SPECIALIST REPORT – Terrestrial Biodiversity Update: Phase 2F Pipeline

Commissioned by

Zutari

Compiled by

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25 Years

1995 - 2020

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1 EXECUTIVE SUMMARY

Zutari appointed EkoInfo CC and its associate Pachnoda Consulting to update the terrestrial biodiversity component of the Phase 2F pipeline phase of the OMM BRWSP project within Limpopo Province, South Africa. Willem de Frey of EkoInfo CC and Lukas Niemand of Pachnoda Consulting assisted with the previous baseline information on this phase in 2016 for Aurecon.

Scope of work was based on email correspondence received which stated that:

1. The existing information should be updated to accommodate the deviations
2. Comply with the requirements for site verification as required by the National Environmental Screening tool
3. Consider the IFC SP 6 requirements with specific reference to the 2B and 2B + alignments.

A verification site visit was conducted during 04 - 08 November 2024 with the objective to evaluate the results of the screening tool sensitivity rating and to assess the condition of the vegetation cover at selected sampling plots. During the site visit, most of the dominant broad-scale habitat units were investigated by slowly traversing the study site on foot and by vehicle. At several instances digital photographs of the floristic structure, topography and general land use and land cover of the habitat units were recorded. A follow up survey was conducted from 12 – 16 May 2025, after good rainfall received from February to April in the area. Due to the good rains, most of the plants were in flower, and the condition of the veld had significantly improved from October/ November 2024 to April/ May 2025, as is visible in the NDVI derived from remote imagery.

According to the land change modeller analysis between 2014 and 2020, most of the natural areas had been lost to cultivation and transformation (human settlements). In total 53 ha (30%) of natural vegetation persisted within the proposed servitude areas of the pipeline since 2014. Of the proposed servitude 46 ha (26%) experienced change most probably from natural vegetation to transformation (human settlement) or cultivation.

It was evident that the remaining natural vegetation (biodiversity habitat) in the landscape across four quaternary catchments, were not experiencing significant pressure, resulting in limited habitat fragmentation on a regional scale. Approximately, 29% of the landscape associated with study area represented transformed areas. In total 69% (132 706 ha) represented persistent primary/ climax vegetation, mainly associated with the high lying and steep areas in the landscape in which the pipeline is planned.

It was evident from this latest land cover classification from National Department of Environmental Affairs[1] that the proposed pipeline cuts mainly through a landscape which experienced 52% modification, with the pipeline servitude temporarily affecting 27% natural areas. Therefore, the temporary disturbance of the pipeline servitude if effectively rehabilitated will influence less than 1% of the landscape, which is clearly not a significant impact.

The temporary disturbance of the pipeline construction, if well rehabilitated, will affect less than 1% of the remaining persistent natural vegetation (climax biodiversity habitat) within the landscape.

From a floristic species perspective, only one of the twelve plant species of conservation concern was verified, namely the shrub *Searsia batophylla*. It was recorded within three of the plots surveyed, but not specifically along the 2F proposed servitude. Using the available Sentinel 2A data from April 2024 and unsupervised cluster analysis it was possible to link these occurrences to both broad and fine clusters. Based on these models, it was evident that this species and other Sekhukuneland endemics have a very localised distribution. It was evident that these species occur in association with erosion gullies/ drainage lines. Due to the presence of several plant species that were in flower and and good foliage on the woody species, additional distribution of nationally protected trees was observed. The presence of a double rain shadow along the northwestern section of the route could influence future rehabilitation success.

[1] https://egis.environment.gov.za/

From an animal species perspective, three of the eight animal species listed by the Screening Tool could be present along the pipeline alignment, namely the Lanner Falcon (*Falco biarmicus*), the African Finfoot (*Podica senegalensis*) and the tortoise *Kinixys lobatsiana. Kinixys lobatsiana* is mainly associated with rocky woodland and on outcrops, while the African finfoot was restricted to perennial systems such as the Olifant River. The Lanner Falcon was regarded as a regular foraging visitor and appears to be resident along the central section of the pipeline (according to the May 2025 site visit).

