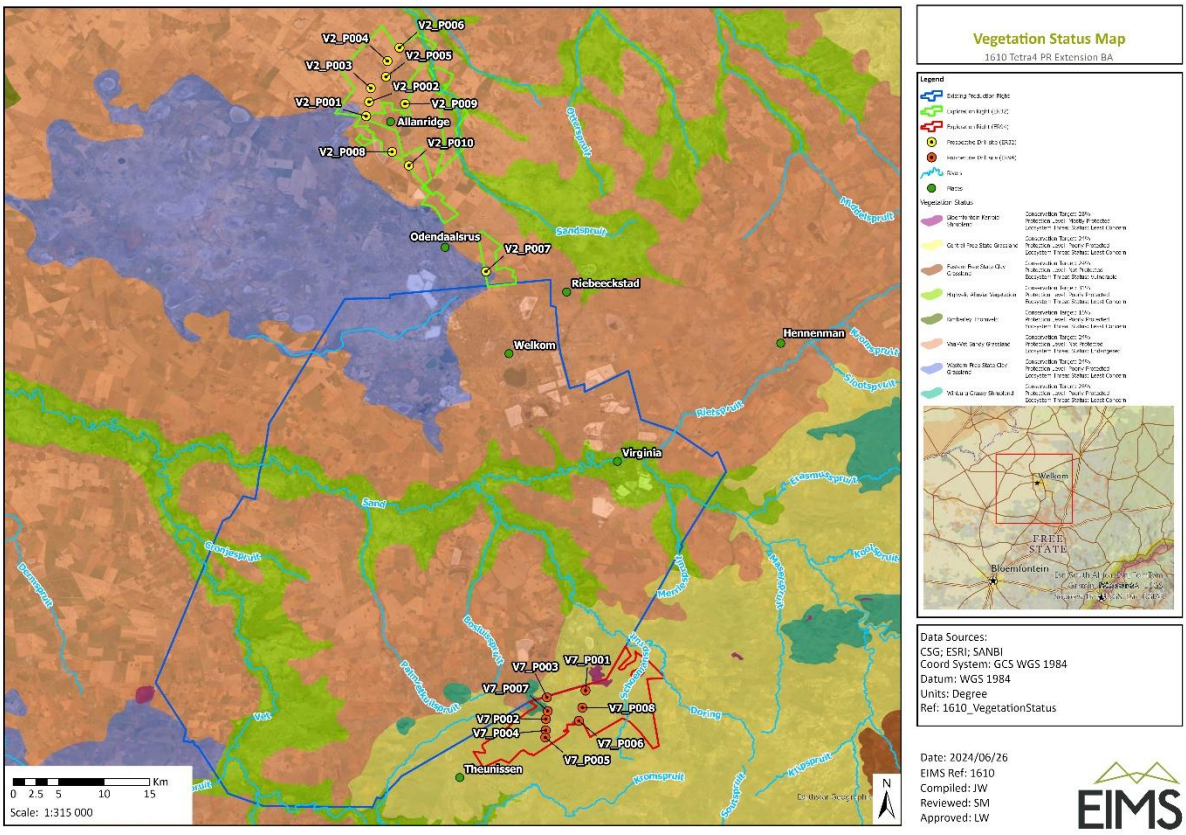

Figure 56: Vegetation Status Map.

9.10.3 FAUNA ASSESSMENT

Avifauna, Mammal and Herpetofauna observations and recordings fall under this section.

9.10.3.1 **AVIFAUNA**

The avian fauna survey conducted within the project area of interest (PAOI) identified a total of fifteen (15) bird species based on direct observation, vocalizations, and visual tracks and signs (Table 25). The relatively low number of species recorded can be attributed to two key factors:

- Low Temperatures: The survey was conducted during a period with low ambient temperatures, which can influence bird activity and detectability.
- Seasonal Constraints: Seasonal variations in bird abundance and distribution may have limited the number of species observed.

Although not recorded directly within the PAOI or its 500-meter buffer zone, three (3) avian Species of Conservation Concern (SCC) were identified in the broader survey area. These species are:

- Secretarybird (*Sagittarius serpentarius*; Endangered)
- Lesser Flamingo (*Phoeniconaias minor*; Near Threatened)
- Greater Flamingo (*Phoenicopterus roseus*; Near Threatened)

Table 25: List of avifauna Species of Conservation Concern that may occur in ER32 and ER94.

Scientific Name	Common Name	Screening Tool Designation	Conservation Status SANBI / IUCN[5]	Likelihood of Occurrence	Reason
Calidris ferruginea	Sandpiper, Curlew	-	LC / NT	Low	No suitable habitat present on site
Charadrius pallidus	Plover, Chestnut-banded	-	NT / NT	Low	No suitable habitat present on site
Ciconia abdimii	Stork, Abdim's	-	NT / LC	Low	No suitable habitat present on site
Ciconia nigra	Stork, Black	-	VU / LC	Low	No suitable habitat present on site
Circus ranivorus	Harrier, African Marsh	High	EN / LC	Low	No suitable habitat present on site
Eupodotis caerulescens	Korhaan, Blue	-	LC / NT	High	Suitable habitat present on site
Falco biarmicus	Falcon, Lanner	-	VU / LC	Moderate	Some suitable habitat present on site
Gyps africanus	Vulture, White-backed	-	CR / CR	Low	No suitable habitat present on site
Hydroprogne caspia	Tern, Caspian	High	Unlisted / LC	Low	No suitable habitat present on site
Mycteria ibis	Stork, Yellow-billed	-	EN / LC	Low	No suitable habitat present on site
Oxyura maccoa	Duck, Maccoa	-	NT / VU	Low	No suitable habitat present on site
Phoeniconaias minor	Flamingo, Lesser	-	NT / NT	High	Recorded in the area
Phoenicopterus roseus	Flamingo, Greater	-	NT / LC	High	Recorded in the area

[5] CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable.

Scientific Name	Common Name	Screening Tool Designation	Conservation Status SANBI / IUCN[5]	Likelihood of Occurrence	Reason
Rostratula benghalensis	Painted-snipe, Greater	-	NT / LC	Low	No suitable habitat present on site
Sagittarius serpentarius	Secretarybird	Medium	VU / EN	High	Recorded in the area

During the survey, a total of fifteen (15) bird species were documented within the PAOI, listed in Table 26. These observations were based on either direct sightings, vocalizations, or the presence of visual tracks and signs. The relatively low number of species recorded is likely attributable to two main factors: the low temperatures experienced on site at the time of the survey and seasonal limitations.

It is important to note that three (3) avian Species of Conservation Concern (SCC) were recorded in the general area but not specifically within the PAOI or its 500-meter buffer zone. These species are the Secretarybird (*Sagittarius serpentarius*, Endangered), Lesser Flamingo (*Phoeniconaias minor*, Near Threatened), and Greater Flamingo (*Phoenicopterus roseus*, Near Threatened). While not confirmed within the PAOI itself, all three SCCs have the potential to occur within the area, particularly the Secretarybird.

Table 26: Avifauna species recorded for ER32 and ER94 during the field visit.

Species	Common Name	Conservation Status Regional / IUCN[6]	Free State Nature Conservation Ordinance 8 of 1969
Acridotheres tristis	Myna, Common	Unlisted / LC	-
Afrotis afraoides	Korhaan, Northern Black	Unlisted / LC	Schedule 1
Ardea cinerea	Heron, Grey	Unlisted / LC	Schedule 1
Bostrychia hagedash	Ibis, Hadeda	Unlisted / LC	Schedule 1
Bubulcus ibis	Egret, Cattle	Unlisted / LC	Schedule 1
Corvus albus	Crow, Pied	Unlisted / LC	-
Elanus caeruleus	Kite, Black-shouldered	Unlisted / LC	Schedule 1
Fulica cristata	Coot, Red-knobbed	LC / LC	Schedule 2
Melierax canorus	Goshawk, Pale Chanting	LC / LC	Schedule 1
Ploceus velatus	Masked-weaver, Southern	Unlisted / LC	-

[6] CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable.

Species	Common Name	Conservation Status Regional / IUCN[6]	Free State Nature Conservation Ordinance 8 of 1969
Spilopelia senegalensis	Dove, Laughing	Unlisted / LC	-
Struthio camelus	Ostrich	LC / LC	-
Threskiornis aethiopicus	Ibis, African Sacred	LC / LC	Schedule 1
Vanellus armatus	Lapwing, Blacksmith	Unlisted / LC	Schedule 1
Vanellus coronatus	Lapwing, Crowned	Unlisted / LC	Schedule 1

9.10.3.2 **MAMMALS**

The MammalMap database, maintained by the Animal Demography Unit, identified 21 potential mammal species within the PAOI. Species typically restricted to protected areas, such as game reserves, were excluded from this list due to their low likelihood of occurrence within the PAOI. However, all species identified by the screening tool were retained for further consideration. Three (3) mammal species of conservation concern within the PAOI were identified by the MammalMap database, with one (1) additional species flagged by the screening tool (Table 27).

Table 27: List of mammal Species of Conservation Concern that may occur in ER32 and ER94.

Scientific Name	Common Name	Screening Tool Designation	Conservation Status SANBI / IUCN[7]	Likelihood of Occurrence	Reason
Felis nigripes	Black-footed Cat	-	VU / VU	Low	No suitable habitat present on site
Hyaena brunnea	Brown Hyena	-	NT / NT	Low	No suitable habitat present on site
Hydrictis maculicollis	Spotted-necked Otter	Medium	VU / NT	Low	No suitable habitat present on site

The mammal species recorded for the PAOI during the field survey are presented in Table 28 below. Additional common mammal species are expected for the PAOI.

Table 28: Mammal species recorded for ER32 and ER94 during the field visit.

Scientific Name	Common Name	Conservation Status SANBI / IUCN[4]	Free State Nature Conservation Ordinance 8 of 1969
Canis mesomelas	Black-backed Jackal	LC / LC	
Cynictis penicillata	Yellow Mongoose	LC / LC	

[7] CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable.

Scientific Name	Common Name	Conservation Status SANBI / IUCN[4]	Free State Nature Conservation Ordinance 8 of 1969
Damaliscus pygargus	Blesbok	LC / LC	Schedule 2
Lepus saxatilis	Scrub Hare	LC / LC	Schedule 2
Raphicerus campestris	Steenbok	LC / LC	Schedule 2
Suricata suricatta	Suricate	LC / LC	
Xerus inauris	Cape Ground Squirrel	LC / LC	

9.10.3.3 HERPETOFAUNA

A review of the ReptileMap database, maintained by the Animal Demography Unit, identified sixteen (16) reptile species with the potential to occur within the Project Area of Interest (PAOI). One of these potentially occurring species is listed as a Species of Conservation Concern (SCC) (Table 29). It is important to note that the screening tool did not identify any SCC reptiles within the PAOI. A similar review of the AmphibianMap database, also maintained by the Animal Demography Unit, revealed nine (9) amphibian species with the potential to occur within the PAOI. One (1) of these potentially occurring species is also listed as an SCC (Table 29). Similar to the reptile findings, the screening tool did not identify any SCC amphibians within the PAOI.

Table 29: List of herpetofauna Species of Conservation Concern that may occur in ER32 and ER94.

Scientific Name	Common Name	Screening Tool Designation	Conservation Status SANBI / IUCN[8]	Likelihood of Occurrence	Reason
Psammophis leightoni	Cape Sand Snake	-	VU / LC	Low	No suitable habitat present on site
Pyxicephalus adspersus	Giant Bull Frog	-	NT / LC	Low	No savanna habitat present on site

While no reptile or amphibian species were observed within the PAOI during the survey, this absence is likely attributable to seasonal limitations and the low temperatures encountered at the time. The PAOI is expected to support a variety of common reptile and amphibian species.

9.10.4 HABITAT ASSESSMENT AND SITE ECOLOGICAL IMPORTANCE

9.10.4.1 HABITAT ASSESSMENT

Five (5) main habitat types were identified across the PAOI and include:

- Grassland;
    - The surveyed habitat unit aligns with the expected Central Free State Grassland vegetation type. *Themeda triandra* is the dominant graminoid species, accompanied by various others like *Eragrostis curvula* and *Aristida congesta.* While some encroachment *by Vachellia karroo* is evident in previously disturbed areas, the overall habitat remains largely intact with minimal grazing impact. Species identification was limited by seasonal factors, with additional graminoid and geophyte species likely present within the Project Area of Interest (PAOI).

[8] CR = Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened and VU = Vulnerable.

Notably, some protected flora were identified, and further discoveries are anticipated. While no Species of Conservation Concern (SCC) were recorded for flora or fauna during the survey, this habitat could potentially support avifaunal SCC expected for the broader PAOI.

- Rocky Grassland;
    - This habitat unit consists of rocky grassland interspersed with rocky outcrops and trees. The area has experienced minimal disturbance, primarily from livestock grazing, but remains intact and in good ecological condition. This habitat provides valuable microhabitats for a variety of plant and animal species. Dominant plant species include various grasses, shrubs, and some succulent species. Dominant trees include Searsia species, wild olive (*Olea europaea subsp. Africana*, a protected species), and *Vachellia karroo.* While no specific plants or animals of conservation concern (SCC) were identified within this unit, the habitat is suitable for some bird SCC expected to occur within the broader Project Area of Interest (PAOI)
- Degraded grassland;
    - This habitat unit was originally classified as the endangered Vaal-Vet Sandy Grassland vegetation type, with a small portion corresponding to the Western Free State Clay Grassland for the V2_P007 drilling collar. However, due to high levels of anthropogenic disturbance, the area is now severely degraded and no longer representative of either vegetation type. Seasonal limitations hindered complete species identification, particularly for graminoids and geophytes. Dominant plant species observed included the graminoid *Digitaria didactyla* and herbs *Nidorella hottentotica* and *Asparagus laricinus*. Notably, alien and invasive species were prevalent within the habitat unit, including *Bidens pilosa, Eucalyptus camaldulensis,* and *Verbena bonariensis.* Despite the original vegetation classification, no Species of Conservation Concern (SCC) were recorded for fauna or flora, and none are expected to be present.
- Water resource; and
    - The non-terrestrial habitat unit consists of wetlands and drainage lines dominated by hydrophyte species. While a detailed description of this unit can be found in the accompanying wetland report (Appendix 3), it is important to note that no flora Species of Conservation Concern (SCC) are expected to be present. However, this habitat unit may provide suitable habitat for some avifauna SCC anticipated within the broader area.
- Modified.
    - The project area encompasses a habitat unit classified as highly disturbed with minimal to no native vegetation. This classification reflects the substantial modification of the area's natural state through anthropogenic activity, resulting in a significant decline in its ecological functions and species composition. The habitat unit, consisting primarily of gravel roads and agricultural fields, no longer retains its functional ecological integrity and offers minimal contribution to ecosystem services.

The habitat units for the ER32 PAOI and ER94 PAOI can be seen delineated in Figure 57.

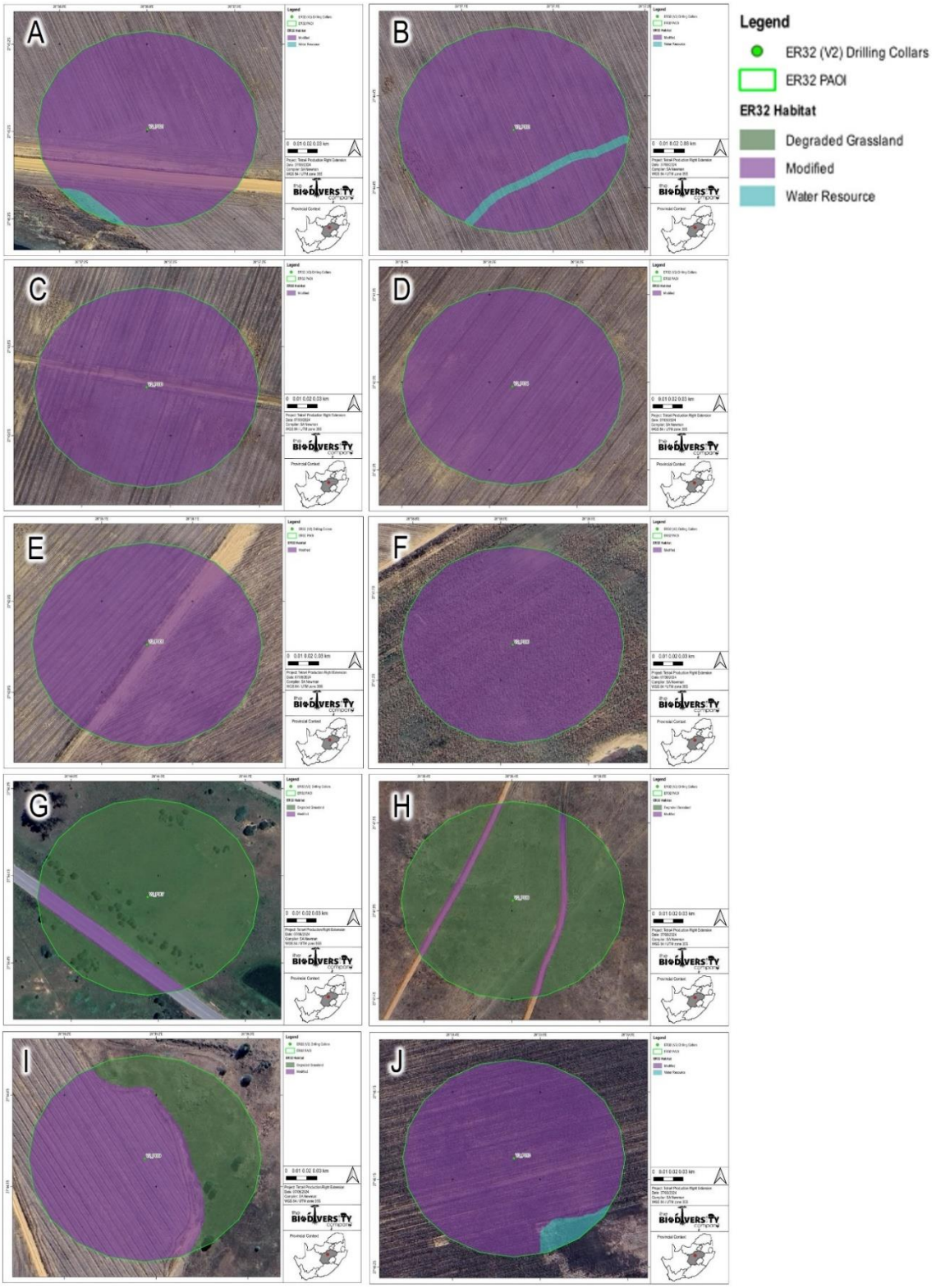

Figure 57: ER32 Habitats.

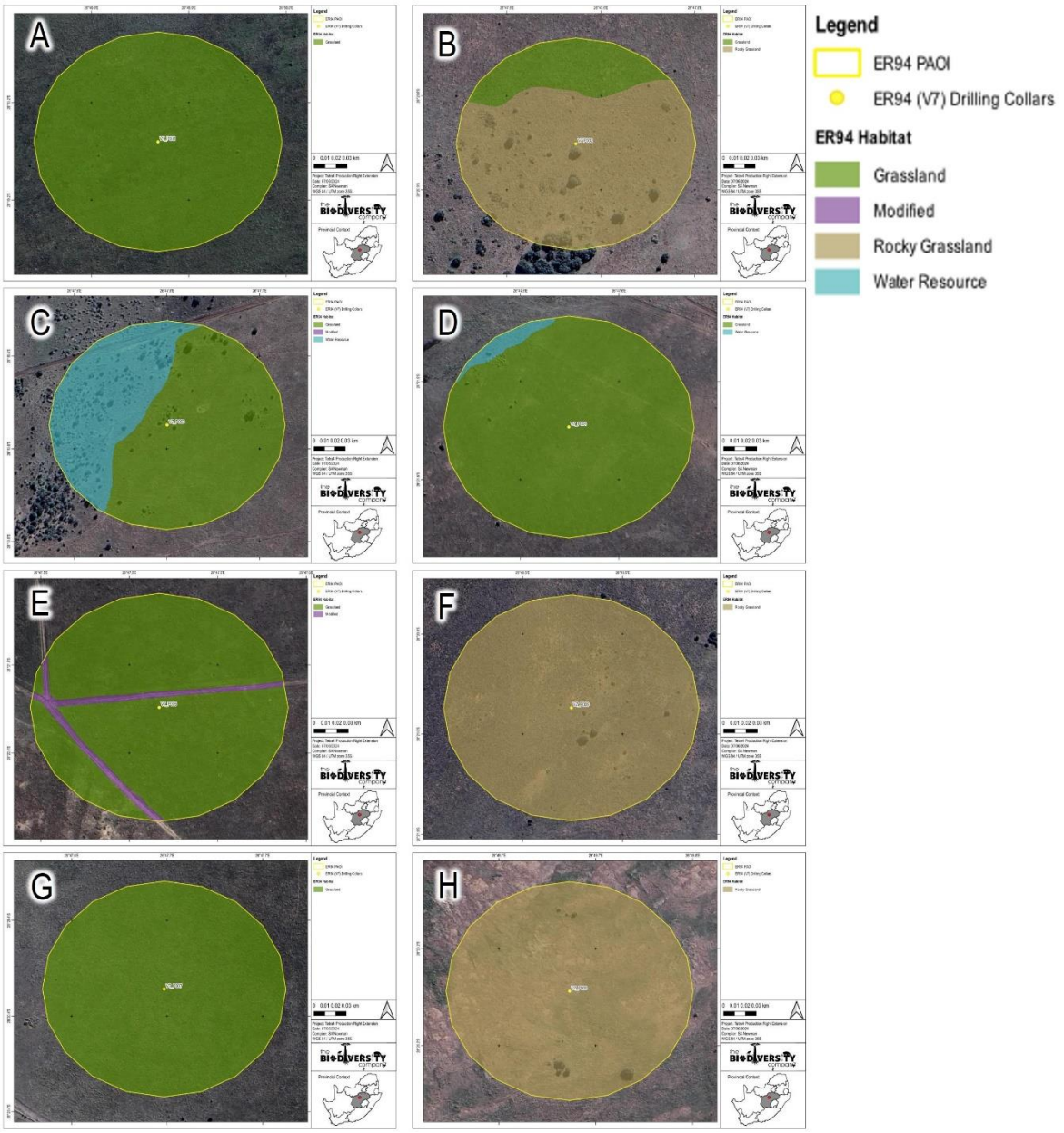

Figure 58: ER94 Habitats.

9.10.4.2 **SITE ECOLOGICAL IMPORTANCE**

All habitats within the PAOI were assigned a sensitivity category, i.e., a SEI category. The PAOI was categorised as possessing habitats with areas ranging from 'Very Low' to 'High' SEI. This indicates that the findings of this assessment are contrary to the Screening Tool with respect to the Combined Terrestrial, Plant and Animal Species Theme sensitivity. The SEI of the ER32 PAOI is illustrated in Figure 59 and Figure 60 and the SEI of the ER94 PAOI is illustrated in Figure 61.

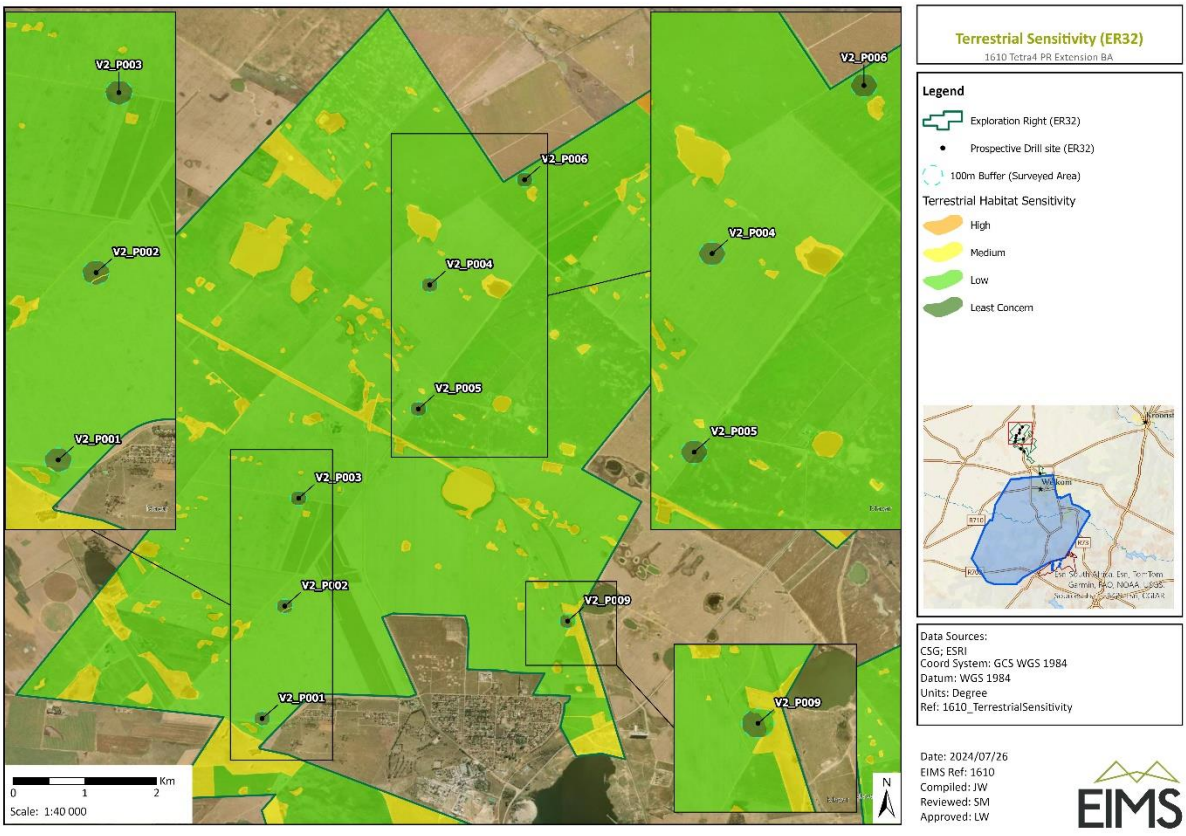

Figure 59: Site Terrestrial sensitivity for the northern section of ER32.

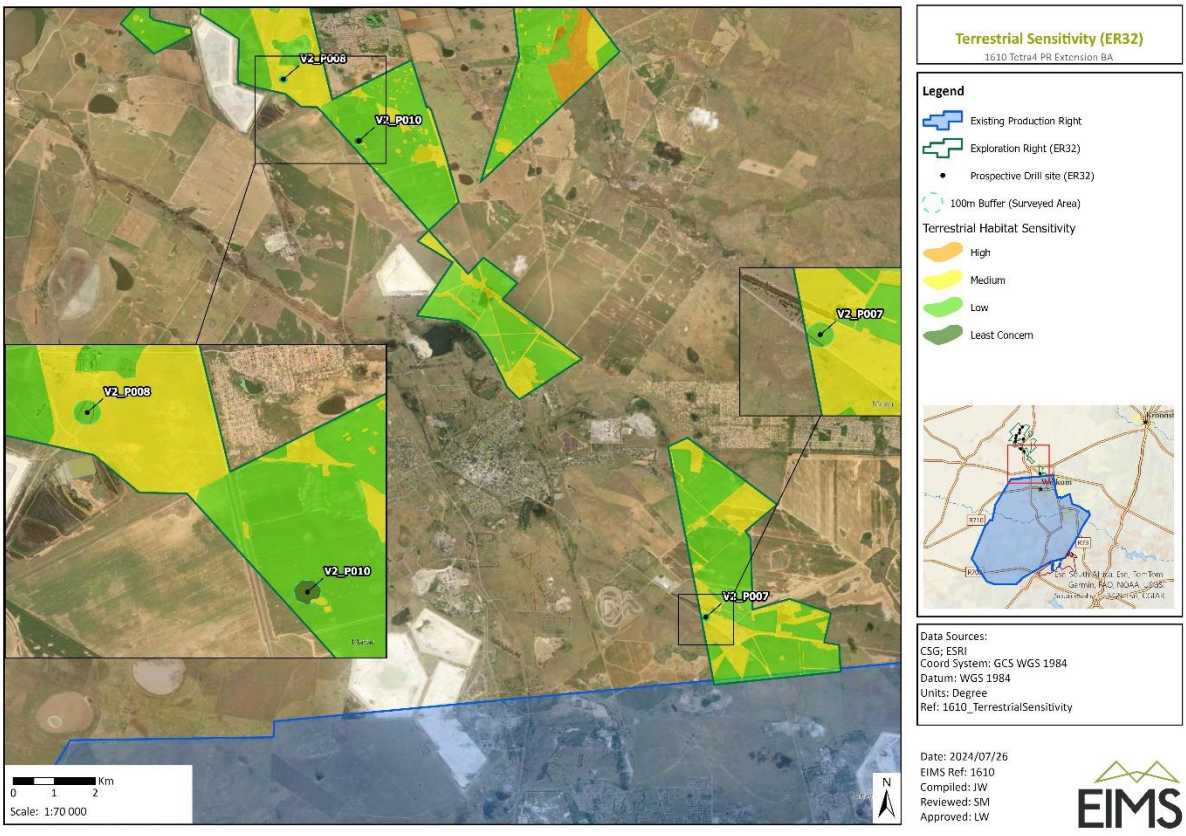

Figure 60: Site Terrestrial sensitivity for the southern section of ER32.

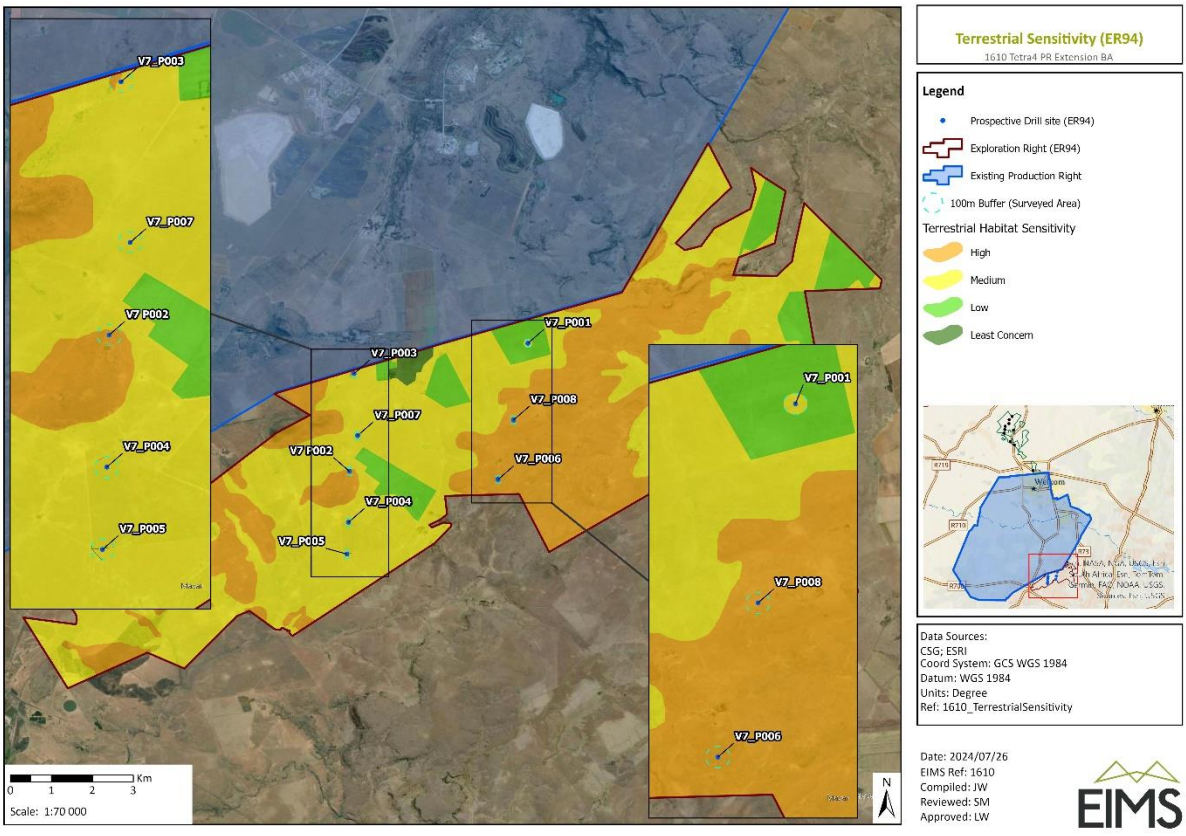

Figure 61: Site Terrestrial sensitivity for ER94.

The following is deduced from the National Web-based Environmental Screening Tool (Appendix 4):

- Terrestrial Biodiversity Theme sensitivity is 'Very High' for the ER32 development area, due to it overlapping with a CBA 1, ESA 1, ESA 2 and the Endangered Vall-Vet Sandy Grassland vegetation type and it is 'Very High' for the ER94 development area due to it overlapping with a CBA 1, CBA 2, ESA 1, ESA 2, FEPA Sub catchment and an NPAES;
- Plant Species Theme sensitivity is 'Low' for the ER32 PAOI due the presence of low sensitivity species and it is 'Low' for the ER94 PAOI due to the presence of low sensitivity species; and
- Animal Species Theme sensitivity is 'High' for the ER32 PAOI due to the possible presence of one high sensitivity avifauna species and several medium sensitivity fauna species and it is 'Medium' for the ER94 PAOI due to the possible presence of two medium sensitivity fauna species .

Table 30 evaluates the allocated sensitivities for each relevant theme within the assessed areas of the ER32 and ER94 PAOIs, respectively. These tables highlight any discrepancies between the allocated sensitivities and the findings of this assessment. Accompanying explanations are provided for each disputed or validated sensitivity rating. The specialist-assigned sensitivities are primarily based on the SEI process outlined in the preceding section, with additional consideration given to the observed or potential presence of Species of Conservation Concern (SCC) or protected species.

Table 30: Sensitivities for allocated themes (Animal, Plant and Terrestrial) as per DFFE Screening tool.

Screening Tool Theme	Screening Tool Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Summary of the screening tool vs specialist assigned sensitivities for the ER32 PAOI			

Screening Tool Theme	Screening Tool	Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Animal Theme	High	-	Low	Disputed – Most of the PAOI is modified, with the remaining grassland areas existing in a heavily degraded state. Fauna SCC are unlikely to be resident here, although some may make use of the PAOI for foraging.
Plant Theme	Low	-	Low	Validated – Most of the PAOI is modified with the remaining grassland areas existing in a heavily degraded state. These grassland areas have been overgrazed and the incidence of Alien and invasive plants is high. SCC are unlikely.
Terrestrial Theme	Very High	Degraded grassland	Low	Disputed – Habitat heavily degraded, forming part of a fragmented landscape, with high levels of human ingress and high incidence of alien and invasive plants. As a result, flora SCC are unlikely to be present. Fauna SCC may make use of this habitat as a corridor or for foraging, but are unlikely to be resident here. CBA area has been transformed and is no longer representative of a CBA.
		Water Resource	Medium	Disputed – Habitat is degraded and surrounded by agricultural fields. It forms part of a fragmented landscape. Fauna SCC may use this habitat for foraging but are unlikely to be resident here. Flora SCC are unlikely to occur here.
		Modified	Very Low	Disputed – Habitat modified in nature and currently and/or historically used for agricultural activities with limited potential to support SCC. Severe levels of disturbance present. Fauna and flora SCC unlikely to occur here.
Summary of the screening tool vs specialist assigned sensitivities for the ER94 PAOI				
Animal Theme	Medium	-	Medium	Validated – Habitat is disturbed but still capable of supporting some species of SCC, and also acts as a corridor and foraging resource in a highly fragmented landscape. Fauna SCC likely.
Plant Theme	Low	-	Low	Validated – Habitat is disturbed and predominantly used for grazing cattle. Due to current land-use, SCC are unlikely to occur in the grassland habitat due to trampling by cattle. However, protected species were recorded and are likely present so a walkdown must be performed prior to commencement of project activities.
Terrestrial Theme	Very High	Grassland	Medium	Disputed – Habitat disturbed in nature, with evidence of overgrazing and the subsequent bush encroachment by *Vachellia karroo* in some areas. Other areas remain in good condition. Flora SCC were not recorded and are

Screening Tool Theme	Screening Tool	Habitat	Specialist	Tool Validated or Disputed by Specialist - Reasoning
				not likely. Fauna SCC may make use of this habitat as a corridor or for foraging.
		Rocky Grassland	High	Disputed – Habitat is disturbed but inherently sensitive due to the microhabitats provided by rocky areas. Flora SCC were not recorded and are not likely, but protected species were recorded and more are expected. Fauna SCC may make use of this habitat as a corridor or for foraging.
		Water Resource	High	Disputed – Habitat is disturbed but inherently sensitive, providing an important resource for fauna in the region. It forms part of a fragmented landscape. Flora SCC may be present but seasonality restricted confirmation of this. Fauna SCC may make use of this habitat as a corridor or for foraging.
		Modified	Very Low	Disputed – Habitat modified in nature, predominantly made up of roads. Fauna and flora SCC unlikely to occur here.

A combination of desktop study and field survey yielded high-medium confidence in the ecological assessment of Potential Areas of Interest (PAOIs) ER32 and ER94. The survey ensured comprehensive coverage of open spaces, natural habitats, and ecosystems, allowing for a general overview of flora and fauna and identification of major current impacts. The following habitat conditions and species were observed:

- Within the ER32 area it was found to be mostly modified habitat with degraded grassland remnants. No confirmed Species of Conservation Concern (SCC) for flora or fauna, but avifauna SCC are expected.
- Within the ER94 area it was found to be primarily disturbed grassland habitat due to cattle grazing. No confirmed flora or fauna SCC, but potential for avifauna SCC.

Seasonal limitations hindered complete flora identification. A site walkdown with permit applications will be required during the appropriate flowering season (October-March) to search for protected and red-listed species. The walkdown should also include a fauna survey with a specific focus on Sensitive Species 15.

The screening tool identified the PAOIs as "Very High" sensitivity due to Critical Biodiversity Area (CBA) 1, Ecological Support Area (ESA), and National Protected Area Expansion Strategy (NPAES) designations. However, the Site Ecological Importance (SEI) assessment assigned a "Medium" sensitivity to the grassland habitat and "High" sensitivity to the rocky grassland habitat. The rationale for the SEI classification is as follows:

- Disturbed grassland areas still provide valuable ecological functions.
- Habitats serve and represent ESA and NPAES areas.
- Degraded CBA no longer functions as intended.
- Connectivity to natural areas exists.
- Potential presence of protected flora and avifauna SCC.

Water resources within ER32 and ER94 were classified as "Medium" and "High" sensitivity, respectively. Buffers as outlined in the freshwater assessment (to be confirmed) are mandatory, and these areas should be entirely avoided by project activities.

The ecological integrity and functionality of these habitats are crucial for various flora and fauna. Their preservation is paramount for the proposed project. Mitigation measures must prioritize the protection and improvement of these ecologically valuable areas, especially considering their fragmented landscape context. Development within "High" sensitivity areas is generally discouraged, while "Medium" sensitivity areas require minimization and restoration efforts.

9.11 AQUATIC BIODIVERSITY

The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) dataset, developed collaboratively by SANBI and CSIR as part of the 2018 National Biodiversity Assessment, provides a comprehensive inventory of wetlands in South Africa. This dataset refines information from previous initiatives like NFEPA. Wetland analysis using SAIIAE revealed multiple depression wetland systems within the 500-meter regulated area surrounding the ER32 and ER94drilling collars (refer to Figure 62 to Figure 64).

Figure 62: Northern section ER32 SAIIAE Wetlands.

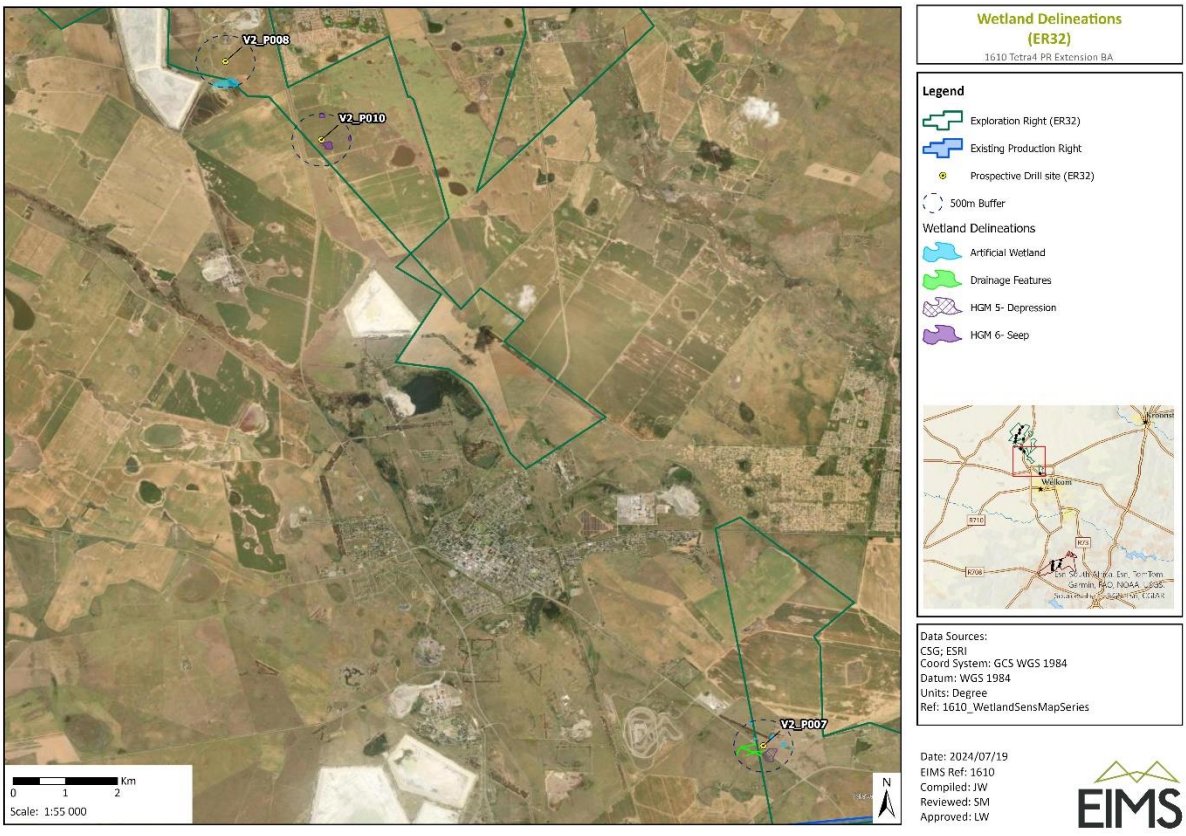

Figure 63: Southern section ER32 SAIIAE Wetlands.

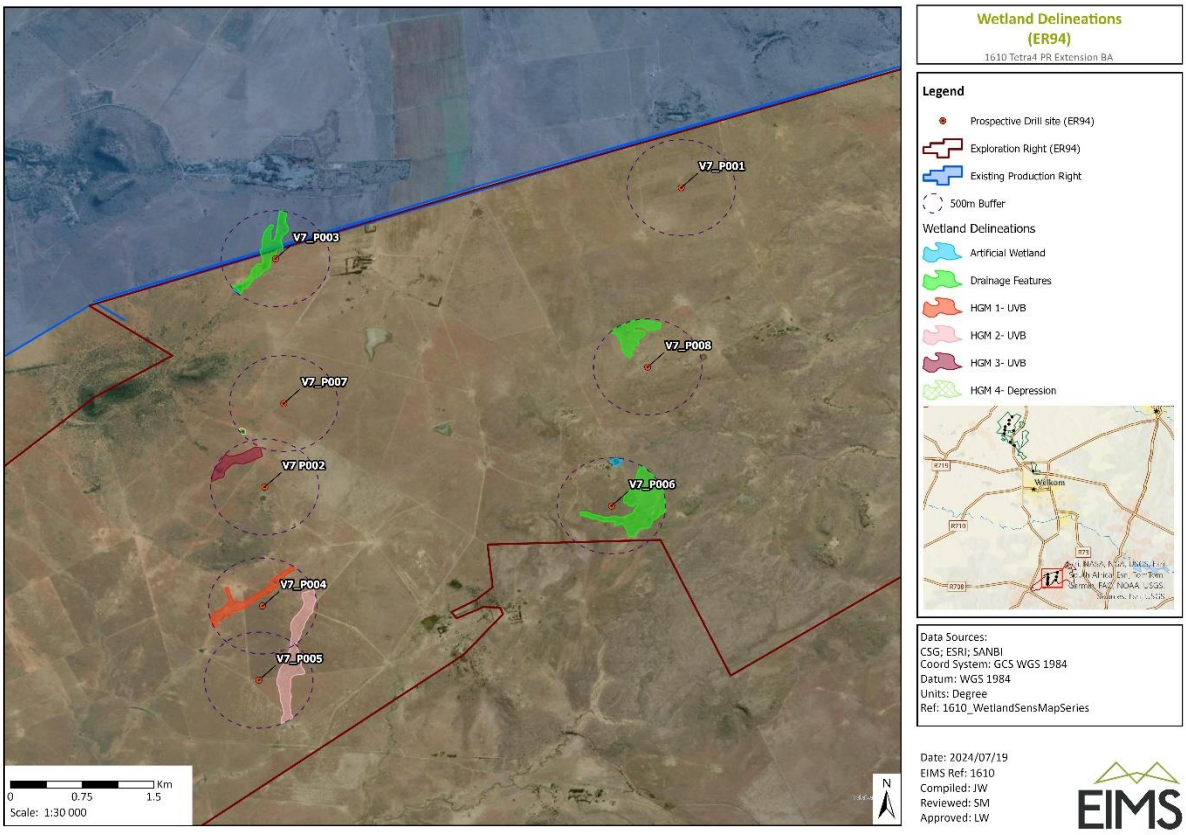

Figure 64: ER94 SAIIAE Wetlands.