The following National Protected Trees in terms of the National Forest Act were observed within the proposed temporary disturbance servitude and surrounding landscape: *Sclerocarya b*irrea subsp. *caffra* (Marula tree), *Boscia albitrunca* (Shepard's Tree), *Combretum imberbe* (Leadwood) and *Balanites maughamii* subsp. *maughamii* (Torchwood). These species have a wide distribution in the landscape, and were Least Concern in terms of the IUCN Red Data[2] list on national level. However, a permit is required for the destruction, removal or trimming of these species.

The following recommendations were made:

1. A detailed rehabilitation plan should be compiled showing areas where topsoil management is critical and non-negotiable for example natural areas, potential critical habitats (eroded areas) and outcrops (boulders and sheet). The rehabilitation plan should be compiled by a registered scientific professional in the fields of botanical science and/ or ecological science with experience in botany and plant rehabilitation/ restoration with a minimum of 10 years' experience. This will require detail mapping at a scale of 1: 10 000 or larger along the approved pipeline servitude.
    a. The mapping should form part of the pre-construction baseline, and the following areas within the natural areas should be highlighted:
        i. Eroded areas
        ii. Stream/ river crossing
        iii. Wetlands
        iv. Steep areas – more than 8% or 5° slopes
        v. Outcrops – boulders and sheets
    b. The mapping should be done during the optimal flowering time from January to March.
    c. The rehabilitation plan should incorporate the results of the soil assessment with regards to soil form, soil texture and soil depth.
2. To apply for the removal of national protected trees a registered scientific professional in the field of ecological science with a minimum of 5 years' experience should do surveys along the approved pipeline servitude using plotless methods to document the height of the individuals in the following height classes up to a distance of 50 m along the centre of the permanent servitude:
    - Seedlings: 0 – 0.5 m
    - Juveniles: 0.5 – 1 m
    - Young adults: 1 – 3 m
    - Mature adults: 3 – 6 m (Fire tolerant)
    - Reproductive adults: 6 m > (Fire tolerant)
    - The survey should be done during the optimal flowering time from January to March.
    - The survey plots should be at least 250 m apart within natural areas or at least one plot per 2 ha of remaining natural vegetation within the approved temporary and permanent servitude
3. Areas with permanent footprints (valve chambers, scour chambers) exceeding 1 ha **within natural areas** should be surveyed in detail for species of concern as indicated in the screening report during the optimal flowering time from January to March.
4. If any faunal species of conservation concern (especially *Kinixys lobatsiana*) are exposed during the construction phase, a natural scientific professional registered in the field of zoological science and/ or ecological science who specialise in the species of concern will be appointed to assist with its capture, translocation and safe release to nearby suitable habitat with the relevant permits obtained from the authority.

[2] http://redlist.sanbi.org/

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2 INTRODUCTION

Zutari appointed EkoInfo CC and its associate Pachnoda Consulting to update the terrestrial biodiversity component of the 2F pipeline phase of the OMM BRWSP project within Limpopo Province, South Africa. Willem de Frey of EkoInfo CC and Lukas Niemand of Pachnoda Consulting assisted with the previous baseline information on this phase in 2016 for Aurecon. This phase of the project is described as follows:

> "Olifants Management Model Programme Bulk Raw Water Study Phase (OMMP-BRWSP): proposed Phase 2F pipeline re-alignment and associated infrastructure, in the Capricorn and Greater Sekhukhune Greater District Municipalities, within the Tubatse and Lepelle Nkumpi Local Municipalities, in the Limpopo Province." (Xakayi 2024a)

2.1 Scope of work/ Terms of reference

Scope of work is based on email correspondence received which stated that (de Frey 2024):

1. The existing information should be updated to accommodate the deviations
2. Comply with the requirements for site verification as required by the National Environmental Screening tool
3. Consider the IFC SP 6 requirements with specific reference to the 2B and 2B + alignments.