The National Freshwater Ecosystem Priority Areas (NFEPA) database identifies critical areas for conservation to ensure sustainable water resource management as outlined in the National Water Act (NWA). These areas directly influence Catchment Management Strategies, water resource classification, and the protection of biodiversity. NFEPAs also complement the National Environment Management: Biodiversity Act (NEM:BA) by informing the listing of threatened ecosystems and bioregional planning processes.

The ecological assessment identified multiple NFEPA wetland systems within the 500-meter regulated area surrounding the ER32 drilling sites (001, 004, 005, 006, 007, 008, and 009) (refer to Figure 62 and Figure 63). Additionally, NFEPA wetland seeps were found within the 500-meter regulated area of ER94 drilling sites 002 and 009 (refer to Figure 64).

A site visit identified numerous wetlands within the 500-meter regulated area. These wetlands were classified into 15 distinct Hydrogeomorphic (HGM) units based on their type, function, and potential impacts. The identified wetland types included:

- Unchanneled Valley Bottoms (HGM 1, 2, and 3)
- Depression Wetlands (HGM 4, 5, 7, 8, 10, 14, and 15)
- Seep Wetlands (HGM 6, 9, 11, 12, and 13)

For a detailed map of the HGM units for each borehole, refer to Appendix 5. The assessment also identified artificial wetlands (off-channel dams) and drainage features. These dams were excluded from further evaluation due to their artificial nature for water storage. Although numerous natural wetlands were present, their location and the minimal impact of prospecting drilling meant no negative effects on the wetlands were anticipated. Consequently, a functional assessment of these wetlands was not undertaken for this project.

9.11.1 BUFFER REQUIREMENTS

Buffer zones are a land-use planning strategy that safeguards natural resources by mitigating the impacts of one land-use on another. In this project, a buffer zone will act as a protective barrier between the development area and identified wetland systems. The designated buffer area is primarily applicable to wetlands that will not be directly affected by the project or require infrastructure construction within them.

A wetland buffer zone tool was employed to determine the necessary buffer widths for the Tetra4 Production Expansion project. The tool recommends post-mitigation buffer distances of 10 meters for drainage features and 20 meters for natural wetlands. These buffer zones aim to minimize potential impacts on wetland health and functionality.

9.11.2 ECOLOGY SENSITIVITY

The national web-based Environmental Screening Tool assigned a "Low" sensitivity rating to the specific development footprint for aquatic ecosystems (Appendix 3). However, the broader regulated area encompassing the development footprint is characterized as "Very High" sensitivity.

Table 31 offers a comparison between this initial screening and the specialist's evaluation using the Site Ecological Importance (SEI) process. The specialist's ratings, which are likely more detailed and nuanced, heavily influence the final SEI classification.

Table 31: Sensitivities for Aquatic Biodiversity Theme as per DFFE Screening tool.

Screening Tool Theme	Screening Tool	System	Specialist	Tool Validated or Disputed by Specialist - Reasoning
Aquatic Biodiversity Theme	Very High	Wetlands	Moderate	Disputed – Much of the area within the wetlands has been historically modified through livestock grazing, agricultural field and road development. The proposed activities are not anticipated to significantly modify the hydrological characteristics of the entire area; therefore a "Moderate" sensitivity has been assigned for these areas in relation to freshwater biodiversity.
	Low	Terrestrial	Low	Validated – No natural surface water features were identified within the rest of the project area of influence.

9.12 OVERALL SENSITIVITY

A comprehensive assessment of all sensitivity factors and their corresponding levels was undertaken. The results were synthesized into two maps: a maximum sensitivity map and a sensitivity intensity map. The former delineates areas exhibiting the highest sensitivity based on a single dominant factor, such as agriculture or terrestrial ecology. Conversely, the sensitivity intensity map represents an aggregate of all sensitivity factors, providing a holistic overview of environmental vulnerability.

As shown in Figure 65 and Figure 66, boreholes V2_P001, V2_P002, V2_P003, V2_P004, V2_P005, V2_P006, V2_P009 and V2_P010 fall within High sensitive areas. V2_P007 and V2_P008 fall within a High and Medium area. Figure 67 indicates that boreholes V7_P001, V7_P002, V7_P003, V7_P004, V7_P005, V7_P007, and V7_P008 fall within Medium and High sensitive areas, whereas V7_P006 falls within a Medium sensitive area. The high sensitivities can be attributed to the high agriculture sensitivity, in Section 9.7 it is determined that the land capability assessment of the proposed project area indicates a classification ranging from low to medium. Correspondingly, the agricultural potential of the region is evaluated as low to medium.

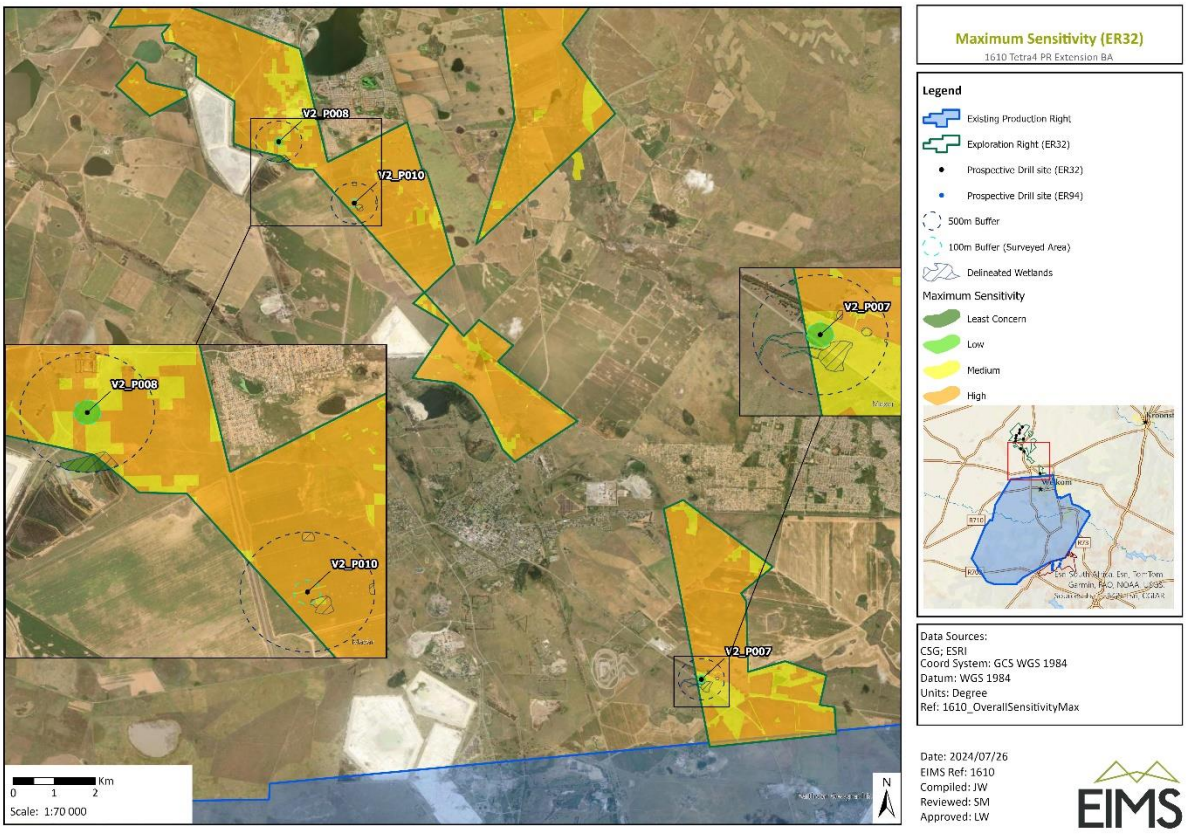

Figure 65: Maximum sensitivity map for southern ER32 area.

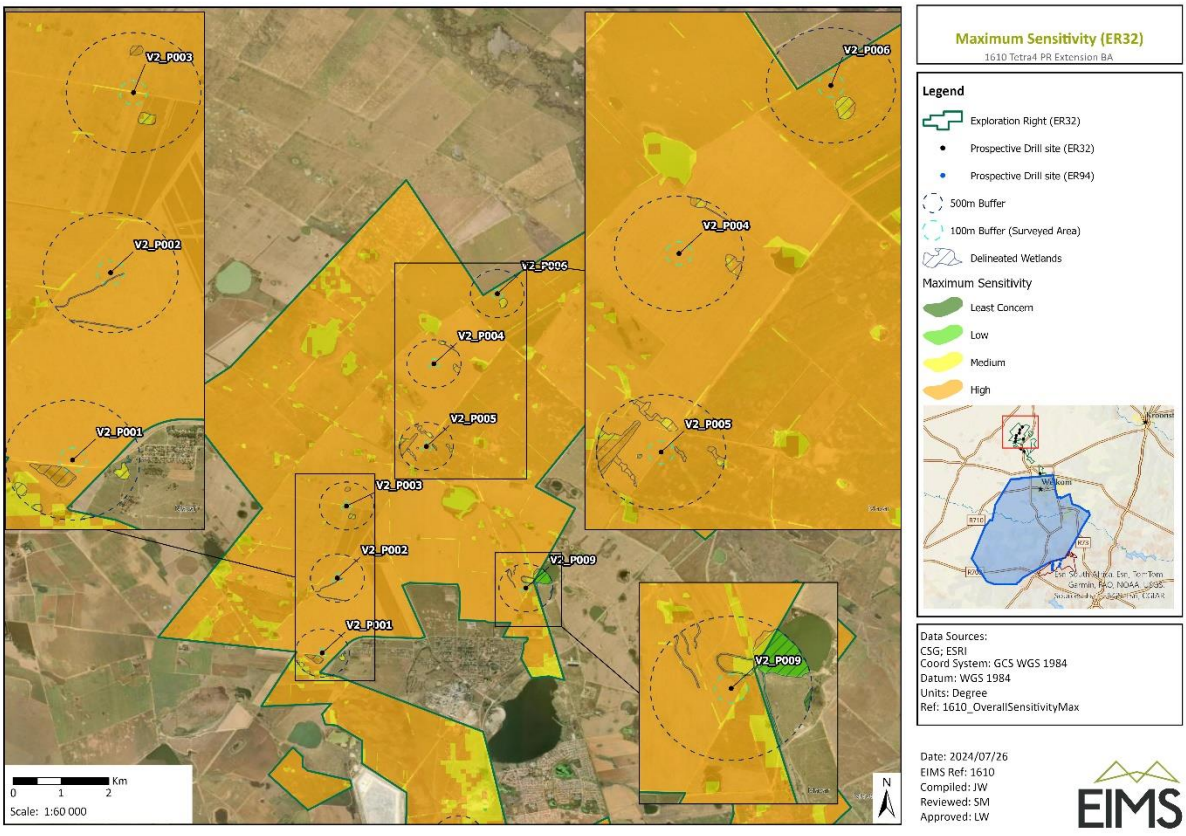

Figure 66: Maximum sensitivity map for northern ER32 area.

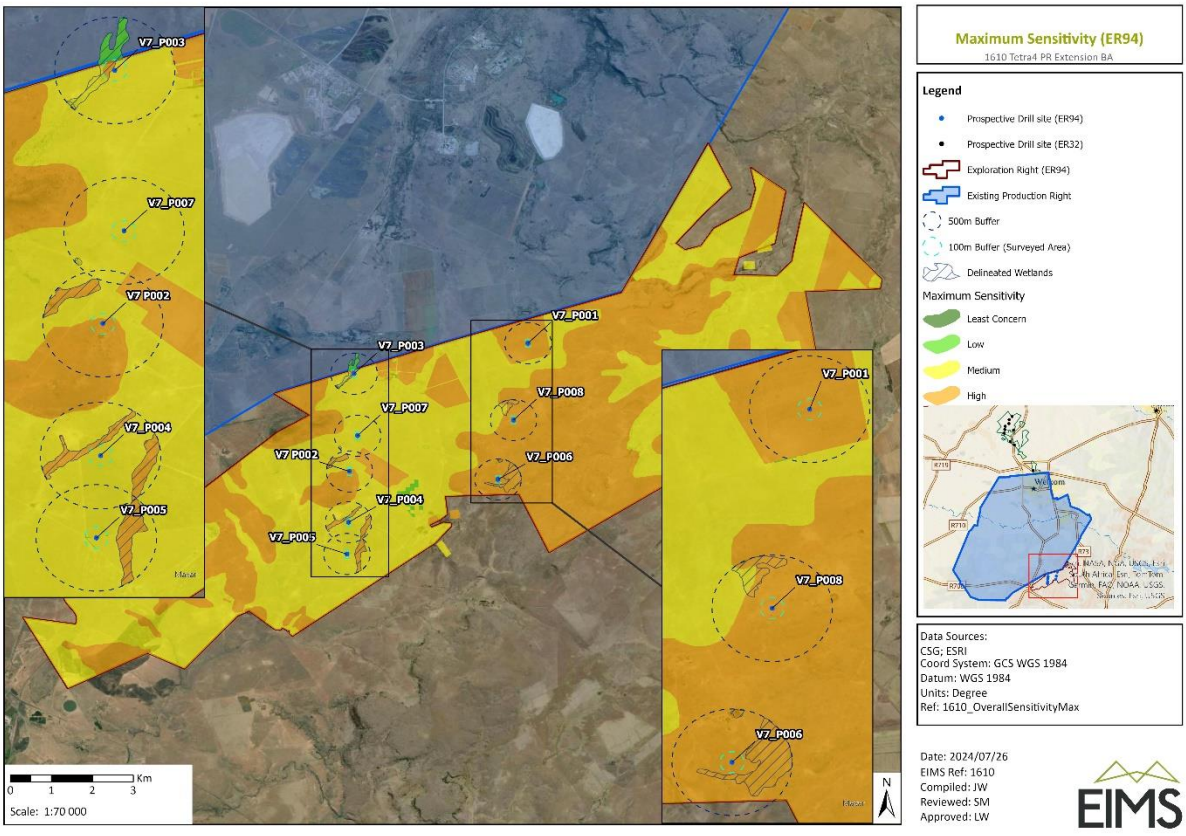

Figure 67: Maximum sensitivity map for ER94 area.

As shown in Figure 65Figure 68 and Figure 69, boreholes V2_P001, V2_P004, V2_P005, V2_P007, V2_P009 and V2_P010 contain sensitivity features with intensities of 8 – 11, within the 100 m buffer. Figure 70 indicates that boreholes V7_P002, and V7_P006 contain sensitivity features with intensities of 8 – 11, within the 100 m buffer. The high features indicate areas where the mitigations for the relevant sensitivities need to be strictly adhered to.

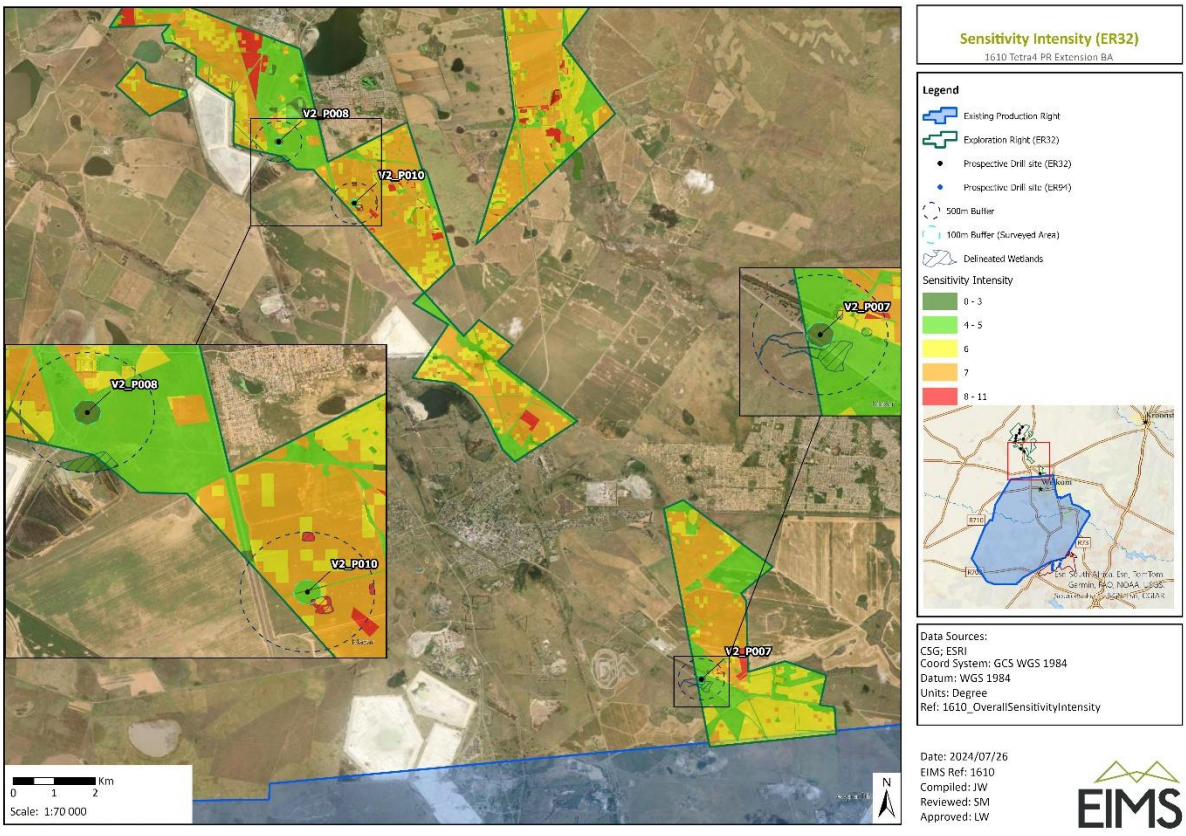

Figure 68: Sensitivity intensity map for southern ER32 area.

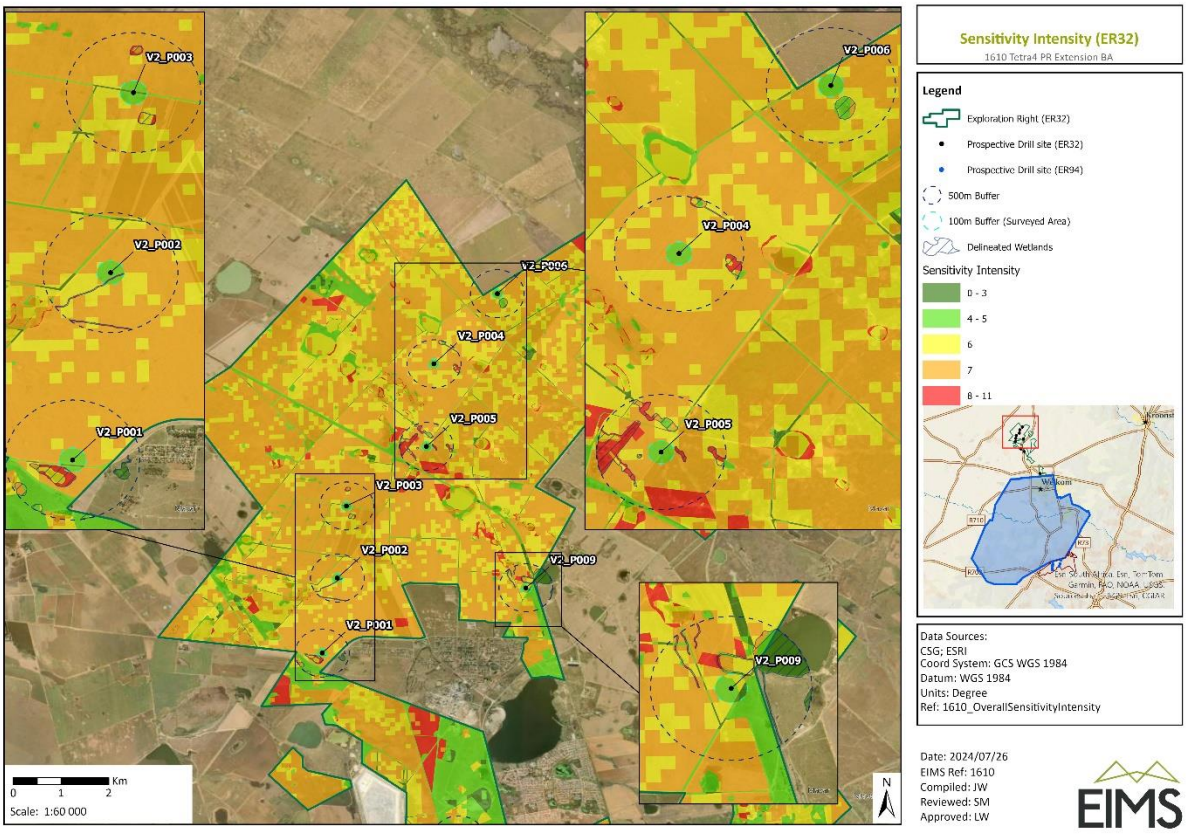

Figure 69: Sensitivity intensity map for northern ER32 area.

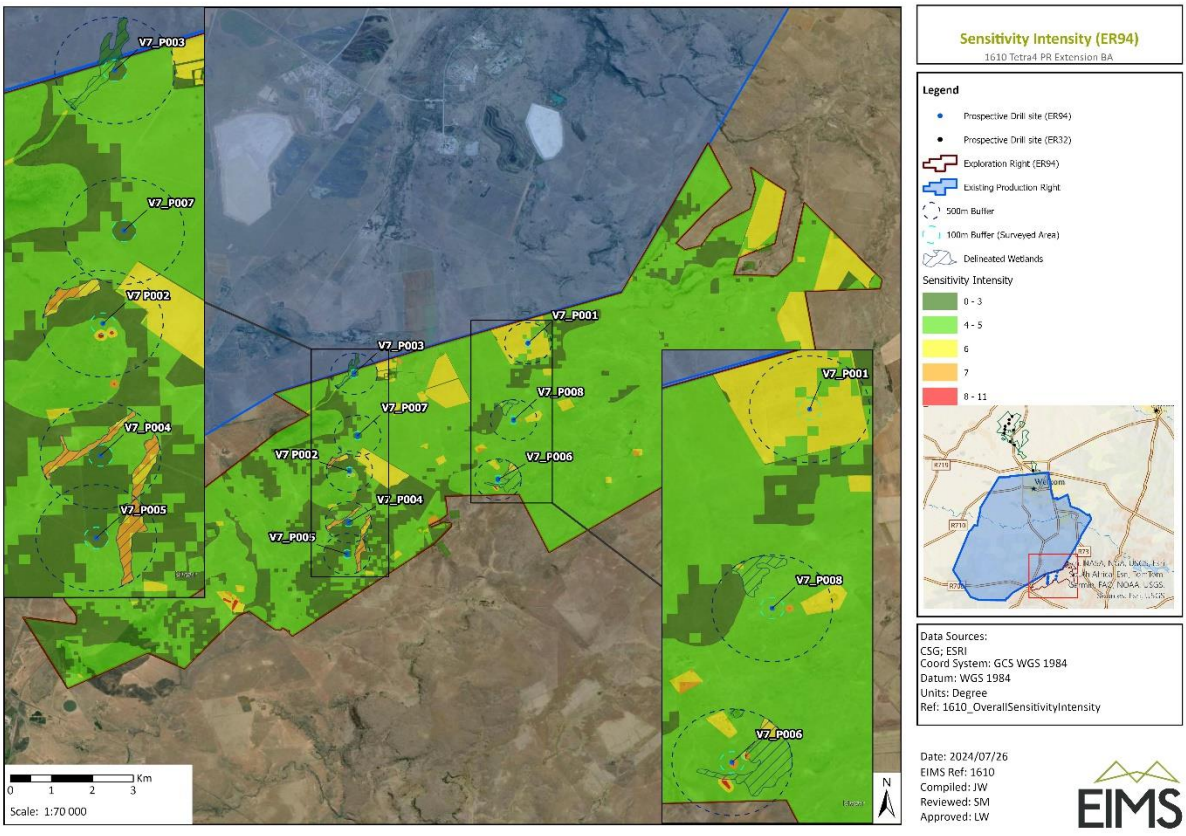

Figure 70: Sensitivity intensity map for ER94 area.