To address the above requirements, EkoInfo CC compiled the same team that assisted with the previous work, namely:

1. Willem de Frey of EkoInfo CC, a registered Natural Scientific Professional in the fields of ecological – and botanical science with more than 25 years' experience. He was responsible for the team administration, spatial analysis and flora component.
2. Lukas Niemand if Pachnoda Consulting, a registered Natural Scientific Professional in the fields of ecological – and zoological science with more than 20 years' experience. He was responsible for fauna component and IFC SP 6 input.

The team visited the area during the week of 4th of November 2024 as well as a follow up survey during the week of the 12th of May 2025, after the area received good rains during the second half of the rainy season.

3 STUDY AREA

The 2F pipeline and its permanent and temporary servitudes represent the disturbance footprint of the project and is located within the landscape presented by quaternary catchments B52J, B52G, B71E and B52E (Figure 1). A detailed description of the study area is beyond the scope of the current document, and for a detail description of the receiving environment, please refer to the previous reports (de Frey & Niemand 2016).

In essence what has changed since the previous reports, is the implementation of the Screening Phase within the EIA process from 2019. The National Environmental Screening Tool generates a report based on the known environmental sensitivities of the landscape. These environmental sensitivities are based on national and provincial datasets such as:

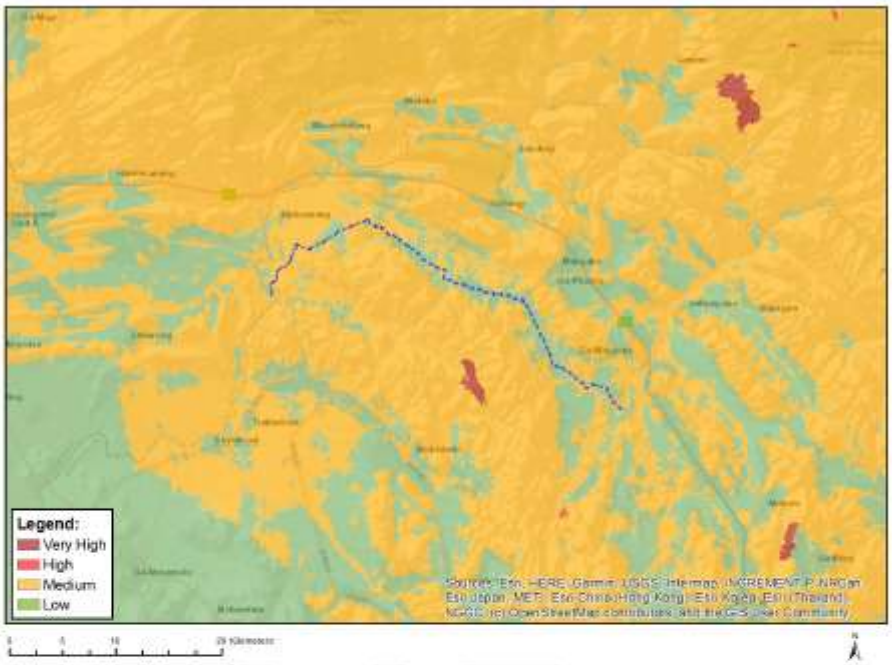
1. Limpopo Province Biodiversity Sector Plan (2013)
2. National Protected Areas Expansion Strategy (2016)
3. NBA2018 National Wetland Map 5 (2018)

The current alignment mainly follows the original alignment except in the north where a deviation occurs (Figure 2). Only results for this deviation area was provided in the screening report supplied with regards to flora (Figure 3), fauna (Figure 4) and terrestrial biodiversity (Figure 5) (Xakayi 2024b). According to the screening tool the deviation is in an area of medium sensitivity for plant species, medium - high sensitivity for animal species and very high sensitivity for terrestrial biodiversity. The relevance of these sensitivity classes was verified during the site visit in November 2024, prior to good rainfall and in May 2025 after the area received good rainfall. This ensures a high level of confidence and credibility with regards to this document.