10 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence I of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for impacts identified.

10.1.1 DETERMINATION OF ENVIRONMENTAL RISK

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence I of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent I, Duration (D), Magnitude (M), and reversibility I applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented below:

$$C = \frac{(E + D + M + R) \times N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 32 below.

Table 32: Criteria for Determining Impact Consequence.

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 33.

Table 33: Probability Scoring.

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 34: Determination of Environmental Risk.

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 35.

Table 35: Significance Classes.

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

10.1.2 IMPACT PRIORITISATION

In accordance with the requirements of 2014 EIA Regulations (GN R 982), and further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition, it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision-making process.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 36.

Table 36: Criteria for Determining Prioritisation.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The impact priority is therefore determined as follows:

$$Priority = PR + CI + LR$$

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (refer to Table 37).

Table 37: Determination of Prioritisation Factor.

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33

6	Medium	1.5
7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance, the PF is multiplied by the ER of the post-mitigation scoring. The ultimate aim of the PF is to be able to increase the post-mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Environmental Significance Rating	
Value	Description
< -10	Low Negative (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥ -10 < -20	Medium Negative (i.e. where the impact could influence the decision to develop in the area),
≥ -20	High Negative (i.e. where the impact must have an influence on the decision process to develop in the area).
< 10	Low Positive (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥ 10 < 20	Medium Positive (i.e. where the impact could influence the decision to develop in the area),
≥ 20	High Positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

10.2 IMPACTS IDENTIFIED

This section presents the impacts that have been assessed for the BA. Potential environmental impacts were identified by the EAP, the appointed specialists, as well as the preliminary input from the public. The impacts are included in Table 38 below. It should be noted that this report is currently made available to I&APs for review and comment, to ensure their comments and concerns were able to be addressed in the final BA Report to be submitted to the PASA/DMRE for adjudication.

The impacts and mitigation measures identified in Section 10.2.1 are derived from the existing, approved Production Right EMPr and applicable to this project and its activities. These measures remain applicable to the current project. Additional mitigations proposed by specialists for this Production Right Extension project are detailed in Section 10.2.2 and will be incorporated into the EMPr.

The Impacts were assessed in terms of nature, significance, consequence, extent, duration and probability in line with the methodology described in Section 10.1 above. The impact assessment matrix (including pre- and post-mitigation assessment) is included in Appendix 6. Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested and have been updated during the investigation.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

10.2.1 EXISTING PRODUCTION RIGHT IMPACTS

10.2.1.1 **CONSTRUCTION PHASE IMPACT**

The construction phase constitutes the activities that take place prior to exploration, i.e. clearing of vegetation, setting up the drill pad, etc. The following impacts are applicable to the activities that will be undertaken during the construction phase.

10.2.1.1.1 AIR QUALITY IMPACTS

For air quality impacts during the construction phase, the assumption is that construction activities would be during day-time hours only. Given the nature of construction activities for the roads, wells and drill pads (where the location may vary depending on the gas reserves in the area) the air quality impacts (due to dust and vehicle exhaust gas) at the nearest residential receptors to the construction areas may exceed the respective short-term NAAQS's for residential areas. If there are exceedances of the standards, however, it would be of short duration. The negative air quality impacts are therefore considered to be of medium significance without mitigation and low significance with mitigation at the nearest receptors due to construction activities for roads/pipeline sections and construction of wells/booster stations.

The following air quality impacts have been identified:

- Increase in air quality impacts due to construction of the road
- Increase in air quality impacts due to construction of the wells

In order to mitigate the above impacts, the following mitigation measures are put forward:

(i). Mitigation measures

- As construction will only take place during day-time hours and will be of limited duration, Air Quality Sensitive Receptors (AQSRs) within 150 m of the road construction site should be notified of the activities and potential disturbance durations prior to construction taking place.
- As construction will only take place during day-time hours and will be of limited duration, AQSRs within 300 m radius of all well construction sites should be notified of the activities and potential disturbance durations prior to construction taking place.
- For topsoil management during construction and rehabilitation, the exposed areas must be ensured to remain moist through water spraying during dry, windy periods (CE 50%).
- During all phases, material transfers are to be controlled using water sprays resulting in 50% control efficiency.

- The following good practice should be followed during all phases of the project:
    - To ensure lower exhaust emissions from vehicles and machinery, equipment suppliers or contractors should be required to ensure compliance with appropriate emission standards for production fleets.
    - Maintenance and repair of diesel engines should be carried out as prescribed by manufacturer to maximize combustion and reduce gaseous emissions.
- Fuel efficient driving practices on site, during all phases of the Project, may also help lower exhaust emissions from vehicles and machinery, such as stipulating a maximum speed on all unpaved roads. In addition, other fuel-efficient practices that may lower exhaust emissions include limiting idling of machinery, driving in an upper gear rather than a lower gear as much as possible, ensuring tire pressure are always adequate etc.
- Products, liquid fuels, and chemicals should be stored in areas where there are provisions for containment of spills.
- The project proponent has indicated that all infrastructure and facilities will be designed, installed and maintained according to best industry practices to control fugitive and unintended methane emissions as prescribed in (US EPA, 2015). In addition, the following actions are recommended:
    - If applicable, the implementation of a leak detection and repair (LDAR) program, which include identifying equipment, leak definition, monitoring equipment, repairing equipment, and recordkeeping; and
    - Regular check (monthly or quarterly) and reporting of exploration well, booster and compressor facility installations, as well as pipelines portions close to ground surface or those that have potential to be vandalized.

(ii). Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii). Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.2 CLIMATE CHANGE IMPACT

Given the nature of construction activities for the roads and drill pads the negative climate change impacts are considered to be of low significance without mitigation and low significance with mitigation.

(i). Mitigation measures

- As construction will be of limited duration develop and implement management programs and procedures to limit GHG emissions as far as possible.

(ii). Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii). Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.3 NOISE IMPACTS

For noise impacts during the construction phase, the assumption is that construction activities would be during day-time hours only. Given the nature of construction activities for the wells, the noise levels at the nearest

residential receptors to the construction areas may exceed IFC guidelines for residential areas (55 dBA). If there are exceedances of this guideline, it would be of short duration. The negative noise impacts are therefore considered to be of medium significance without mitigation and low significance with mitigation at the nearest receptors due to these activities.

(i) Mitigation measures

- As construction will only take place during day-time hours and will be of limited duration, Noise Sensitive Receptors (NSRs) within 400 m radius of all well construction sites should be notified of the activities and potential disturbance durations prior to construction taking place.
- Although the current EMPr (Production Right EMPr) specifies complaints need to be registered it is recommended that the complaints register description be expanded (for number 50 and number 78) as follows:
    - A complaints register, including the procedure which governs how complaints are received, managed and responses given, must be implemented, and maintained.
- The existing EMPr specifies that construction activities should where possible be during day-time. It is recommended that this be expanded as follows (applying to all phases of the project):
    - Unless it is an emergency situation, non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.
- Equipment to be employed should be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.
- It should be noted that the effectiveness of partial enclosures and screens can be reduced if used incorrectly, e.g., noise should be directed into a partial enclosure and not out of it, there should not be any reflecting surfaces such as parked vehicles opposite the open end of a noise enclosure.
- Machines and mobile equipment used intermittently should be shut down between work periods or throttled down to a minimum and not left running unnecessarily. This will reduce noise and conserve energy.
- Acoustic covers of engines should be kept closed when in use or idling.
- Construction activities that are to take place within 500 m from noise sensitive receptors must first be discussed and agreed with the affected party.
- In the event that noise related complaints are received, the existing EMPr makes provision for short term ambient noise measurements. The EMPr specifies that the noise levels should be co-ordinated with the 5 m/s wind speed.
- Any surveys should be designed and conducted by a trained specialist.
- Sampling should be carried out using a Type 1 SLM that meets all appropriate IEC standards and is subject to annual calibration by an accredited laboratory.
- The acoustic sensitivity of the SLM should be tested with a portable acoustic calibrator before and after each sampling session.
- Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples, representative of the day- and night-time acoustic environment should be taken.
- The SLM should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.

- Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.
- A detailed log and record should be kept. Records should include site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.4 SOCIAL IMPACT

The proposed Production Right Extension project will impact on high quality agricultural soil which is used to grow crops that contribute to food security in South Africa. One of the most significant potential social impacts associated with the proposed project is the potential impacts on livelihoods of the farming community. Farmers may fear that their land rights and property values will be affected. The project will require access to farms, and because of the current socio-political issues in South Africa, this is a sensitive matter. Farmers may also be concerned about the impact of the Production Rights Extension project on their existing way of life, and on the infrastructure on their farms. An impact assessment of each of the below impacts has been undertaken. Furthermore, each of the below impacts is relevant to the construction and operational phases.

- Impact on livelihoods
- Uncertainty in landowners maintaining full control over their properties
- Nuisance factor due to increase in ambient dust and noise levels
- Changes in travel patterns
- Damage to farm roads, existing services, and infrastructure
- Impacts on livelihoods due to behaviour of contractors
- Impacts on safety and security of local residents
- impacts on sense and spirit of place
- Impacts on the social licence to operate
- Increase in social pathologies
- Secondary economic opportunities.

(i) Mitigation measures

- The Tetra4 community liaison officer (CLO) must continue to communicate with the affected landowners throughout the life of the project
- In cases where there the farmer does not agree with the compensation offered by Tetra4 related to loss of potential income due to exploration, construction or operational activities, Tetra 4 must appoint an agricultural economist at their cost to determine what the actual losses will be to the farmers due to the drilling and trenching activities on their properties. Farmers must be compensated for the actual losses for the entire period that they cannot use the land due to Tetra's activities. This may be one or two years, depending on when in the season the drilling and trenching take place, and how long the property is affected. The principles explained in the IFC Handbook for Preparing a Resettlement Action

Plan must be followed. This includes a land-use/land capability inventory; an asset register and physical asset survey; an income stream analysis and entitlement matrix. Compensation must be determined with input from the landowners.

- If any existing livelihood activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and obtain his consent to execute the activity on his/her land.
- If any interference takes place and there are actual losses, the landowner should be compensated for their losses. Tetra4 must have a claims procedure that is communicated to all affected landowners. There must be specific timeframes dealing with response times and time it takes to close out complaints. In order to receive compensation, the claim forms must be submitted to the Tetra4 CLO Compensation should follow the IFC principles, which states that market related prices should be paid, and if anything is restored, it must be to the same or better standards than before.
- If areas are fenced, the fences must be checked for snares on a daily basis for the duration of the construction period. All incidences must be reported to the closest police station. Anti-poaching toolbox talks should form part of the induction process of all the fencing teams. Any contractor or employee caught poaching should be removed from site.
- Tetra4 must provide detailed written information to the landowners to assist them with making informed decisions. The information must include:
    - Timeframe associated with the drilling process - when will the exploration activities commence.
    - A3 or A2 maps of the entire project area for each affected landowner
    - Information about well heads and boreholes:
        - How long does it take to drill a borehole?
        - Can more than one borehole be drilled with the same drill point?
        - What infrastructure are needed around the well heads and sketches of this infrastructure
        - Are all the drill points necessary?
        - What will happen if there is a change in the infrastructure presented to the landowners?
        - Can more than one wellhead be operated from one underground manhole?
        - Will the boreholes be left open for a period of time after the holes were drilled?
        - What happens if no gas is found at a borehole?
        - Will unproductive boreholes be investigated again later?
    - How will power be supplied for the drilling activities?
    - What maintenance will be required, and how often will teams need access for maintenance?
    - Who will be responsible for damage to Tetra4 property?
- Any future expansion plans must be communicated to any landowner that will be influenced by the expansion.
- The relevant specialists will provide scientific mitigation measures for this aspect. Practical, visible solutions such as putting shade nets against fences close to dwellings during the construction phase

should be investigated. No drilling or construction must take place on weekends or between sunset and sunrise.

- It may be unavoidable to change travel patterns. It is important to inform the affected stakeholders about the possibility of this impact as soon as possible. It will allow them time to get used to the idea and plan their activities accordingly. It is also important that locally affected parties give input in potential mitigation measures. Before construction and drilling commences Tetra4 must meet individually with each landowner to discuss their movement patterns and needs. Tetra4 must provide all the affected landowners with a construction and drilling schedule to ensure that they know when construction will take place on their properties. It is recommended that construction and drilling be done outside the peak planting and harvesting seasons. Any changes to the construction and drilling schedule must be communicated to the farmers at least a week in advance. As far as possible obstruction of access routes and sensitive areas must be avoided. If it cannot be avoided both parties must agree on alternative routes, and Tetra4 should carry the cost of implementing the alternatives. Industrial vehicles should not travel during peak traffic times. If practical and required by the landowner, access routes to land/infrastructure should be reinstated in the decommissioning phase. This must be done in conjunction with the landowners.
- If private roads are affected by project activities, it is the responsibility of Tetra4 to maintain these roads as long as they use it. Tetra4 should engage with the relevant farmers about road maintenance, as some of them have preferential ways in which the roads must be maintained, for example if roads are only graded and not built up it turns into rivers when there is heavy rain. The road maintenance agreements must be formalised before construction and drilling commences to ensure all parties involved are protected and know their rights and responsibilities. Tetra4 must make sure that all compacting and rehabilitating of trenches are done to the specifications in the EMP. It is recommended that construction and drilling be planned for the dry season. Tetra4 must provide all the affected landowners with a construction and drilling schedule to ensure that they know when construction will take place on their properties. Any changes to the construction and drilling schedule must be communicated to the farmers at least a week in advance.
- Before the project commences Tetra4 should compile an asset and infrastructure baseline of any landowner infrastructure such as fences, pipes, electricity lines, roads and troughs that may be affected by the project. Photographs and GPS co-ordinates of the infrastructure must be included in the baseline. A copy of the baseline affecting their property should be given to each landowner, who should sign off the document to ensure that it is accurate. Tetra4 should keep the master document. If any damage occurs it should be reinstated to its pre-project status. If the infrastructure must move, it must be done at Tetra4's cost. Tetra4 must ensure that the construction team has a copy of the asset and infrastructure baseline to guarantee that no infrastructure will be damaged due to ignorance during the construction phase of the project.
- All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners. It is important to instil respect for the landowners and their livelihoods from the beginning of the project.
- Tetra4 should work with the preferred farmers' security group and implement the AgriSA farm access protocol for everybody that need to access the properties. Pictures, make and registration numbers of all vehicles used by Tetra4 on site should be provided to the farmer's security group and distributed to all affected landowners to ensure that they will be able to identify these vehicles if they access their properties. For scheduled and maintenance work Tetra4 should give a roster to the farmers stating dates and approximate times that contractors will be on the farms. Farmers emphasised that they need to know of people accessing the farm ahead of time. It is too late to inform them when entering the property. All access arrangements should be made at least 24 hours before access is required. Tetra4 must meet with the landowners before the construction and drilling phase commence and formalise

security arrangements. This should be done in writing and include the existing forums that the landowners know and trust.

- All contractors and employees need to wear photo identification cards. Vehicles should be marked as construction vehicles and should have Tetra4's logo clearly exhibited. Entry and exit points of the site should be controlled during the construction and drilling phase. Areas where materials are stockpiled must be fenced. The schedules of the security company should be communicated to the farmers, especially to those farmers that have Tetra4 infrastructure that need to be guarded. It must be considered that guards changing shifts contribute to the impact of strangers accessing properties, and therefore a system that consider the safety of both the Tetra4 infrastructure and the safety of the landowners must be implemented. The necessary sanitation facilities must be made available, and some form of shelter from the elements. The security guards must not be allowed to make fires for cooking or heating purposes.
- A system to arrange access to properties must be devised and formalised. The landowners must agree to the system. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. Landowners have the right to refuse people access to their properties if it was not arranged in advance. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts.
- It is difficult to mitigate the impact on sense of place as it is experienced on a personal level. In general, the mitigation measures suggested in the visual, noise, ecological impact assessments and other relevant specialist studies should be adhered to. The relevant specialists will provide scientific mitigation measures for the aspects relevant to their studies. The direction and brightness of lights close to residences must be considered. Sense of place is a personal experience, but successful rehabilitation will go a long way in recreating a rural sense of place. The public perception would be negative or positive depending on the successful implementation of the rehabilitation.
- Tetra4 has a dedicated person that communicate with the landowners with whom they have a positive relationship. It is important that this relationship is extended to the Exploration Rights Areas' landowners. Information sharing, frequent communication and quick responses to issues/complaints/enquiries will assist Tetra4 with maintaining their SLO
- Toolbox talks should include talks about the impact of promiscuous behaviour. Tetra4 should develop an in-house infectious diseases strategy to address health issues within the workforce. A workforce code of conduct should be developed to maximise positive employee behaviour in the local community and optimise integration.
- Tetra4 should ensure that a good proportion of secondary economic opportunities are given to local contractors. Services and goods must be procured locally as far as reasonably possible. Aspects of this positive impact will occur by default when the construction force lives locally, and they utilise local services and support local shops.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources but where this may occur, mitigation measures shall be put forward to reduce this potential as far as possible.

The majority of the economic impacts of this project have been rated as positive with the impacts extending from a local level, through to the region and also to a national level. This project will need to comply with these

provisions which compliance will have an obvious positive impact on economic transformation. During the construction and operational phase, the positive impacts on the local economy will be the greatest (through employment opportunities as well as material and contractor requirement) From an economic perspective, the decommissioning phase would represent a negative impact due to the local, regional and national financial and general economic benefits from the project effectively ceasing.

The following economic impacts relating to all phases of the project have been identified:

- Gross Geographical Product (GGP)/ Gross Domestic Product (GDP) Impact
- Employment Impacts
- Economic development per capita
- Country and Industry Competitiveness
- Black Economic Transformation
- Alternative Land-use
- Need and Desirability
- Impact on individual farmland values

(i) Mitigation measures

- Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas.
- Communication to stakeholders about the nature and extent of economic opportunities should be undertaken. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with stakeholders early on in the process.
- Landowners must be consulted, and all reasonable requests complied with. A written landowner agreement should be negotiated and concluded prior to commencement. Should this not be possible, a record should be kept of reasonable negotiations with the landowners.
- If any farm labourers apply for positions at Tetra4 or one of its contractors, Tetra4 or the contractor must ensure that the labourer is aware that the position may only be temporary and what the long-term consequences of taking the position are.
- Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.
- Tetra4 should liaise with local training institutions or service providers to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants as prescribed in the Social and Labour Plan (SLP). The skills development requirements and bursaries for local learners as discussed in SLP must be implemented.
- Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating

dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.

- Contractors should be required to make use of a certain proportion of local labour - it is acknowledged that not all skills will be available locally. Jobs should be advertised in a way that is accessible to all members of society and labour desks (labour registration stations) should be in accessible areas. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with the stakeholders early on in the process.
- Procurement targets to be in line with the existing SLP.
- Comply with downscaling regulations of the DMPR.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact may result in the irreplaceable loss of resources however the value of these resources would be limited.

10.2.1.1.5 GROUNDWATER IMPACTS

The following impacts and mitigation measures were included in the Production Right EMPr. The environmental significance rating of the following potential impact is rated as medium negative without the implementation of mitigation measures and low negative with the implementation of mitigation measures.

- Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.

During the construction phase minimal impacts on the groundwater system are expected. The environmental significance rating of the following potential impacts is rated as low negative with and without the implementation of mitigation measures.

- Groundwater deterioration and siltation due to contaminated stormwater run-off from the construction area.
- Poor quality leachate may emanate from the construction camp which may have a negative impact on groundwater quality.
- Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.

The following mitigation measures should be considered to minimise the potential groundwater impacts during the construction phase.

(i) Mitigation measures

- Develop a stormwater management plan in accordance with GN704 in order to separate dirty/contact water from clean water circuits. All water retention structures, process water dams; storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events.
- All construction should take place during the dry season, as far as possible.

- Location of construction camps must be carefully considered and within the approved area to ensure that the site does not impact on sensitive areas identified during the Environmental Assessment phase or field work.
- Sites must be located, where possible, on previously disturbed areas.
- Every effort must be made to keep the footprint as small as possible.
- Any excess sand, stone and cement must be removed or reused from site on completion of the construction period and disposed at a registered disposal facility. Certificates of safe disposal for general and recycled waste must be maintained and retained on file.
- Construction vehicles and machinery must be serviced and maintained regularly in order to ensure that oil spillages are limited. Spill trays must be provided if refuelling of operational vehicles is done on site. Further to this spill kits must be readily available in case of accidental spillages with regular spot checks to be conducted.
- During servicing of vehicles or equipment, especially where emergency repairs are effected outside the workshop area, a suitable drip tray must be used to prevent spills onto the soil.
- Leaking equipment must be repaired immediately or be removed from site to facilitate repair.
- Drill pad areas must be monitored for oil and fuel spills.
- An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken.
- All hazardous substances used on-site should have an applicable Material Safety Data Sheet (MSDS) to provide information regarding the hazards, emergency response, protective measures and correct storage methodology.
- Hazardous substance containment facilities to be used during operational phase should comply with the relevant hazardous substance storage legislation in order to ensure spillages are contained.
- All hazardous substances and material used on-site should be stored in a dedicated, closed-off facility with an impervious floor and bunded area to prevent seepage and/or run-off in case of accidental spills.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact may result in irreplaceable loss of resources if not adequately mitigated but the value of the resources will be limited.

10.2.1.1.6 HYDROLOGICAL IMPACTS

During the construction phase, the drill pad for exploration drilling will be set-up, including clearing of the area and excavating sumps. The potential hydrological impacts that have been identified during the construction phase include the following:

- Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses.
- Soil and stormwater contamination by oils and hydrocarbons spills, originating from construction vehicles
- Increase in the number of alien and/or invasive vegetation as a result of disturbances.
- Alterations of the riverbanks and riverbed due to movement near the drainage lines.

Although the above hydrological impacts are predicted to have a minimal/negligible impact significance, the following mitigation measures should be considered:

(i) Mitigation measures

- Ensure total footprint area is kept to a minimum.
- Traffic and movement of machinery should be minimised and restricted to certain paths.
- Progressive rehabilitation of disturbed land should be carried out.
- Construction waste must be collected and stored safely for disposal in accordance with the relevant waste regulations, protocols, and product specifications. Care must be taken not to leave any waste on project area that can lead to future contamination of the project area or the downstream area.
- Monitoring for the project area for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.
- The reaches of all watercourses where no construction activities are planned to occur must be considered no-go areas.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.7 IMPACTS ON HERITAGE AND PALAEONTOLOGICAL FEATURES

The pre-mitigation impact significance for burial grounds, graves, heritage sites/structures is rated as MEDIUM, but with the implementation of the required mitigation measures the post-mitigation impact will be LOW. The overall Environmental significance will be Low negative.

No visible evidence of fossiliferous outcrops was found in the development footprint and thus an overall medium palaeontological significance is allocated to the development footprint. It is therefore considered that the proposed development will not lead to detrimental impacts on the palaeontological reserves of the area.

(iv) Mitigation measures

- Implement a chance find procedures in case where possible heritage finds are uncovered.
- Burial Grounds and Graves (T4-002, T4-007 and T4-008):
    - The graves should be demarcated with a 50-meterbuffer and should be avoided and left in situ.
    - A Grave Management Plan should be developed for the graves which also need to be approved by SAHRA BGG.
    - If the site is going to be impacted and the graves need to be removed a grave relocation process as per the Heritage Management Plan for the site is recommended as a mitigation and management measure. This will involve the necessary social consultation and public participation process before grave relocation permits can be applied for with the SAHRA BGG under the NHRA and National Health Act regulations.
- Historic to recent sites with possible grave sites (T4-004):
    - Apply for the test excavation and/or GPR permit to determine if the site contains graves.

- If human remains are discovered a grave relocation process is recommended as a mitigation and management measure. This will involve the necessary social consultation and public participation process before grave relocation permits can be applied for with the SAHRA BGG under the NHRA and National Health Act regulations.
- When graves are discovered/uncovered the site should be demarcated with a 50-meter no-go-buffer-zone and the grave should be avoided.
- If, during test excavations, it is determined that the site does not contain graves, no further mitigation will be required.

- Structures (T4-001, T4-003, T4-004, T4-005 and T4-006):
  - It is recommended that a no-go-buffer-zone of at least 30m is kept to the closest infrastructure.
  - If development occurs within 30m of the site, the structure will need to be satisfactorily studied and recorded before impact occurs.
  - Recording of the site i.e. (a) map indicating the position and footprint of the structure (b) photographic recording of the structure (c) measured drawings of the floor plans of the structure.
  - Submission of permit application to SAHRA to allow for the disturbance to the site. A Heritage Report must accompany the permit.
- Palaeontology:
  - The ECO for the project must be informed that the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity.
  - If Palaeontological Heritage is uncovered during surface clearing and excavations the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that mitigation (recording and collection) can be carried out.
  - Before any fossil material can be collected from the development site the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

(v) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(vi) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.8 TERRESTRIAL BIODIVERSITY IMPACT

The majority of the biodiversity within the study area has been fragmented and impacted on by existing land-uses including agriculture, farmsteads, roads powerlines and other infrastructure. Due to the spatial extent of the proposed Production Right Extension, a variety of terrestrial biodiversity areas exist. These range from low sensitive (e.g. agricultural areas etc) to highly sensitive areas (e.g. pristine areas, wetlands and watercourses as well as areas where red data species occur). Furthermore, the study area contains CBA 1&2 and ESA 1&2 areas. The ecological integrity, importance, and functioning of these terrestrial biodiversity areas provide a variety of ecological services that are considered beneficial, with one key service being the maintenance of biodiversity. The preservation of these systems is the most important aspect to consider for the proposed project. Thus, if

these areas are not maintained in a natural or near natural state, destroyed or fragmented further, then meeting targets for biodiversity features will not be achieved.

The following construction phase impacts have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).
- Potential leaks, discharges, pollutant from machinery and storage leaching into the surrounding environment.

(i) Mitigation measures

- Any drill sites or infrastructure routes located inside medium, high or very high sensitive sites on the sensitivity /constraint map require a site-specific pre-commencement assessment. The pre-commencement assessment must address the sensitive aspects on site, as identified in the overall sensitivity / constraint map. The pre-commencement assessment must be compiled by the site Environmental Officer (EO) with a suitable environmental qualification and experience. All recommendations of the pre-commencement assessment must be implemented on site. The completeness and adequacy of the pre-commencement assessment in respect of identifying and managing on site sensitivities must be included in the ECO reports and annual independent audit.
- The area delineated as no-go must be avoided. No development may take place within this area.
- Once prospective drilling sites are identified, a suitably trained EO must undertake a site-specific pre-commencement assessment to assess the site for any potential environmental sensitivities prior to commencement. Should environmental sensitivities be identified, the relevant Tetra4 Response or Action Plan Procedures must be adhered to.
- If sensitive species occur within the preferred footprint, the first option should be to relocate the proposed footprint followed by the alternative of preparing a relocation plan (prepared by a suitably qualified specialist).
- Search and rescue of species of concern. Obtain permits for disturbance/destruction of any listed/protected species found on site. Where possible, undertake activities in previously disturbed areas and/or habitats with lower sensitivity. Where possible, locate activities on the boundaries of existing disturbance. Use existing access roads as much as possible.
- Construction activities must take place systemically, especially in relation to the game farm areas. These particularly pertains for Game Farm Areas.
- Where possible, locate infrastructure in previously disturbed places and/or habitats with a lower sensitivity score. Rehabilitate disturbed areas as soon as possible. Control alien plants.
- Where possible, undertake activities in previously disturbed areas and/or habitats with lower sensitivity. Where possible, locate activities on the boundaries of existing disturbance. Use existing access roads as much as possible. Rehabilitate disturbed areas as soon as possible.
- If areas are fenced, the fences must be checked for snares. All incidences must be reported to the closest police station. Anti-poaching toolbox talks should form part of the induction process of all the fencing teams. Any contractor or employee caught poaching should be removed from site.
- The areas to be developed must be specifically demarcated to prevent movement into surrounding environments, especially wetlands and watercourses. Areas of indigenous vegetation, even secondary

communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible.

- Restrict the clearing of watercourse vegetation as far as possible. Areas that have been cleared should be re-vegetated with indigenous species or other suitable plant species after construction and initial rehabilitation work (reinstatement of the geomorphological template) is completed. Compile and implement an alien plant control program with a particular focus on alien control in watercourses (including wetlands) during the rehabilitation phase of the project. Rehabilitate disturbed areas as soon as possible. Restrict new footprints to disturbed areas as far as possible. Regular monitoring should be undertaken in the watercourses to check any possible invasion by alien vegetation so that they can be weeded out before they grow and spread out.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources over the majority of the application area.

10.2.1.1.9 AQUATIC AND WETLAND IMPACTS

The impacts that have been identified on aquatic and wetland systems during the construction phase include altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; sedimentation of the water resource; direct and indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; altering hydromorphic properties; altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; and altering hydromorphic properties.

Three levels of risk have been identified and determined for the impact assessment and these include low, medium and high risks. High risks are applicable despite the potential direct risks posed, this is motivated by the direct impacts posed by the project and the nature of the proposed project. Medium risk refers to wetland areas that are either directly affected or on the periphery of the infrastructure and at an indirect risk. Low risks are wetland systems beyond the application area that would be avoided, or wetland areas that could be avoided if feasible. The significance of all post-mitigation risks was determined to be low.

(iv) Mitigation measures

- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access.
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly.
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces.
- All chemicals and toxicants to be used for the construction must be stored within the drilling site and in a bunded area.
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”.

- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the application area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

(v) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(vi) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.1.10 IMPACTS ON SOIL (PEDOLOGY)

During the construction phase, foundations will be cleared with topsoil often being stripped and stockpiled. Access roads might be created. Drill pads and laydown areas will also be cleared with construction and exploration material being transported to laydown areas. For the wells the construction phase will consist of the clearance of drilling sites.

Based on the impact assessment, the results indicate “Insignificant” to “Very Low” post-mitigation significance ratings for the proposed components. It is therefore clear that the proposed activities are expected to have a minimal impact on land potential resources.

(i) Mitigation measures

- Only predefined access roads are to be used to reduce any unnecessary compaction.
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks.
- Invasive plant control must be undertaken quarterly.
- All excess soil (soil that are stripped and stockpiled to make way for foundations) must be stored, continuously rehabilitated to be used for rehabilitation of eroded areas.
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.

(ii) Cumulative Impacts

- The cumulative impacts have been scored “Medium”, indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The irreplaceable loss of resources has been scored “Low”, where the impacts are unlikely to result in an irreplaceable loss of resources.

10.2.1.1.11 VISUAL IMPACT

In general terms the proposed project could industrialise this Landscape Character Area. Large scale mining operations are currently visible from within this landscape. The proposed project will see drilling operations occurring throughout the area during exploration and construction. At the time of this Report, 18 boreholes are planned for exploration, once the exploration activities have been undertaken and completed, there will be 18

wells. These are relatively small infrastructure elements. The large-scale agricultural nature of the landscape will remain very evident. A degree of industrialisation will therefore occur however, the existing landscape character will still dominate.

In terms of cumulative effects, the proposed project will not significantly change the character of views. It will however combine with large scale mining operations including stockpiles and plant during the construction and operational phases to intensify current impacts on landscape character.

After decommissioning, visual impacts will reduce due to the removal of operational plant etc. Due to the fact that the affected landscape is relatively flat and open, no mitigation is feasible.

(i) Mitigation measures

- Rehabilitate disturbed area and reinstate agricultural usage or the land usage requested by the landowner.
- Minimise disturbance of the natural landscape.
- Return disturbed agricultural land to agricultural use.
- Undertake rehabilitation and screen planting where possible.
- Locate wells and compressor stations a minimum 250m from the edge of local roads.
- Ensure that temporary lighting is of sufficient power to ensure safety but not so powerful that it creates glare that could cause danger for drivers or nuisance for neighbours.
- Ensure that temporary lighting minimises light spill outside the area that it is intended to light.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.2 **OPERATIONAL PHASE IMPACTS**

The Operational Phase constitutes the activities that take place during exploration, including but not limited to borehole drilling. The following impacts are applicable to the activities that will be undertaken during the Operational Phase.

10.2.1.2.1 AIR QUALITY IMPACTS

For air quality impacts during the operational phase, the assumption is that the operational activities would take place during day- and night-time conditions. The operation of vehicles on unpaved roads, even under mitigated conditions, could result in single exceedances of the respective NAAQS's and NDCR limits for residential areas at AQSRs. The negative air quality impacts are therefore considered to be of medium significance at the nearest receptors but will reduce to low significance should the roads be paved.

The air quality impacts due to the diesel-powered generator operations are likely to exceed the long-term NAAQS's for residential areas up to 90 m from the operations. Care should be taken to site the generator at least 100 m from all AQSRs. With careful siting, NAAQSs for residential areas should not be exceeded at AQSRs. The negative air quality impacts are therefore considered to be of medium significance (given the possible impact zone of 90 m) but will reduce to low significance at the nearest receptors with mitigation measures in place.

(i) Mitigation measures

- Ground level concentrations and dust fallout due to vehicle operations on unpaved roads are likely to exceed the PM_{10} NAAQS limit and NDCR limit for residential areas up to 80 m from the operations. Care should be taken to apply mitigation measures to unpaved roads located near AQSRs.

- Air quality impacts due to diesel-powered generators are likely to exceed the $PM_{2.5}$ and NO_2 NAAQS for residential areas up to 100 m from the operations. Care should be taken to site the generators at least 100 m from all AQSRs.
- The existing PR EMPr states that in controlling vehicle entrained PM during construction, it is recommended that water (at an application rate of 2 litre/m^2-hour), be applied on all unpaved road sections to ensure a minimum of 50% control efficiency (CE), and that binding agents or chemical suppressants (such as "Dust-A-Side" or "Dustex") should be considered for application on all unpaved road sections (emissions reduction efficiency of more than 80%).
- During all phases, material transfers are to be controlled through the use of water sprays resulting in 50% control efficiency.
- The following good practice should be followed during all phases of the project:
    - In order to ensure lower exhaust emissions from vehicles and machinery, equipment suppliers or contractors should be required to ensure compliance with appropriate emission standards for production fleets.
    - Maintenance and repair of diesel engines should be carried out as prescribed by manufacturer in order to maximize combustion and reduce gaseous emissions.
- Fuel efficient driving practices on site, during all phases of the Project, may also help lower exhaust emissions from vehicles and machinery, such as stipulating a maximum speed on all unpaved roads. In addition, other fuel-efficient practices that may lower exhaust emissions include limiting idling of machinery, driving in an upper gear rather than a lower gear as much as possible, ensuring tire pressure are always adequate etc.
- Products, liquid fuels, and chemicals should be stored in areas where there are provisions for containment of spills.
- The project proponent has indicated that all infrastructure and facilities will be designed, installed and maintained according to best industry practices to control fugitive and unintended methane emissions as prescribed in (US EPA, 2015). In addition, the following actions are recommended:
    - Regular check (quarterly) and reporting of exploration well that has potential to be vandalized.
    - Quarterly reporting of fugitive emissions from wells.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.2.2 CLIMATE CHANGE IMPACTS

Given the nature of operation activities for the roads and wells (where the location may vary depending on the gas reserves in the area) the negative climate change impacts are considered to be of low significance without mitigation and low significance with mitigation.

(iv). Mitigation measures

- As operations will be of limited duration, develop and implement management programs and procedures to limit GHG emissions as far as possible.
- Flaring of GHG is prioritized over venting and should be minimized to the greatest extent possible. A flare efficiency of 97-99% is mandated.

- A leak-detection program to be implemented to reduce product loss.

(v). Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(vi). Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.2.3 NOISE IMPACTS

For noise impacts during the operational phase, the assumption is that the operational activities would take place during day- and night-time conditions. With careful siting, IFC noise guidelines for residential areas should not be exceeded at NSRs. The negative noise impacts are therefore considered to be of low significance at the nearest receptors. The negative noise impacts are therefore considered to be of low significance at the nearest receptors.

(i) Mitigation measures

- Although the current EMPr specifies complaints need to be registered it is recommended that the complaints register description be expanded as follows:
    - A complaints register, including the procedure which governs how complaints are received, managed and responses given, must be implemented, and maintained.
- The existing EMPr specifies that construction activities should where possible be during day-time. It is recommended that this be expanded as follows (applying to all phases of the project):
    - Unless it is an emergency situation, non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.
- Equipment to be employed should be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.
- It should be noted that the effectiveness of partial enclosures and screens can be reduced if used incorrectly, e.g., noise should be directed into a partial enclosure and not out of it, there should not be any reflecting surfaces such as parked vehicles opposite the open end of a noise enclosure.
- The following good practice should be implemented (additional measures to be included in the EMPr:
    - Machines and mobile equipment used intermittently should be shut down between work periods or throttled down to a minimum and not left running unnecessarily. This will reduce noise and conserve energy.
    - Acoustic covers of engines should be kept closed when in use or idling.
- Operational activities that take place within the below specified distances from noise sensitive receptors must first be discussed and agreed with the affected party (prior to construction):
    - Operation (daytime):
        - Wells: 400 m
    - Operation (night-time):
        - Wells: 400 m
- Regular and effective maintenance of equipment are included in the current EMPr.

- In the event that noise related complaints are received, the existing EMPr makes provision for short term ambient noise measurements. The EMPr specifies that the noise levels should be co-ordinated with the 5 m/s wind speed.
- It is also recommended that the following procedure be adopted and included in the EMPr for all noise surveys (for complaints):
    - Any surveys should be designed and conducted by a trained specialist.
    - Sampling should be carried out using a Type 1 SLM that meets all appropriate IEC standards and is subject to annual calibration by an accredited laboratory.
    - The acoustic sensitivity of the SLM should be tested with a portable acoustic calibrator before and after each sampling session.
    - Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples, representative of the day- and night-time acoustic environment should be taken.
    - The SLM should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.
    - Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.
    - A detailed log and record should be kept. Records should include site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources

10.2.1.2.4 SOCIAL IMPACTS

The proposed Production Rights Extension project will impact on high quality agricultural soil which is used to grow crops that contribute to food security in South Africa. One of the most significant potential social impacts associated with the proposed project is the potential impacts on livelihoods of the farming community. Farmers may fear that their land rights and property values will be affected. The project will require access to farms, and because of the current socio-political issues in South Africa, this is a sensitive matter. Farmers may also be concerned about the impact of the project on their existing way of life, and on the infrastructure on their farms. An impact assessment of each of the below impacts has been undertaken. Furthermore, each of the below impacts is relevant to the construction and operational phases.

- Impact on livelihoods
- Impact of servitudes on land values
- Damage to farm roads, existing services, and infrastructure
- Impacts on safety and security of local residents
- impacts on sense and spirit of place
- Impacts on the social licence to operate

- Public perceptions about safety associated with gas production
- Contribution to economy of South Africa
- Secondary economic opportunities
- Potential opportunity for education, skills development, and training.

(i) Mitigation measures

- The Tetra4 community liaison officer (CLO) must continue to deal with the affected landowners throughout the life of the project.
- In cases where there the farmer does not agree with the compensation offered by Tetra4 related to loss of potential income due to exploration, construction or operational activities, Tetra 4 must appoint an agricultural economist at their cost to determine what the actual losses will be to the farmers due to the drilling and trenching activities on their properties. Farmers must be compensated for the actual losses for the entire period that they cannot use the land due to Tetra's activities. This may be one or two years, depending on when in the season the drilling and trenching take place, and how long the property is affected. The principles explained in the IFC Handbook for Preparing a Resettlement Action Plan must be followed. This includes a land-use/land capability inventory; an asset register and physical asset survey; an income stream analysis and entitlement matrix. Compensation must be determined with input from the landowners.
- If any existing livelihood activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and obtain his consent to execute the activity on his/her land.
- If any interference takes place and there are actual losses, the landowner should be compensated for their losses. Tetra4 must have a claims procedure that is communicated to all affected landowners. There must be specific timeframes dealing with response times and time it takes to close out complaints. In order to receive compensation, the claim forms must be submitted to the Tetra4 CLO Compensation should follow the IFC principles, which states that market related prices should be paid, and if anything is restored, it must be to the same or better standards than before.
- If areas are fenced, the fences must be checked for snares on a daily basis for the duration of the construction period. All incidences must be reported to the closest police station. Anti-poaching toolbox talks should form part of the induction process of all the fencing teams. Any contractor or employee caught poaching should be removed from site.
- Servitudes should only be registered for the life of the operations or as long as the well operational. At the end of the life of operations, or when a well or pipeline is no longer productive or used, servitudes must be de-registered at the cost of Tetra4. Servitudes cannot be seen as access routes unless it has been specified as such and agreed on by both parties.
- Temporary access and land arrangements must be made until there are more certainty on exactly where the wells will be. Servitudes should only be registered for productive wells.
- If private roads are affected by project activities, it is the responsibility of Tetra4 to maintain these roads as long as they use it. Tetra4 should engage with the relevant farmers about road maintenance, as some of them have preferential ways in which the roads must be maintained, for example if roads are only graded and not built up it turns into rivers when there is heavy rain. The road maintenance agreements must be formalised before construction and drilling commences to ensure all parties involved are protected and know their rights and responsibilities. Tetra4 must make sure that all compacting and rehabilitating of trenches are done to the specifications in the Environmental Management Plan. It is recommended that construction and drilling be planned for the dry season. Tetra4 must provide all the affected landowners with a construction and drilling schedule to ensure

that they know when construction will take place on their properties. Any changes to the construction and drilling schedule must be communicated to the farmers at least a week in advance.

- Before the project commences Tetra4 should compile an asset and infrastructure baseline of any landowner infrastructure such as fences, pipes, electricity lines, roads and troughs that may be affected by the project. Photographs and GPS co-ordinates of the infrastructure must be included in the baseline. A copy of the baseline affecting their property should be given to each landowner, who should sign off the document to ensure that it is accurate. Tetra4 should keep the master document. If any damage occurs it should be reinstated to its pre-project status. If the infrastructure must move, it must be done at Tetra4's cost. Tetra4 must ensure that the construction team has a copy of the asset and infrastructure baseline to guarantee that no infrastructure will be damaged due to ignorance during the construction phase of the project.
- Tetra4 should work with the preferred farmers' security group and implement the AgriSA farm access protocol for everybody that need to access the properties. Pictures, make and registration numbers of all vehicles used by Tetra4 on site should be provided to the farmer's security group and distributed to all affected landowners to ensure that they will be able to identify these vehicles if they access their properties. For scheduled and maintenance work Tetra4 should give a roster to the farmers stating dates and approximate times that contractors will be on the farms. Farmers emphasised that they need to know of people accessing the farm ahead of time. It is too late to inform them when entering the property. All access arrangements should be made at least 24 hours before access is required. Tetra4 must meet with the landowners before the construction and drilling phase commence and formalise security arrangements. This should be done in writing and include the existing forums that the landowners know and trust.
- All contractors and employees need to wear photo identification cards. Vehicles should be marked as construction vehicles and should have Tetra4's logo clearly exhibited. Entry and exit points of the site should be controlled during the construction and drilling phase. Areas where materials are stockpiled must be fenced. The schedules of the security company should be communicated to the farmers, especially to those farmers that have Tetra4 infrastructure that need to be guarded. It must be considered that guards changing shifts contribute to the impact of strangers accessing properties, and therefore a system that consider the safety of both the Tetra4 infrastructure and the safety of the landowners must be implemented. The necessary sanitation facilities must be made available, and some form of shelter from the elements. The security guards must not be allowed to make fires for cooking or heating purposes.
- A system to arrange access to properties must be devised and formalised. The landowners must agree to the system. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. Landowners have the right to refuse people access to their properties if it was not arranged in advance. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts.
- It is difficult to mitigate the impact on sense of place as it is experienced on a personal level. In general, the mitigation measures suggested in the visual, noise, ecological impact assessments and other relevant specialist studies should be adhered to. The relevant specialists will provide scientific mitigation measures for the aspects relevant to their studies. The direction and brightness of lights close to residences must be considered. Sense of place is a personal experience, but successful rehabilitation will go a long way in recreating a rural sense of place. The public perception would be negative or positive depending on the successful implementation of the rehabilitation.
- Tetra4 has a dedicated person that communicate with the landowners with whom they have a positive relationship. It is important that this relationship is extended to the Production Right landowners.

Information sharing, frequent communication and quick responses to issues/complaints/enquiries will assist Tetra4 with maintaining their SLO.