Figure 1: Regional orientation of the study area consisting of the 2F pipeline disturbance footprint, Limpopo Province

Figure 2: Local orientation of the 2F pipeline with the current deviation in the north

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

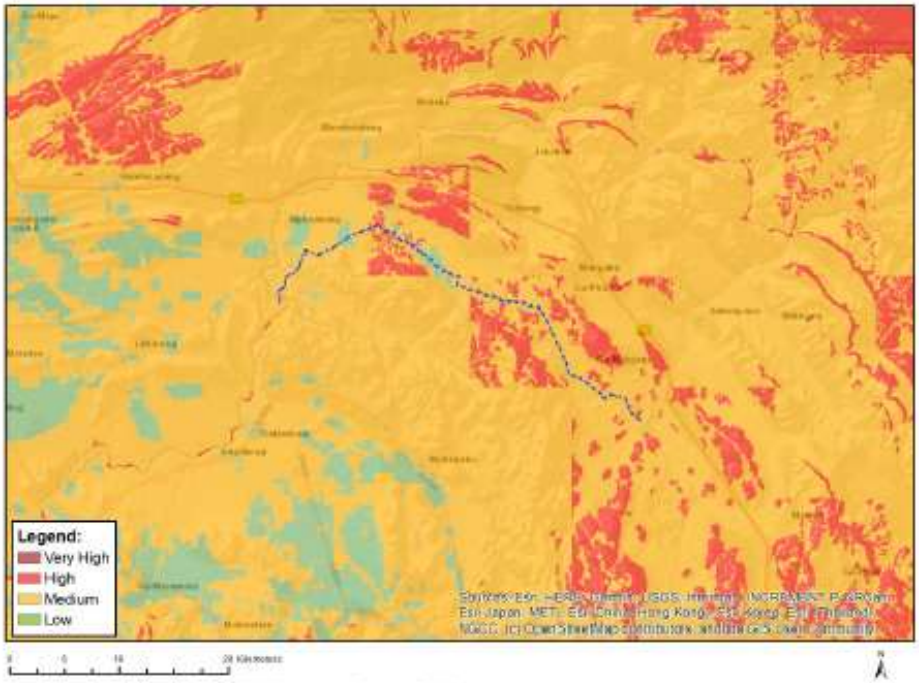
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1252
Medium	Sensitive species 1033
Medium	Sensitive species 587
Medium	Asparagus fourei
Medium	Asparagus sekukuniensis
Medium	Asparagus hirsutus
Medium	Sensitive species 303
Medium	Plectranthus venteri
Medium	Sensitive species 485
Medium	Polygala sekhukhuniensis
Medium	Searsia batophylla
Medium	Combretum petrophilum

Figure 3: Screening tool results for deviation area - plant species theme

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Falco biarmicus
Low	Subject to confirmation
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Aquila rapax
Medium	Aves-Podica senegalensis
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Dasymys robertsii
Medium	Reptilia-Kinixys lobatsiana
Medium	Invertebrate-Aroegas fuscus

Figure 4: Screening tool results for deviation area - animal species theme

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	CBA 1
Very High	CBA 2
Very High	ESA 1
Very High	ESA 2
Very High	EN_Sekhukhune Plains Bushveld

Figure 5: Screening tool results for deviation area – terrestrial biodiversity theme

4 METHOD STATEMENT

4.1 Site verification of the screening tool results

During the site visit, the guideline requirements[3] of the screening report with regards to site verification were implemented. The guideline requirements state the following:

1. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS

Prior to commencing with a specialist assessment, the current use of the land and the environmental sensitivity of the site under consideration identified by the screening tool must be confirmed by the undertaking a site sensitivity verification

1.1 The site sensitivity verification must be undertaken by an environmental assessment practitioner or a specialist.

1.2 The site sensitivity verification must be undertaken through the use of:

(a) a desk top analysis, using satellite imagery;
(b) a preliminary site inspection; and
(c) any other available and relevant information.