- Tetra4 should compile a background information document (BID) explaining the process and potential risks in laymen terms. This should be distributed to local stakeholders. Special sessions to inform the farm workers in their native languages must be conducted. They can also consider a media awareness campaign on local radio stations and press statements to local papers.
- Tetra4 must become a member of the local firefighting association. Access routes and procedures in case of any veld fire must be determined and shared with the firefighting association, farm owners and Tetra4 staff.
- Wells and pipelines must be kept away from residences as far as possible.
- Tetra4 should ensure that a good proportion of secondary economic opportunities are given to local contractors. Services and goods must be procured locally as far as reasonably possible. Aspects of this positive impact will occur by default when the construction force lives locally, and they utilise local services and support local shops.
- Tetra4 should liaise with local training institutions to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants. The skills development requirements in their Social and Labour Plan (SLP) must be implemented. Tetra4 can liaise with local schools to participate in science classes or bring science pupils to visit the facility once it is operational.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources but where this may occur, mitigation measures shall be put forward to reduce this potential as far as possible.

10.2.1.2.5 ECONOMIC IMPACTS

The majority of the economic impacts of this project have been rated as positive with the impacts extending from a local level, through to the region and also to a national level. This project will need to comply with these provisions which compliance will have an obvious positive impact on economic transformation. During the construction and operational phase, the positive impacts on the local economy will be the greatest (through employment opportunities as well as material and contractor requirement). From an economic perspective, the decommissioning phase would represent a negative impact due to the local, regional and national financial and general economic benefits from the project effectively ceasing.

The following economic impacts relating to all phases of the project have been identified:

- GGP/GDP Impact
- Employment Impacts
- Economic development per capita
- Country and Industry Competitiveness
- Black Economic Transformation
- Alternative Land-use
- Need and Desirability
- Impact on individual farmland values

(i) Mitigation measures

- Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas.
- Communication to stakeholders about the nature and extent of economic opportunities should be undertaken. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with stakeholders early on in the process.
- Landowners must be consulted, and all reasonable requests complied with. A written landowner agreement should be negotiated and concluded prior to commencement. Should this not be possible, a record should be kept of reasonable negotiations with the landowners.
- If any farm labourers apply for positions at Tetra4 or one of its contractors, Tetra4 or the contractor must ensure that the labourer is aware that the position may only be temporary and what the long-term consequences of taking the position are.
- Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.
- Tetra4 should liaise with local training institutions or service providers to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants as prescribed in the SLP. The skills development requirements and bursaries for local learners as discussed in their Social and Labour Plan (SLP) must be implemented.
- Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.
- Contractors should be required to make use of a certain proportion of local labour - it is acknowledged that not all skills will be available locally. Jobs should be advertised in a way that is accessible to all members of society and labour desks (labour registration stations) should be in accessible areas. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with the stakeholders early on in the process.
- Procurement targets to be in line with the existing Social Labour Plan (SLP).
- Comply with downscaling regulations of the DMPR.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative positive economic change.

(iii) Irreplaceable loss of Resources

- The impact may result in the irreplaceable loss of resources however the value of these resources would be limited.

10.2.1.2.6 GROUNDWATER IMPACTS

The potential impacts on groundwater resources associated with the operational phase activities include the following:

- Migration of saline groundwater from the deep, fractured aquifer to the overlying, shallow freshwater aquifer(s) during the gas exploration phase.
- Migration of stray methane (CH_4) gas from the deep, fractured aquifer to the overlying, shallow freshwater aquifer(s) during the gas exploration phase.
- Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.
- Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.
- Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.
- Leakage of harmful substances from tanks, pipelines or other equipment may cause groundwater pollution.
- Leachate of contaminants used in the drilling mud sump(s) to the intergranular, potable aquifer(s) during the operational phase.

The environmental significance rating of the following potential impacts is rated as high negative without the implementation of mitigation measures and medium negative with the implementation of mitigation measures.

- Migration of saline groundwater from the deep, fractured aquifer to the overlying, shallow freshwater aquifer(s) during the gas exploration phase.
- Migration of stray methane (CH_4) gas from the deep, fractured aquifer to the overlying, shallow freshwater aquifer(s) during the gas exploration phase.

The environmental significance rating of the following potential impacts is rated as medium negative without the implementation of mitigation measures and low negative with the implementation of mitigation measures.

- Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.
- Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.
- Leakage of harmful substances from tanks, pipelines or other equipment may cause groundwater pollution.
- Leachate of contaminants used in the drilling mud sump(s) to the intergranular, potable aquifer(s) during the operational phase.

The environmental significance rating of the following potential impact is rated as low negative without the implementation of mitigation measures and low negative with the implementation of mitigation measures.

- Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.

The following mitigation measures should be considered to minimise the potential groundwater impacts during the operational phase.

(i) Mitigation measures

- All exploration wells should be sealed-off with a combination of casing and grouting to ensure isolation of the saline water from the host-aquifer(s).
- Development and implementation of an integrated groundwater monitoring program evaluating hydrochemistry will serve as early warning and detection mechanism to implement mitigation measures.
- Monitoring results should be evaluated and reviewed on a biannual basis by a registered hydrogeologist for interpretation and trend analysis for submission to the Regional Head of Department. Based on the water quality results, the monitoring network should be refined and updated every three to five years based on hydrochemical results obtained to ensure optimisation and adequacy of the proposed localities.
- The calibrated groundwater flow model should be updated on a bi-annual basis as newly gathered monitoring results become available in order to be applied as groundwater management tool for future scenario predictions.
- All exploration wells should be sealed-off with a combination of casing and grouting to ensure isolation of the gas from the host-aquifer(s).
- Develop a stormwater management plan in accordance with GN704 in order to separate dirty/contact water from clean water circuits. All water retention structures, process water dams; storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events.
- An appropriately sized spill kit must be kept onsite and available at all times. The spill kit size must be relevant to the scale of the activities involving the use of hazardous substances.
- An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken.
- The responsible operator must have the required training to make use of the spill kit in emergency situations.
- Plant areas must be fitted with a containment facility for the collection of dirty water. This facility must be impervious to prevent soil and groundwater contamination.
- Operational vehicles and machinery must be serviced and maintained regularly in order to ensure that oil spillages are limited. Spill trays must be provided if refuelling of operational vehicles is done on site. Further to this spill kits must be readily available in case of accidental spillages with regular spot checks to be conducted.
- During servicing of vehicles or equipment, especially where emergency repairs are affected outside the workshop area, a suitable drip tray must be used to prevent spills onto the soil.
- Leaking equipment must be repaired immediately or be removed from site to facilitate repair.
- An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken.
- All hazardous substances used on-site should have an applicable Material Safety Data Sheet (MSDS) to provide information regarding the hazards, emergency response, protective measures and correct storage methodology.
- Hazardous substance containment facilities to be used during operational phase should comply with the relevant hazardous substance storage legislation in order to ensure spillages are contained.
- All hazardous substances and material used on-site should be stored in a dedicated, closed-off facility with an impervious floor and bunded area to prevent seepage and/or run-off in case of accidental spills.

- External audits should be conducted to ensure that exploration activities are maintained and functioning effectively and according to licence conditions.
- The Licensee shall appoint a suitably qualified and responsible person to give effect to all recommendations as stipulated in specialist reports to ensure compliance to licence conditions pertaining to activities in order to ensure that potential impact(s) are minimised, and mitigation measures proposed are functioning effectively.
- A stormwater management plan in accordance with GN704, separating dirty/contact water from clean water circuits, should be in place until all decommissioning and rehabilitation activities have been concluded.
- A rehabilitation plan must be developed based on site-specific issues and requirements including soft and hard engineering interventions and revegetation.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact may result in irreplaceable loss of resources if not adequately mitigated but the value of the resources will be limited.

10.2.1.2.7 HYDROLOGICAL IMPACTS

The activities expected during the operational phase involve the operation of the drill pad, drilling vehicles and equipment, movement of trucks and other vehicles, general and hazardous waste management, gas processing as well as operation of road tankers for gas distribution. The potential environmental impacts and mitigation measures during the operational phase are listed below.

- Disturbance to soil and ongoing erosion as a result of periodic maintenance activities.
- Altered water quality as a result of increased availability of pollutants.
- Potential increase in the number of alien and/or invasive vegetation as a result of floods or people who visit the site.

Although the above hydrological impacts are predicted to have a minimal/negligible impact significance, the following mitigation measures should be considered:

(vii) Mitigation measures

- No movement of construction equipment through the watercourses may be permitted during standard operational activities or maintenance activities. Use must be made of the existing and/or approved watercourse crossings only.
- Regular conditional inspections of all stormwater infrastructure are required. Inspection data must be recorded and accumulated for tracking purposes. Regular reporting should be scheduled management task.
- Specific attention must be given to inspection during and after any rain and/or flood event to kerb any damage that may have occurred.
- Oil recovered from construction vehicles and machinery should be collected, stored and disposed of by accredited vendors for recycling.
- Monitoring for the project area for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.

(viii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(ix) Irreplaceable loss of Resources

- The impact may result in irreplaceable loss of resources if not adequately mitigated but the value of the resources will be limited.

10.2.1.2.8 TERRESTRIAL BIODIVERSITY IMPACTS

Most of the biodiversity within the study area has been fragmented and impacted on by existing land-uses including agriculture, farmsteads, roads powerlines and other infrastructure as well as mining. Due to the spatial extent of the Production Rights Extension project, a variety of terrestrial biodiversity areas exist. These range from low sensitive (e.g. agricultural areas etc) to highly sensitive areas (e.g. pristine areas, wetlands and watercourses as well as areas where red data species occur). Furthermore, the study area contains CBA1 and ESA 1&2 areas. The ecological integrity, importance, and functioning of these terrestrial biodiversity areas provide a variety of ecological services that are considered beneficial, with one key service being the maintenance of biodiversity. The preservation of these systems is the most important aspect to consider for the proposed project. Thus, if these areas are not maintained in a natural or near natural state, destroyed or fragmented further, then meeting targets for biodiversity features will not be achieved.

The following operational phase impacts have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).
- Potential leaks, discharges, pollutant from machinery and storage leaching into the surrounding environment.

(i) Mitigation measures

- Tetra4 must timeously control alien and invasive species in all areas disturbed by project specific construction.
- Use existing access roads as much as possible. Rehabilitate disturbed areas as soon as possible.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.2.9 AQUATIC AND WETLAND IMPACTS

The impacts that have been identified on aquatic and wetland systems during the operational phase include altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; sedimentation of the water resource; direct and indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; altering hydromorphic properties; altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; and altering hydromorphic properties.

Three levels of risk have been identified and determined for the impact assessment and these include low, medium and high risks. High risks are applicable despite the potential direct risks posed, this is motivated by the

direct impacts posed by the project and the nature of the proposed project. Medium risk refers to wetland areas that are either directly affected or on the periphery of the infrastructure and at an indirect risk. Low risks are wetland systems beyond the application area that would be avoided, or wetland areas that could be avoided if feasible. The significance of all post-mitigation risks was determined to be low.

(i) Mitigation measures

- Maintenance and inspection vehicles and machinery must make use of existing and pre-defined access routes.
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- All waste generated on-site must be adequately managed. Separation and recycling of different waste materials should be supported.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.2.10 IMPACTS ON SOIL (PEDOLOGY)

The operational phase will include an increase in traffic, ongoing maintenance and anthropogenic activities associated with the exploration drilling. It is worth noting that the bulk of the impacts would have already been associated with the construction phase, with the remainder of the operational activities only being associated with the already developed areas. The operational phase of the wells includes anthropogenic movement. Besides compaction and erosion caused by increased traffic, few aspects are expected to be associated with this phase. The operational phase of the drill pad and associated exploration activities will include infrastructure being maintained and monitored regularly, with no other expected impacts potentially threatening the land capability.

Based on the impact assessment, the results indicate “Insignificant” to “Very Low” post-mitigation significance ratings for the proposed components. It is therefore clear that the proposed activities are expected to have a minimal impact on land potential resources.

(i) Mitigation measures

- Only predefined access roads are to be used to reduce any unnecessary compaction.
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.

(ii) Cumulative Impacts

- The cumulative impacts have been scored “Medium”, indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The irreplaceable loss of resources has been scored “Low”, where the impacts are unlikely to result in an irreplaceable loss of resources.

10.2.1.2.11 VISUAL IMPACTS

In general terms the proposed project could industrialise this Landscape Character Area. Large scale mining operations are currently visible from within this landscape. The proposed project will see drilling operations

occurring throughout the area during exploration and construction. At the time of this Report, 18 boreholes are planned for exploration, once the exploration activities have been undertaken and completed, there will be 18 wells. These are relatively small infrastructure elements. These are relatively small infrastructure elements. The large-scale agricultural nature of the landscape will remain very evident.

In terms of cumulative effects, the proposed project will not significantly change the character of views. It will however combine with large scale mining operations including stockpiles and plant during the construction and operational phases to intensify current impacts on landscape character.

After decommissioning, visual impacts will reduce due to the removal of surface structures etc. Since the affected landscape is relatively flat and open, no mitigation is feasible.

(i) Mitigation measures

- Undertake rehabilitation.
- Re-establish agricultural uses.
- Undertake screen planting between the exploration areas and the adjacent public roads, if possible.
- Ensure that temporary lighting is of sufficient power to ensure safety but not so powerful that it creates glare that could cause danger for drivers or nuisance for neighbours.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.3 DECOMMISSIONING REHABILITATION AND CLOSURE PHASE IMPACTS

The decommissioning, rehabilitation and closure phase constitutes the activities that take place after exploration, when a well has been determined to undergo decommissioning. The following impacts are applicable to the activities that will be undertaken during the decommissioning, rehabilitation and closure phase.

10.2.1.3.1 AIR QUALITY IMPACTS

The assumption is that decommissioning would be during day-time hours only. Given the nature of decommissioning activities, and the extent of the process, NAAQS limits for residential areas may be exceeded sporadically at AQSRs. Mitigation measures, however, can be implemented to reduce emissions due to fugitive dust. The negative air quality impacts are therefore considered to be of medium significance without mitigation and low significance with mitigation at the nearest receptors.

(i) Mitigation measures

- In controlling vehicle entrained PM, it is recommended that water be applied on all unpaved road sections to ensure a minimum of 50% control efficiency (CE). In addition, binding agents or chemical suppressants (such as “Dust-A-Side” or “Dustex”) should be considered for application on all unpaved road sections.
- For topsoil management during construction and rehabilitation, the existing EMPr should be amended to include the recommendation that exposed areas must be ensured to remain moist through water spraying during dry, windy periods (CE 50%).
- During all phases, material transfers are to be controlled through the use of water sprays resulting in 50% control efficiency.
- The following good practice should be followed during all phases of the project: In order to ensure lower exhaust emissions from vehicles and machinery, equipment suppliers or contractors should be required to ensure compliance with appropriate emission standards for production fleets. Also,

maintenance and repair of diesel engines should be carried out as prescribed by manufacturer in order to maximize combustion and reduce gaseous emissions.

- Fuel efficient driving practices on site, during all phases of the Project, may also help lower exhaust emissions from vehicles and machinery, such as stipulating a maximum speed on all unpaved roads. In addition, other fuel-efficient practices that may lower exhaust emissions include limiting idling of machinery, driving in an upper gear rather than a lower gear as much as possible, ensuring tire pressure are always adequate etc.
- Products, liquid fuels, and chemicals should be stored in areas where there are provisions for containment of spills.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.3.2 CLIMATE CHANGE IMPACTS

As operations progress, the previously cleared areas that form part of the project will be rehabilitated resulting in a carbon sink gain. Even assuming rehabilitation uses the same indigenous vegetation, the carbon balance will not be completely restored. There may also be potential soil degradation due to stockpiling. However, there is insufficient data at this point to determine the decommissioning GHG emissions and significance thereof during the decommissioning phase. This is likely to be equivalent or less than the construction phase, with the reestablishment of a carbon sink in the revegetation of the site.

10.2.1.3.3 NOISE IMPACTS

The assumption is that decommissioning would be during day-time hours only. Given the nature of decommissioning activities, and the extent of the process, IFC noise guidelines for residential areas may be exceeded sporadically at NSRs. Attenuation measures, however, can be implemented to reduce noise levels. The negative noise impacts are therefore considered to be of medium significance without mitigation and low significance with mitigation at the nearest receptors.

(i) Mitigation measures

- Regular and effective maintenance of equipment are essential to noise control. Increases in equipment noise are often indicative of eminent mechanical failure. Also, sound reducing equipment/materials can lose effectiveness before failure and can be identified by visual inspection.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.3.4 ECONOMIC IMPACTS

Whilst the construction phase and operational phase economic impacts were largely rated as highly positive, the decommissioning phase would represent a negative impact due to the local, regional and national financial and general economic benefits from the project effectively ceasing.

The following economic impacts relating to the decommissioning phase of the project have been identified:

- GGP/GDP Impact
- Employment Impacts

- Economic development per capita
- Country and Industry Competitiveness
- Black Economic Transformation
- Alternative Land-use
- Need and Desirability
- Impact on individual farmland values

(i) Mitigation measures

- Ensure that as much of the infrastructure as possible is sited away from agricultural lands. Utilize servitudes, farm roads and any other routes to avoid sensitive areas.
- Communication to stakeholders about the nature and extent of economic opportunities should be undertaken. No unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with stakeholders early on in the process.
- Landowners must be consulted, and all reasonable requests complied with. A written landowner agreement should be negotiated and concluded prior to commencement. Should this not be possible, a record should be kept of reasonable negotiations with the landowners.
- If any farm labourers apply for positions at Tetra4 or one of its contractors, Tetra4 or the contractor must ensure that the labourer is aware that the position may only be temporary and what the long-term consequences of taking the position are.
- Preference for employment should be given to the local community. The recruitment policy must be communicated openly and made available to the public if requested.
- Tetra4 should liaise with local training institutions or service providers to determine whether there are any opportunities to offer internships and practical experience for their students. Tetra4 must ensure that skills development requirements form part of their contracts with sub-consultants as prescribed in the SLP. The skills development requirements and bursaries for local learners as discussed in their Social and Labour Plan (SLP) must be implemented.
- Tetra4 must appoint a CLO that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra4 must consult with the landowner and take reasonable steps to obtain his consent to execute the activity on his/her land. A system to arrange access to properties must be devised and formalised. All reasonable efforts must be taken to obtain agreement on the system with the landowners and it must be formalised. Access must be arranged at least 24 hours prior, except in emergencies, when the landowners should also be informed immediately. If routine access is required, the landowners must be provided with a roster indicating dates and approximate times that access will be required. Tetra4 must compensate the landowners for any damage to property or goods if it was due to behaviour of their contractors. Sub-contractors must be made aware of this and a clause spelling out their liability should be included in their contracts. All contractors should sign a code of conduct as part of their induction process. Induction must explicitly include aspects such as closing gates and littering. Toolbox talks must be designed to include social and environmental aspects. A fining system must be put in place for any transgressions affecting the landowners.
- Contractors should be required to make use of a certain proportion of local labour - it is acknowledged that not all skills will be available locally. Jobs should be advertised in a way that is accessible to all members of society and labour desks (labour registration stations) should be in accessible areas. No

unrealistic expectations should be created and the recruitment policy giving preference to local labour should be communicated from the beginning of the project. The local area of influence should be agreed with the stakeholders early on in the process.

- Procurement targets to be in line with the existing Social Labour Plan (SLP).
- Comply with downscaling regulations of the DMPR.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative positive economic change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of recourses.

10.2.1.3.5 GROUNDWATER IMPACTS

The potential impacts on groundwater resources associated with the decommissioning phase activities include the following:

- Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the borehole closure and decommissioning phase.
- Migration of stray methane (CH_4) gas from the deep, fractured aquifer to the overlying, potable aquifer(s) borehole closure and decommissioning phase.
- Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.
- De-mobilisation of heavy vehicle and machinery as part of the decommissioning phase on-site may cause hydrocarbon contamination of groundwater resources.

The environmental significance rating of the following potential impacts is rated as medium negative without the implementation of mitigation measures and medium negative with the implementation of mitigation measures.

- Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the borehole closure and decommissioning phase.
- Migration of stray methane (CH_4) gas from the deep, fractured aquifer to the overlying, potable aquifer(s) borehole closure and decommissioning phase.

The environmental significance rating of the following potential impacts is rated as low negative without the implementation of mitigation measures and low negative with the implementation of mitigation measures.

- Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.
- Poor quality leachate may emanate from the plant footprint area which may have a negative impact on groundwater quality.
- De-mobilisation of heavy vehicle and machinery as part of the decommissioning phase on-site may cause hydrocarbon contamination of groundwater resources.

The following mitigation measures should be considered to minimise the potential groundwater impacts during the decommissioning, rehabilitation and closure phase.

(i) Mitigation measures

- "Contractor/Tetra4 to prepare a consolidated site-specific closure/sealing plan to be submitted for approval. The plan should include a detailed description of the following aspects:
    - Calliper Logging should be conducted to identify and investigate potential blockages/cavities within well.

- Cement Bond Logging should be performed to investigate the current integrity of the casing and cementation.
- Contractor to determine the most suitable and appropriate closure, sealing and rehabilitation strategy with specific focus on the plugging method to ensure no vertical gas and/or fluid movements within the well.
- Develop cement formulation for cementing the entire well annulus.
- Develop cement formulation to top-up “no bond” or “poor bond” cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations.
- Cement formulations and volumetric calculations to be approved by well engineer/cement specialist.
- Contractor must ensure cement mixture seals the entire well length along the well annulus.
- Cement plugs must be stacked along the full length and diameter of the well to surface (open hole section above the packer as well as the upper casing) to ensure efficient redundancy.
- All plugs must be tagged to ensure successful placement.
- Cementation extent: Should be from end of hole (bottom of well) to surface.
- Cementation technique: Squeeze technique - this displacement method minimizes the contamination of the cement by being able to displace fluid within the well, thus allowing for a more stable well plug. Contractor must also make use of wiper plugs for cement displacement.
- Contractor to conduct cement top-ups along the annulus and existing cemented sections showing “no bond” or “poor bond” from logging results.
- A surface / shallow cement plug (+/ 50m below ground Level) must be set, and the well casing must be cut and capped 1 m below ground level to remove the wellhead and all casing above this point.
- Integrity of the plugs must be confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test for 4 hours at determined pressure with less than 10% bleed over the period. Pressure test data to be captured in 15-minute intervals for the entire 4-hour testing period. "

- Development and implementation of a post-closure groundwater monitoring program evaluating hydrochemistry will serve as early warning and detection mechanism to implement mitigation measures.
- A rehabilitation plan must be developed based on site-specific issues and performed in accordance to best practise guidelines and guided by the closure and rehabilitation plans.
- Operational vehicles and machinery must be serviced and maintained regularly in order to ensure that oil spillages are limited. Spill trays must be provided if refuelling of operational vehicles is done on site. Further to this spill kits must be readily available in case of accidental spillages with regular spot checks to be conducted.
- During servicing of vehicles or equipment, especially where emergency repairs are affected outside the workshop area, a suitable drip tray must be used to prevent spills onto the soil.
- Leaking equipment must be repaired immediately or be removed from site to facilitate repair.
- Workshop areas must be monitored for oil and fuel spills, and a suitable oil/water separator should be in place where maintenance work on vehicles and equipment can be performed.

- An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact may result in irreplaceable loss of resources if not adequately mitigated but the value of the resources will be limited.

10.2.1.3.6 HYDROLOGICAL IMPACTS

The decommissioning phase involves the removal of all berms, trenches and other storm water infrastructure, stationary infrastructure, certain surface infrastructure and wastes. The hydrological impact is considered minimal/negligible.

The potential hydrological impacts that have been identified during the decommissioning phase include the following:

- Increased erosion due to construction vehicles movement.
- Stormwater Contamination resulting from spillages of polluted groundwater from wells
- Potential increase in the number of alien and/or invasive vegetation as a result of floods or people who visit the site.

Although the above hydrological impacts are predicted to have a minimal/negligible impact significance, the following mitigation measures should be considered:

(x) Mitigation measures

- Topsoil removed during construction must be stored on site for rehabilitation and re-vegetation. The soil must be stabilised using materials such as netting or geotextiles where necessary.
- The site shall be re-instated to its original condition as far as possible. No foreign material generated / deposited during decommissioning shall remain on site.
- Rehabilitate disturbance areas as soon as decommissioning in an area is completed.
- All wells should be capped to prevent the spilling of contaminated groundwater.
- Monitoring for the project area for alien and invasive vegetation species must be undertaken, specifically for access roads through or along the watercourses. Should alien and invasive plan species be identified, they must be removed and disposed of as per an alien and invasive species control plan and the area must be revegetated with suitable indigenous vegetation.

(xi) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact may result in spatial and temporal cumulative change.

(xii) Irreplaceable loss of Resources

- The impact may result in irreplaceable loss of resources if not adequately mitigated but the value of the resources will be limited.

10.2.1.3.7 TERRESTRIAL BIODIVERSITY IMPACTS

The majority of the biodiversity within the study area has been fragmented and impacted on by existing land-uses including agriculture, farmsteads, roads powerlines and other infrastructure. Due to the spatial extent of the proposed Production Rights Extension, a variety of terrestrial biodiversity areas exist. These range from low sensitive (e.g. agricultural areas etc) to highly sensitive areas (e.g. pristine areas, wetlands and watercourses as

well as areas where red data species occur). Furthermore the study area contains CBA 1&2 and ESA 1&2 areas. The ecological integrity, importance, and functioning of these terrestrial biodiversity areas provide a variety of ecological services that are considered beneficial, with one key service being the maintenance of biodiversity. The preservation of these systems is the most important aspect to consider for the proposed project. Thus, if these areas are not maintained in a natural or near natural state, destroyed or fragmented further, then meeting targets for biodiversity features will not be achieved.

The following decommissioning and rehabilitation phase impacts have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).

(i) Mitigation measures

- Use existing access roads as much as possible. Rehabilitate disturbed areas as soon as possible.
- Compile and implement an alien plant control program with a particular focus on alien control in watercourses (including wetlands) during the rehabilitation phase of the project. Rehabilitate disturbed areas as soon as possible. Restrict new footprints to disturbed areas as far as possible. Regular monitoring should be undertaken in the watercourses to check any possible invasion by alien vegetation so that they can be weeded out before they grow and spread out.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.3.8 AQUATIC AND WETLAND IMPACTS

The impacts that have been identified on aquatic and wetland systems during the decommissioning and rehabilitation phase include altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; sedimentation of the water resource; direct and indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; altering hydromorphic properties; altered surface flow dynamics; erosion; alteration of sub-surface flow dynamics; indirect loss of wetland areas; water quality impairment; compaction; decrease in vegetation; change of drainage patterns; and altering hydromorphic properties.

Three levels of risk have been identified and determined for the impact assessment and these include low, medium and high risks. High risks are applicable despite the potential direct risks posed, this is motivated by the direct impacts posed by the project and the nature of the proposed project. Medium risk refers to wetland areas that are either directly affected or on the periphery of the infrastructure and at an indirect risk. Low risks are wetland systems beyond the application area that would be avoided, or wetland areas that could be avoided if feasible. The significance of all post-mitigation risks was determined to be low.

(i) Mitigation measures

- All vehicles and machinery must make use of existing access routes as much as possible.
- Spill kits must be available to ensure that any fuel or oil spills are clean-up and discarded correctly.

- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the application area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation).
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.
- All waste generated on-site during decommissioning must be adequately managed. Separation and recycling of different waste materials should be supported as a first priority and only thereafter disposed of at a suitably waste disposal facility.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.1.3.9 IMPACTS ON SOIL (PEDOLOGY)

The decommissioning/closure phase for the proposed activities will result in similar impacts to the construction phase, in that infrastructure will be removed and the application area disturbed once again. The rehabilitation phase is expected to reduce the overall negative impact significance for selected aspects such as the removal and rehabilitation of roads.

Based on the impact assessment, the results indicate "Insignificant" to "Very Low" post-mitigation significance ratings for the proposed components. It is therefore clear that the proposed activities are expected to have a minimal impact on land potential resources.

(i) Mitigation measures

- Only predefined access roads are to be used to reduce any unnecessary compaction.
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks.
- Invasive plant control must be undertaken quarterly.
- Rip compacted soil and return topsoil to ensure that good vegetation cover is achieved.
- Only indigenous species are to be used in rehabilitation and revegetation.

(ii) Cumulative Impacts

- The cumulative impacts have been scored "Medium", indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The irreplaceable loss of resources has been scored "Low", where the impacts are unlikely to result in an irreplaceable loss of resources.

10.2.1.3.10 VISUAL IMPACTS

In general terms the proposed project could industrialise this Landscape Character Area. Large scale mining operations are currently visible from within this landscape. The proposed project will see drilling operations occurring throughout the area during exploration and construction. At the time of this Report, 18 boreholes are planned for exploration, once the exploration activities have been undertaken and completed, there will be 18 wells. These are relatively small infrastructure elements. The large-scale agricultural nature of the landscape will remain very evident. A degree of industrialisation will therefore occur however, the existing landscape character will still dominate.

In terms of cumulative effects, the proposed project will not significantly change the character of views. It will however combine with large scale mining operations including stockpiles and plant during the construction and operational phases to intensify current impacts on landscape character.

After decommissioning, visual impacts will reduce due to the removal of operational plant etc. Since the affected landscape is relatively flat and open, no mitigation is feasible.

(i) Mitigation measures

- Rehabilitate disturbed area and reinstate agricultural usage.
- Remove all above ground infrastructure.
- Return land to pre-construction use.
- Minimise disturbance of the natural landscape.
- Ensure that temporary lighting is of sufficient power to ensure safety but not so powerful that it creates glare that could cause danger for drivers or nuisance for neighbours.
- Ensure that temporary lighting minimises light spill outside the area that it is intended to light.

(ii) Cumulative Impacts

- Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.

(iii) Irreplaceable loss of Resources

- The impact is unlikely to result in irreplaceable loss of resources.

10.2.2 ADDITIONAL PRODUCTION RIGHT EXTENSION IMPACTS

10.2.2.1 **CONSTRUCTION PHASE IMPACTS**

10.2.2.1.1 HYDROLOGICAL IMPACTS

During the construction phase, the drill pad for exploration drilling will be set-up, including clearing of the area and excavating sumps. The potential hydrological impacts that have been identified during the construction phase include the following:

- Exposure of soil, leading to increased runoff, and erosion, and thus increased sedimentation of the watercourses.
- Soil and stormwater contamination by oils and hydrocarbons spills, originating from construction vehicles
- Increase in the number of alien and/or invasive vegetation as a result of disturbances.
- Alterations of the riverbanks and riverbed due to movement near the drainage lines.

Although the above hydrological impacts are predicted to have a minimal/negligible impact significance, the following mitigation measures should be considered:

(i) Mitigation measures

- Sumps are to be lined with an impermeable liner to prevent seepage of drill fluids to the surrounding soil and leaching to the groundwater systems. Consideration to be given to the implementation of a pitless drilling system to contain and recycle drilling fluids in an above-ground container, thereby eliminating the need for traditional sumps. This approach significantly reduces the environmental impact of drilling operations by preventing the discharge of harmful substances into the surrounding environment.

10.2.2.1.2 TERRESTRIAL BIODIVERSITY

The following construction phase impacts (terrestrial biodiversity impact) have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).
- Potential leaks, discharges, pollutant from machinery and storage leaching into the surrounding environment.

(i) Mitigation measures

- Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be avoided where possible, otherwise minimised. All activities must be restricted within the very low-medium sensitivity areas. No further loss of high sensitivity areas and associated buffers should be permitted. It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon. Minimise vegetation clearing to the minimum required. Areas should be cleared and disturbed on a need only basis, as opposed to clearing and disturbing a number of sites simultaneously.
- All laydown, chemical toilets etc. should be restricted to Very Low SEI areas. Any materials may not be stored for extended periods of time and must be removed from the PAOI once the construction/closure phase has been concluded. No permanent structures should be permitted on site. No storage of vehicles or equipment will be allowed outside of the designated project areas.
- It should be made an offence for any staff to remove any indigenous plant species from any portion of the PAOI or to bring any alien species into the PAOI outside of rehabilitation and AIP management activities. This is to prevent the spread of exotic or invasive species and the illegal collection of plants.
- The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas
- Compile and implement a Solid Waste Management Plan. Waste management must be a priority and all waste must be collected, stored and disposed of adequately. It is recommended that all waste be removed from site on a weekly basis as a minimum
- Where possible, work should be restricted to one area at a time and be systematic. This is to reduce the number and extent of on-site activities, allowing fauna to move off as the Project progresses. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.
- Noise must be kept to an absolute minimum during the evenings and at night to minimise all possible disturbances to amphibian species and nocturnal mammals

- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate.
- Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons.
- Activities should take place during the day
- *Eupodotis caerulescens* (Korhaan, Blue) breed from September to February, the project must avoid this period.
- Any holes/deep excavations must be done in a progressive manner on a need only basis. No holes/excavations may be left open overnight. In the event holes/excavations are required to remain open overnight, these areas must be covered to prevent fauna falling into these areas and subsequently inspected prior to backfilling.
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. No non-environmentally friendly suppressants may be used as this could result in pollution of the environment, especially water sources.
- Inspect vehicles and machinery on a daily basis for fuel and oil leakages and repair such. All mine vehicles to have spill kits to absorb medium sized oil or fuel spills
- Leaking equipment and vehicles must be repaired immediately or be removed from the project site to facilitate repair

10.2.2.2 **OPERATIONAL PHASE IMPACTS**

10.2.2.2.1 GROUNDWATER

The potential impacts on groundwater resources associated with the operational phase activities include the following:

- Leachate of contaminants used in the drilling mud sump(s) to the intergranular, potable aquifer(s) during the operational phase.

The environmental significance rating of the potential impact is rated as medium negative without the implementation of mitigation measures and low negative with the implementation of mitigation measures.

The following mitigation measure should be considered to minimise the potential groundwater impacts during the operational phase:

(i) Mitigation measure

- Sumps are to be lined with an impermeable liner to prevent seepage of drill fluids to the surrounding soil and leaching to the groundwater systems. Consideration to be given to the implementation of a pitless drilling system to contain and recycle drilling fluids in an above-ground container, thereby eliminating the need for traditional sumps. This approach significantly reduces the environmental impact of drilling operations by preventing the discharge of harmful substances into the surrounding environment.

10.2.2.2.2 HYDROLOGICAL IMPACTS

The activities expected during the operational phase involve the operation of the drill pad, drilling vehicles and equipment, movement of trucks and other vehicles, general and hazardous waste management, gas processing as well as operation of road tankers for gas distribution. The potential environmental impacts and mitigation measures during the operational phase are listed below.

- Disturbance to soil and ongoing erosion as a result of periodic maintenance activities.
- Altered water quality as a result of increased availability of pollutants.

Although the above hydrological impacts are predicted to have a minimal/negligible impact significance, the following mitigation measures should be considered:

(ii) Mitigation measures

- Sumps are to be lined with an impermeable liner to prevent seepage of drill fluids to the surrounding soil and leaching to the groundwater systems. Consideration to be given to the implementation of a pitless drilling system to contain and recycle drilling fluids in an above-ground container, thereby eliminating the need for traditional sumps. This approach significantly reduces the environmental impact of drilling operations by preventing the discharge of harmful substances into the surrounding environment.

10.2.2.2.3 TERRESTRIAL BIODIVERSITY

The following operational phase impacts (terrestrial biodiversity impact) have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).
- Potential leaks, discharges, pollutant from machinery and storage leaching into the surrounding environment.

(i) Mitigation measures

- Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be avoided where possible, otherwise minimised. All activities must be restricted within the very low-medium sensitivity areas. No further loss of high sensitivity areas and associated buffers should be permitted. It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon. Minimise vegetation clearing to the minimum required. Areas should be cleared and disturbed on a needs only basis, as opposed to clearing and disturbing a number of sites simultaneously.
- All laydown, chemical toilets etc. should be restricted to Very Low SEI areas. Any materials may not be stored for extended periods of time and must be removed from the PAOI once the construction/closure phase has been concluded. No permanent structures should be permitted on site. No storage of vehicles or equipment will be allowed outside of the designated project areas.
- It should be made an offence for any staff to remove any indigenous plant species from any portion of the PAOI or to bring any alien species into the PAOI outside of rehabilitation and AIP management activities. This is to prevent the spread of exotic or invasive species and the illegal collection of plants.
- The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas
- Compile and implement a Solid Waste Management Plan. Waste management must be a priority and all waste must be collected, stored and disposed of adequately. It is recommended that all waste be removed from site on a weekly basis as a minimum
- Where possible, work should be restricted to one area at a time and be systematic. This is to reduce the number and extent of on-site activities, allowing fauna to move off as the Project progresses. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories.

- Noise must be kept to an absolute minimum during the evenings and at night to minimise all possible disturbances to amphibian species and nocturnal mammals
- Prior to commencing work each day, two individuals should traverse the working area in order to disturb any fauna and so they have a chance to vacate.
- Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons.
- Activities should take place during the day
- *Eupodotis caerulescens* (Korhaan, Blue) breed from September to February, the project must avoid this period.
- Any holes/deep excavations must be done in a progressive manner on a needs only basis. No holes/excavations may be left open overnight. In the event holes/excavations are required to remain open overnight, these areas must be covered to prevent fauna falling into these areas and subsequently inspected prior to backfilling.
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to, for all roads and dumps especially. No non-environmentally friendly suppressants may be used as this could result in pollution of the environment, especially water sources.
- Inspect vehicles and machinery on a daily basis for fuel and oil leakages and repair such. All mine vehicles to have spill kits to absorb medium sized oil or fuel spills
- Leaking equipment and vehicles must be repaired immediately or be removed from the project site to facilitate repair

10.2.2.3 DECOMMISSIONING REHABILITATION AND CLOSURE PHASE IMPACTS

The following decommissioning and rehabilitation phase impacts (terrestrial biodiversity impact) have been identified and assessed in this report:

- Destruction, further loss and fragmentation of the vegetation community.
- Introduction of alien species, especially plants.
- Erosion due to storm water runoff and wind.
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).

(i) Mitigation measures

- All vehicles should adhere to a speed limit of maximum 40 km/h to avoid collisions.
- Any excavations should not be left open. Limiting the closure and rehabilitation activities to the footprint areas only. Avoid entry/access to previously undisturbed or already rehabilitated areas.

10.2.3 NO-GO ALTERNATIVE

The no-go alternative option means ‘do nothing’ or the option of not undertaking the proposed Production Right Extension project or any of its activities, consequently leading to the continuation of the current land-use. As such, the ‘do nothing’ alternative or keeping the current status quo of the various current land-uses also provides the baseline against which the impacts of all other alternatives were compared.

Should the proposed project not go ahead, there would be certain impacts identified above which would change from negative to positive (mostly biophysical and cultural impacts) and conversely certain impacts would change from positive to negative (mostly social and economic impacts).

10.3 SUMMARY OF IMPACT ASSESSMENT

Table 38: Impacts Identified and Assessed during the BA.

#	Impact	Phase
1	Air Quality - Increase in air quality impacts due to construction of the road	Construction
2	Air Quality - Increase in air quality impacts due to construction of the wells	Construction
3	Noise - Increase in noise levels due to construction of the wells	Construction
4	Groundwater deterioration and siltation due to contaminated stormwater run-off from the construction area.	Construction
5	Poor quality leachate may emanate from the construction camp which may have a negative impact on groundwater quality.	Construction
6	Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.	Construction
7	Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.	Construction
8	Hydrology - Loss of watercourse vegetation	Construction
9	Erosion	Construction
10	Stormwater contamination	Construction
11	Alien and/or Invasive Vegetation	Construction
12	Alterations of the riverbanks and river bed	Construction
13	Impact on unidentified heritage resources	Construction
14	Impact on burial grounds and graves	Construction
15	Impact on historic to recent sites with possible graves	Construction
16	Impact on structures of medium heritage significance	Construction
17	Impact on palaeontology	Construction
18	Impact on livelihoods	Construction
19	Nuisance factor due to increase in ambient dust and noise levels	Construction
20	Changes in travel patterns	Construction
21	Damage to farm roads, existing services, and infrastructure	Construction
22	Impacts on livelihoods due to behaviour of contractors	Construction
23	Impacts on safety and security of local residents	Construction

#	Impact	Phase
24	Impacts on sense and spirit of place	Construction
25	Impacts on the social licence to operate	Construction
26	Increase in social pathologies	Construction
27	Secondary economic opportunities	Construction
28	Impact on Existing Agricultural Landscape Character	Construction
29	Impact on Existing Natural Landscape Character	Construction
30	The visual impact on views from local roads	Construction
31	Change of Natural of Views from Homesteads	Construction
32	The visual impact on views from local homesteads due to Lighting	Construction
33	Destruction, further loss and fragmentation of the vegetation community	Construction
34	Introduction of alien species, especially plants	Construction
35	Erosion due to storm water runoff and wind	Construction
36	Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).	Construction
37	Potential leaks, discharges, pollutant from activities leaching into the surrounding environment	Construction
	Access Roads - Habitat	Construction
	Access Roads - Water Quality	Construction
	Access Roads - Flow	Construction
	Impact on individual farmland values	Construction
	Air Quality - Increase in air quality impacts due to decommissioning and closure	Decommissioning
	Noise - Increase in noise levels	Decommissioning
	Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the borehole closure and decommissioning phase.	Decommissioning
	Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) borehole closure and decommissioning phase.	Decommissioning
58	Poor quality leachate may emanate from the plant footprint area which may have a negative impact on groundwater quality.	Decommissioning

#	Impact	Phase
59	De-mobilisation of heavy vehicle and machinery as part of the decommissioning phase on-site may cause hydrocarbon contamination of groundwater resources.	Decommissioning
60	Erosion	Decommissioning
61	Stormwater contamination	Decommissioning
62	Alien and/or Invasive Vegetation	Decommissioning
63	Impact on Existing Agricultural Landscape Character	Decommissioning
64	Impact on Existing Natural Landscape Character	Decommissioning
65	The visual impact on views from local roads	Decommissioning
66	Change of Natural of Views from Homesteads	Decommissioning
67	The visual impact on views from local homesteads due to Lighting	Decommissioning
68	Continued encroachment of vegetation community by alien invasive plant species as well as erosion due to disturbed soils	Decommissioning
69	Continued displacement and fragmentation of the faunal community (including potential threatened or protected species) due to ongoing habitat degradation/loss (infringement, litter, road mortalities and/or poaching).	Decommissioning
70	Decommissioning of Wells	Decommissioning
71	Access Roads - Habitat	Decommissioning
72	Access Roads - Water Quality	Decommissioning
73	Access Roads - Flow	Decommissioning
74	GGP Impact	Decommissioning
75	Employment Impacts	Decommissioning
76	Forex savings	Decommissioning
77	Fiscal Income	Decommissioning
78	Economic development per capita	Decommissioning
79	Country and Industry Competitiveness	Decommissioning
80	Black Economic Transformation	Decommissioning
81	Alternative Land-use	Decommissioning

#	Impact	Phase
82	Need and Desirability	Decommissioning
83	Impact on individual farmland values	Decommissioning
84	Air Quality - Increase in air quality impacts due to the operation of vehicles on unpaved roads	Operation
85	Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase.	Operation
86	Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase.	Operation
88	Poor quality leachate may emanate from the plant footprint area which may have a negative impact on groundwater quality.	Operation
89	Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.	Operation
90	Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.	Operation
92	Erosion	Operation
93	Stormwater contamination	Operation
94	Alien and/or Invasive Vegetation	Operation
95	Impact on livelihoods	Operation
97	Damage to farm roads, existing services, and infrastructure	Operation
98	Impacts on safety and security of local residents	Operation
105	Impact on Existing Agricultural Landscape Character	Operation
106	Impact on Existing Natural Landscape Character	Operation
109	The visual impact on views from local homesteads due to Lighting	Operation
110	Environmental pollution due to potential leaks, discharges, pollutant leaching into the surrounding environment	Operation
111	Introduction of alien species, especially plants	Operation
112	Continued fragmentation, further loss and fragmentation of the vegetation community	Operation

#	Impact	Phase
113	Vegetation loss due to erosion and encroachment by alien invasive plant species	Operation
114	Potential leaks, discharges, pollutant from activities leaching into the surrounding environment	Operation
115	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Operation
117	Access Roads - Habitat	Operation
118	Access Roads - Water Quality	Operation
119	Access Roads - Flow	Operation
131	Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.	Planning
132	Exploration Wells - Habitat	Planning
133	Exploration Wells - Water Quality	Planning
134	Exploration Wells - Flow	Planning

10.4 DESCRIPTION AND ASSESSMENT OF IMPACTS

The following potential impacts were identified during the BA based on the methodology described in Section 10.1. The impact assessment matrix is included in Appendix 6 and the below subsections describe each impact in more detail.

11 CLOSURE AND REHABILITATION

Tetra4 is the current holder of the Production Right and Environmental Authorization (EA) for the operations within this designated production area. As a condition of obtaining the EA, Tetra4 was required to develop a Final Decommissioning, Rehabilitation and Closure Plan (FRDCP) in accordance with the regulations outlined in GN R 1147. The regulations also requires that every holder must annually-

a. Assess his or her environmental liability in a prescribed manner and must increase his or her financial provision to the satisfaction of the Minister responsible for mineral resources; and

b. Submit an audit report to the Minister responsible for mineral resources on the adequacy of the financial provision from an independent auditor.

Tetra4 is currently applying for an extension of the production area and upon issuance of a new EA for the expanded area, Tetra4 will undertake an update of the existing FRDCP during the subsequent financial year. This update will include the consolidated Exploration Rights Areas, ER32 and ER94, and the planned exploration drilling activities for the following financial year. This revision process will ensure the FRDCP remains comprehensive and reflects the expanded operational footprint, including both the additional land and planned exploration activities.

11.1 REGULATORY FRAMEWORK

On 20th November 2015, the Minister promulgated the Financial Provisioning Regulations under the NEMA (GN R1147). The regulations (as amended) aim to regulate the determining and making of financial provision as

contemplated in the NEMA for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts from prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. These regulations provide for, inter alia:

- Determination of financial provision: An applicant or holder of a right or permit must determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of prospecting, exploration, mining or production operations, as contemplated in the Act and to the satisfaction of the Minister responsible for mineral resources.

- Scope of the financial provision: Rehabilitation and remediation; decommissioning and closure activities at the end of operations; and remediation and management of latent or residual impacts.

- Regulation 6: Method for determining financial provision – An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:

    - Annual rehabilitation – annual rehabilitation plan;

    - Final rehabilitation, decommission and closure at end of life of operations – rehabilitation, decommissioning, and closure plan; and

    - Remediation of latent defects and residual impacts – environmental risk assessment report.

- Regulation 10: An applicant must-

    - Ensure that a determination is made of the financial provision and the plans contemplated in regulation 6 are submitted as part of the information submitted for consideration by the Minister responsible for mineral resources of an application for environmental authorisation, the associated environmental management programme and the associated right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002; and

    - Provide proof of payment or arrangements to provide the financial provision prior to commencing with any prospecting, exploration, mining, or production operations.

- Regulation 11: Requires annual review, assessment, and adjustment of the financial provision. The review of the adequacy of the financial provision including the proof of payment must be independently audited (annually) and included in the audit of the EMPr as required by the EIA regulations.

According to the regulations, financial provision must be made for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of prospecting, exploration, mining or production operations; and remediation and management of latent or residual environmental impacts which may become known in the future. A Report for Tetra4's Production Right has been prepared for the existing Production Rights area to align with these requirements and is attached as Appendix 7 and includes the following sections which aims to comply with the requirements of the Financial Provision Regulations (2015):

- Section A: Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) aligned with the requirements outlined in Appendix 4 of GN R 1147 including the closure cost estimate calculated by a third party;

- Section B Annual Rehabilitation Plan (ARP) aligned with the requirements outlined in Appendix 3 of GN R 1147; and

- Section C: An Environmental Risk Assessment Report aligned with the requirements outlined in Appendix 5 of GN R 1147.

11.2 CLOSURE AND REHABILITATION OBJECTIVES

Appendix 7 includes the current FRDCP for the Production Right, which aligns with the requirements of the NEMA Financial provision Regulations. This FRDCP will need to be extended to include the areas under this application if, and when an EA is issued. The closure principles, vision, objectives and actions contained within the existing FRDCP will be extended onto the areas and activities in this application. Please refer to Appendix 7 for further detail.

The vision, and consequent objectives and targets for rehabilitation, decommissioning, and closure, aim to reflect the local environmental and socio-economic context of the project, and to represent both the corporate requirements and the stakeholder expectations as well as the legislative framework and regulations. The receiving environment within which the current exploration and production activities are being undertaken, as well as the areas of concern (ER32 and ER94) include the following key land-uses:

- Agriculture- cultivated fields;
- Natural and degraded veld primarily utilised or livestock grazing;
- Mining areas; and
- Low density rural residential.

The following concerns were also raised and addressed in the FRCDP:

- Impacts on ground water quality and availability;
- Impacts on surface water quality;
- The proposed pipeline alignment;
- Disruption of current land use and capability;
- Sense of place;
- The quantum for rehabilitation; and
- Security and access to individual farms.

There are certain key rehabilitation, decommissioning, and closure objectives laid out in the FRDCP. Well-defined rehabilitation objectives are essential for assessing associated risks and guiding the development of appropriate mitigation measures throughout the mine's lifecycle. These objectives should clearly articulate the desired outcomes of the rehabilitation process and be aligned with the specific characteristics of the site. To be effective, rehabilitation objectives must be specific, measurable, achievable, realistic, and time-bound. With due consideration of the project context, the following closure objectives and associated targets are presented in Table 39.

Table 39: Closure objectives and associated targets.

Objective	Target
Set the course for eventual ecosystem rehabilitation, including the improvement of the natural vegetation community, hydrology, and wildlife habitats for impacted areas only.	Alignment of soil condition with that required to meet the defined land capability commitments. Sustainable natural areas. Agreed upon viable land-use.
Prevent future environmental issues related to long term fluid or gas leakage or vertical movement through the well.	No migration of gas or water along the rehabilitated well bore.

Objective	Target
Protection of water resources.	Consistent with baseline condition (specifically production indicator parameters).
Ensure that land is usable, in alignment with surrounding land uses.	Agreed upon viable land-use.

In order to align with the defined closure plan and final land use objectives, the Holder will need to implement a series of actions which addresses the mines infrastructure, facilities, and rights area, as well as ongoing maintenance and management thereof. These actions and obligations apply to all infrastructure, activities, and aspects both within the production right area and off the production right area which were associated with the production activities and over which the Holder has responsibility.

The anticipated closure actions can be summarised as follows:

- Phase 1: Preparation for closure.
- Phase 2: Making safe.
- Phase 3: Rehabilitation.
- Phase 4: Monitoring and maintenance.

The detailed closure actions are presented in Appendix 7.

11.3 ESTIMATION OF FINANCIAL PROVISIONS

As noted above, Tetra4 is required to assess and adjust their FRDCP and associated financial provisions for closure, decommissioning and rehabilitation. This includes estimations for annual actions/ activities as well as the final closure costs.

It is not anticipated that the exploration / production activities in the extended areas (ER32 and ER94), which are the subject of this application, will commence within the forthcoming 12 months, or within 12 months from issuance of the EA. The annual updates to the FRDCP will therefore need to consider when the drilling in the extended areas will commence and ensure that financial provision is made available in the prior year's update.

Table 40 provides a breakdown of the current estimated cost to decommission, rehabilitate and close a typical exploration or production well. These figures are representative of 2024 contractors rates and align with the closure objectives and actions specified in the current FRDCP including: general surface rehabilitation of well site and access routes; downhole surveys; bond log testing where required; unblocking collapsed wells (if necessary); well sealing/ plugging; and surface infrastructure removal. It is noted that the cost per well represented below assumes a worst-case scenario and includes activities and costs which would not be required in most well closure scenarios, including:

- Bond log testing;
- Removal of blockages from a collapsed well;
- Removal of surface infrastructure;
- Well tagging; and
- Active hydroseeding.

Table 40: Estimated cost to decommission, rehabilitate and close a production well.

Rehabilitation / Closure Action[9]	Units	Quantity	Rate	Activity Cost
Down Hole survey	/well	1.00	R 18 150.00	R 18 150.00
Setup of Site	/well	1.00	R 10 450.00	R 10 450.00
Setup of Drill Machine	/well	1.00	R 6 700.00	R 6 700.00
Conduct Calliper logging to identify and investigate potential blockages/cavities within well. Step 1 - Tagging of well. Lower tools down hole to ensure equipment can reach bottom of well.	Per Hour	10.00	R 3 080.25	R 30 802.50
Conduct Calliper logging to identify and investigate potential blockages/cavities within well. Step 2 - Lower camera down hole if blockage is detected to determine the blockage and next steps.	Per hour	5.00	R 1 540.13	R 7 700.63
Un-block of collapsed boreholes	/well	1.00	R 166 500.00	R 166 500.00
Dismantle of wellhead, Booster compressor and coalescer filter	/m²	21.65	R 823.09	R -
Concrete Base (Medium concrete)	/m³	6.50	R 982.86	R 6 383.67
Excavation of material and demolition hammer and casing	/m³	0.13	R 14 779.42	R 1 921.32
Plug of well	/well	1.00	R 283 059.98	R 283 059.98
Surface Capping of Well	/m³	0.30	R 9 077.21	R 2 723.16
Dismantle of wellhead, booster compressor and coalescer filter	Per hour	10.00	R 3 080.25	R 30 802.50
Flushing and Cleaning of well	Per hour	5.00	R 3 080.25	R 15 401.25

[9] The Rehabilitation and Closure cost assumes a depth of 850 m per well.

Rehabilitation / Closure Action[9]	Units	Quantity	Rate	Activity Cost
Supply and install cement plug within well via squeezing technique. Develop cement formulation for cementing the entire well annulus. Develop cement formulation to top-up "no bond" or "poor bond" cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations.	Per cube	26.10	R 5 203.13	R 135 801.69
Operational Time - Prepping grouting equipment	Per Hour	5.00	R 3 080.25	R 15 401.25
Operational Time - Grouting of well	Per Hour	3.00	R 3 080.25	R 9 240.75
Operational Time - Cleaning of grouting equipment	Per Hour	7.00	R 3 080.25	R 21 561.75
Top up grouting - if required	Per cube	1.00	R 5 203.13	R 5 203.13
Surface Capping of well	Per hour	5.00	R 3 080.25	R 15 401.25
Cementation integrity testing.	Per hour	4.00	R 3 080.25	R 12 321.00
Removal of any surface infrastructure	Per Hour	5.00	R 3 080.25	R 15 401.25
Excavation of material and demolition hammer and casing	Per hour	5.00	R 3 080.25	R 15 401.25
Supply and install surface tags on each well for monitoring purposes	/well	1.00	R 693.75	R 693.75
Dismantle fencing	/m	40.00	R 54.08	R -
Dismantle electric fencing	/m	30.40	R 62.24	R 1 892.12
Remove fire break (rock finish), Load and haul within the free haul distance	/m^3	0.48	R 18.11	R 8.69
Rip footprint area	/ha	0.01	R 6 633.50	R 66.34
Levelling and shaping of area	/m^3	13.46	R 24.77	R 333.31
Hydroseeding	/ha	0.01	R 42 152.18	R 421.52

Rehabilitation / Closure Action[9]	Units	Quantity	Rate	Activity Cost
TOTAL COST PER WELL (Excl VAT, Contingencies and P&Gs)				R 829 749.08

12 CONCLUSIONS AND RECOMMENDATIONS

The BA process identified potential issues and impacts associated with the proposed project. The BA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with applicable phases of the project and recommends appropriate mitigation measures for potentially significant environmental impacts. The BA report provides sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project. The release of this draft BA Report provides stakeholders with an opportunity to raise any issues concerning the project and the information within this BAR.

The BA report aims to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

12.1 CONCLUSIONS FROM SPECIALIST STUDIES

The conclusions and recommendations of this BA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive, and every effort has been made to include representatives of all stakeholders in the study area. The main conclusions from each of the specialist studies are presented below.

12.1.1 TERRESTRIAL BIODIVERSITY STUDY CONCLUSION

The completion of a comprehensive desktop study, in conjunction with the results from the field survey, suggest there is a medium-high confidence in the information provided. The survey ensured that there was suitable ground-truth coverage of the open-spaces and natural habitats, and ecosystems were assessed to obtain a general species (fauna and flora) overview and the major current impacts were observed.

Most of the ER32 PAOI is composed of Modified habitat, and what little grassland remains is severely degraded and no longer representative of its representative vegetation type or a CBA. Most of the ER94 PAOI is made up of Grassland habitat which has experienced some disturbance, mainly attributed to the grazing of cattle. No flora or fauna SCC were confirmed for the PAOI during the assessment, although some avifauna SCC are expected as they were recorded in the area. Flora species identifications were limited by seasonal constraints, therefore, a site walkdown, and search and rescue must be conducted for any and all protected and red listed species during the correct flowering season for this vegetation type (between October and March), along with permit applications, prior to commencement of any development activities. This walkdown must also incorporate a fauna component, with specific focus on Sensitive Species 15 in case it should occur.

The PAOI was identified with the screening tool as possessing a ‘Very High’ sensitivity within a Terrestrial Biodiversity context, with the PAOI made up of CBA 1, ESA and NPAES areas. However, the outcome of the SEI assessment suggests that the Grassland habitat should be assigned a ‘Medium’ sensitivity and the Rocky Grassland habitat a ‘High’ sensitivity. The following aspects support this classification:

- Disturbed portions of Central Free State Grassland vegetation type which still contribute to valuable ecosystem functions and services;
- Serve and represent ESA areas, as identified by the conservation plan;

- Serve as NPAES;
- CBA area which overlaps with the PAOI no longer functions as a CBA as it has been severely degraded and has lost all functionality;
- Connectivity to natural areas within the landscape; and
- Protected flora species present, with the possibility of avifauna SCC occurring.

The Water Resource habitat was assigned a 'Medium' sensitivity within the ER32 PAOI and a 'High' sensitivity within the ER94 PAOI. These must receive a buffer as stipulated in the accompanying freshwater assessment (TBC, 2024) and should be avoided by all project activities.

The ecological integrity, importance and functioning of these habitats play a crucial role and an important habitat for various fauna and flora. The preservation of these systems is the most important aspect to consider for the proposed project. These habitats need to be protected and improved due to the role they play in a fragmented landscape.

Development within confirmed 'High' sensitivity areas is not considered favourably by the regulating authorities, and implementation of the mitigation hierarchy must be demonstrated. Development in 'Medium' sensitivity areas must demonstrate minimisation and restoration mitigation as much as possible.

12.1.2 AQUATIC STUDY CONCLUSIONS

The development area was traversed on foot, with serval checks being undertaken to identify any soil wetness indicators, and to determine the local soil forms.

Multiple natural wetlands are located within the proposed development footprint. These wetlands were group into fifteen HGM units comprising of Unchannelled Valley Bottoms (HGM 1, 2, and 3), Depression wetlands (HGM 4, 5, 7, 8, 10, 14 and 15), and Seep wetlands (HGM 6, 9, 11, 12, and 13).

Along with the natural wetlands some artificial wetlands (off-channel dams) and drainage features were also identified and delineated. According to Ollis et al. (2013) a dam is classified as: "artificial body of water created specifically for the storage of water, and which is not located along the course of a river". Due to the artificial characteristics of this system, no further assessment has been undertaken for the dam.

The wetland buffer zone tool was used to calculate the appropriate buffer required for the proposed Tetra4 Production Expansion project. A post-mitigation buffer of 10 m and 20 m is recommended for the drainage features and natural wetlands, respectively.

It is evident that the proposed development will take place outside all the buffers, and with the low impact of the proposed activity there are no risk foreseen.

12.1.3 SOIL AND AGRICULTURE STUDY CONCLUSIONS

The representative soil forms including Ermelo, Pinedene, Tukulu, Swartland, Glen, Arcadia, Glenrosa, Mispah and Witbank, found in the proposed project area are characterised by land potential levels of "L5", "L6", "L7" and "L8" and ultimately a "Low" sensitivity. Furthermore, active crop fields under rainfed condition were identified within the proposed project area. Therefore, it can be concluded that the proposed project area has an overall "Medium" sensitivity on the proposed drilling collar sites.

The land capability sensitivity (DAFF, 2017) is dominated by land capabilities with "Very Low to Low", with other areas associated with "Low-Moderate to Moderate" and "Moderate to High" sensitivities. The verified baseline findings, current land-uses and the calculated land potential level disputed the agricultural theme in areas associated with "Moderate to High" sensitivity due to the insignificant impact of the proposed drilling collars on soil and agricultural potential of the project area.

It is the specialist's opinion that the proposed Tetra4 drilling production extension project will have an overall low to medium residual impact on the agricultural production ability of the land. That being the case, the proposed project and associate infrastructure may be favourably considered for development.

Where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr must be provided. The following measures are provided:

- Vegetation clearance must be restricted to areas authorised for development;
- Land clearing and preparation may only be undertaken immediately prior to construction activities and within authorised areas;
- A stormwater management plan must be developed and implemented for the project; and
- If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.

After assessing the updated infrastructure layout (Tetra4 Production Extension-Gas Exploration Phase), it can be concluded that all agricultural sensitive areas will not be impacted as the phase will only be for a short period. Therefore, the updated layout can be considered acceptable for the natural gas exploration phase.

12.2 PREFERRED ALTERNATIVES

12.2.1 ACTIVITY ALTERNATIVES

The study areas primarily consist of existing mining, agriculture, and an operational gas production facility. While gas exploration is often perceived as incompatible with other land-uses, the assessment found that concurrent gas exploration and agriculture is feasible. The minimal footprint of exploration activities, particularly during fallow periods, allows for continued agricultural practices.

Although conservation and gas exploration are typically incompatible, there are no protected areas within the study areas, except for a buffer zone near the ER94 boundary. Given the limited overlap with conservation areas and the compatibility of gas exploration with agriculture and mining, no alternative land-use scenarios were identified.

12.2.2 LOCATION ALTERNATIVES

The proposed exploration and development project is restricted to the ER32 and ER94 study areas within the Lejweleputswa District, Free State Province. This location is dictated by the presence of the target resource and the existence of an approved Production Right held by Tetra4. While the macro-location is fixed, micro-location alternatives for project infrastructure will be considered based on stakeholder feedback and specialist assessments.

12.2.3 LAYOUT ALTERNATIVES

The proposed development will undergo a rigorous design and layout process to optimize its environmental performance. The project's location is primarily determined by the presence of gas-bearing geological formations. A detailed site assessment will be conducted to identify suitable locations for surface infrastructure, access roads, and other structures, minimizing impacts on sensitive environmental areas and existing land-uses. This approach aims to maximize positive outcomes and mitigate potential negative effects.

12.2.4 PROCESS ALTERNATIVE

An alternative to traditional sump-based drilling fluid management is the implementation of pitless drilling systems. Conventional drilling operations involve the circulation of drilling fluids through the wellbore, with subsequent deposition of fluids and cuttings in a reserve pit. In contrast, pitless drilling utilizes closed-loop systems comprising storage tanks, solid-liquid separation equipment (such as screen shakers, hydrocyclones, and centrifuges), and waste collection mechanisms. This approach significantly reduces the volume of drilling waste requiring disposal and maximizes fluid recycling. Generated waste is transported to licensed facilities for appropriate management.

Pitless drilling systems offer several advantages over traditional methods. Primarily, they eliminate the environmental and safety hazards associated with reserve pits. Additionally, they reduce operational costs, minimize land disturbance, and mitigate risks to wildlife and infrastructure. By significantly decreasing water

consumption, waste generation, and transportation requirements, pitless drilling systems can enhance community relations and potentially create opportunities for beneficial reuse of drilling byproducts.

12.2.5 NO-GO ALTERNATIVE

The no-go alternative has been considered as a baseline against all project impacts. This alternative is not considered reasonable as no fatal flaws in the overall project plan have been identified. Where necessary, certain restrictions on sensitive areas have been put forward as well as identification of no-go areas however the overall project plan remains feasible.

12.3 ENVIRONMENTAL IMPACT STATEMENT

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. However, for the Terrestrial studies it was noted that development proposals situated within designated 'High' sensitivity areas are generally regarded unfavourably by regulatory bodies and require explicit demonstration of the mitigation hierarchy. For projects located in 'Medium' sensitivity zones, Tetra4 must prioritize impact minimization and restoration measures to the greatest extent practicable. Based on the nature and extent of the proposed project, the limited level of disturbance predicted as a result of the exploration activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the BA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized on condition that the below recommended conditions are included in the decision and that compliance with the EMPr must be strictly adhered to.

12.4 RECOMMENDATIONS FOR INCLUSION IN INTEGRATED DECISION

In addition to the standard conditions of an integrated Environmental Authorisation, specific conditions must be included in the EA to specifically add focus on the pertinent issues raised during this BA application process. This section will be expanded upon to include additional conditions as requested by landowners during the BA comment period.

13 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations relating to this BA phase assessment should be noted:

13.1 GENERAL

- This study is based on the engineering designs and Reports provided by the applicant, and it is assumed that no significant changes or deviations to the final designs will occur.
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

13.2 TERRESTRIAL BIODIVERSITY

The following assumptions and limitations are applicable for this assessment:

- It is assumed that all information received from the client/developer is accurate;
- The specialist was not provided with an architectural plan or any engineering drawings with regard to the planned development activities and, as such, the potential impacts arising from these activities may only be assumed based on previous experience;
- All datasets accessed and utilised for this assessment are considered to be representative of the most recent and suitable data for the intended purposes;

- The assessment area (PAOI) was based on the footprint areas as provided by the client, and any alterations to the area and/or missing GIS information pertaining to the assessment area would have affected the area surveyed and hence the results of this assessment;
- This assessment does not consider temporal trends (note that the data collected is, however, considered sufficient to derive a meaningful baseline);
- The site visit was conducted during the late dry season, which means that certain flora and fauna would not have been present or observable due to seasonal effects, however, the assessment is still deemed sufficient, provided a walkdown is conducted prior to development activities;
- Whilst every effort was made to cover as much of the PAOI as possible, it is possible that some plant and animal species that are present within the PAOI were not recorded during the field investigations. However, it is the opinion of the specialist that an accurate representative sample of the ecological components considered within this assessment was collected; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by up to 5 m.

13.3 AQUATIC BIODIVERSITY

The following limitations should be noted for the assessment:

- The assessment area was based on the spatial file provided by the client and any alterations to the development area may affect the results;
- Only a 100 m buffer around the proposed drilling site was groundtruthed with the remaining areas of the 500 m regulated area on high level desktop; and
- The seasonality of the site survey is not considered to be a limiting factor for this project.

13.4 SOIL AND AGRICULTURE

The following aspects were considered as limitations;

- Only the slopes affected by the proposed development have been assessed;
- It has been assumed that the extent of the development area provided by the responsible party is accurate;
- The GPS used for ground truthing is accurate to within five meters. Therefore, the soil and the observation site's delineation plotted digitally may be offset by up to five meters to either side; and
- No heavy metals have been assessed nor fertility been analysed for the relevant classified soils.

13.5 HERITAGE AND PALAEONTOLOGY

While the fieldwork conducted for this project was comprehensive, it is important to acknowledge that the identified heritage resources may not represent the full extent of such resources within the study area. Factors such as the subterranean nature of certain archaeological sites and existing vegetation cover may have limited the discovery of additional heritage features. Nonetheless, the majority of the study area was accessible for survey purposes, with a particular focus on undisturbed land that exhibited the highest potential for heritage resource occurrence.

Should any heritage features or objects be encountered outside of the designated heritage sensitive areas during project activities, a heritage specialist must be contacted immediately. Such discoveries must not be disturbed or removed until assessed by a qualified expert. This protocol also applies to the discovery of graves or burial sites. In the event of such a discovery, the relevant procedures and requirements governing the handling of human remains will be strictly adhered to.

The primary focus of geological maps is the geological composition of an area, with palaeontological heritage typically being a secondary consideration. Many regions of South Africa remain unexplored by palaeontologists, and existing data largely relies on aerial imagery. Geological and locality information housed in museums and university databases is often outdated and inadequately documented.

To date, the identification of potential fossil occurrences has been reliant on comparisons with similar assemblage zones in other locations. While this approach provides valuable insights, it is inherently limited as it assumes the presence of exposed fossils within comparable geological formations. Consequently, a comprehensive field assessment is essential to refine the accuracy of preliminary desktop evaluations.

14 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I **Sikhumbuzo Mahlangu** herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected Parties has been correctly recorded in the report.

Signature of the EAP

_____

Date: 2024-08-26

15 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I **Sikhumbuzo Mahlangu** herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with Interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

Signature of the EAP

_____

Date: 2024-08-26

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17 APPENDICES

Appendix 1: EAPs Curriculum Vitae.

Appendix 2: Public Participation Report

Appendix 3: Specialist Studies.

Appendix 4: DFFE Screening Reports for ER32 and ER94.

Appendix 5: Maps.

Appendix 6: Impact Assessment Matrix.

Appendix 7: 2024 Financial Rehabilitation, Decommissioning and Closure Provisions Report.

Appendix 8: Environmental Management Programme

Appendix 9: EA Application Form