1.3 The outcome of the site sensitivity verification must be recorded in the form of a report that:

(a) confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
(b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
(c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations

To address the above requirements, use was made of:

1. Sentinel 2A[4] satellite imagery from April 2024 (End of the growing season, post optimal rainfall - Figure 6)
2. Google Earth Pro Images (Public Access)
3. Limpopo Province Biodiversity Spatial Plan (2013)

The area was visited during the week of the 4th of November 2024, areas indicated as Critical Biodiversity Areas (CBA) or Ecological Support Area (ESA) were visited, and georeferenced digital images were taken. The following equipment were used to capture digital images (Figure 7):

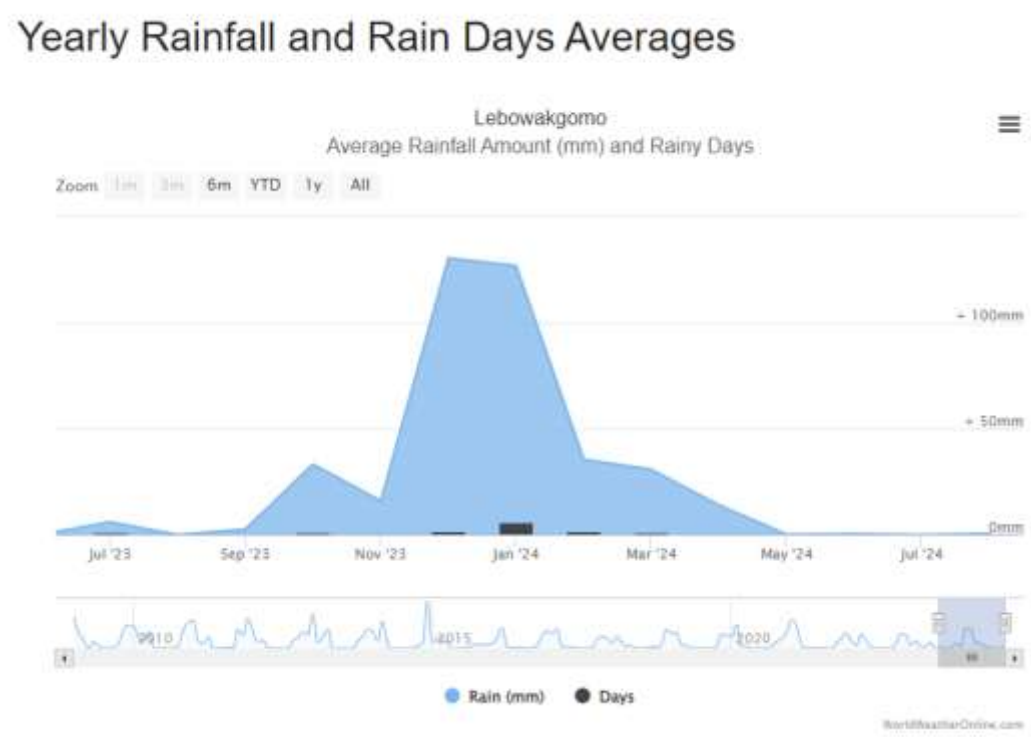
1. Garmin GPS receivers – accurate within 5 meters
2. Garmin Virb Action cameras – accurate within 5 m, an image every 30 seconds
3. DJI P4 multispectral drone – accurate within 5 m, plan and oblique images
4. To compensate for the absence of sufficient rainfall in November 2024, the area was revisited during the week of the 12th of May 2025 after more than sufficient rainfall occurred from February to April 2025 (Figure 8).

To address the species proposed by the Animal theme of the Screening Tool report, the following aspects are applicable:

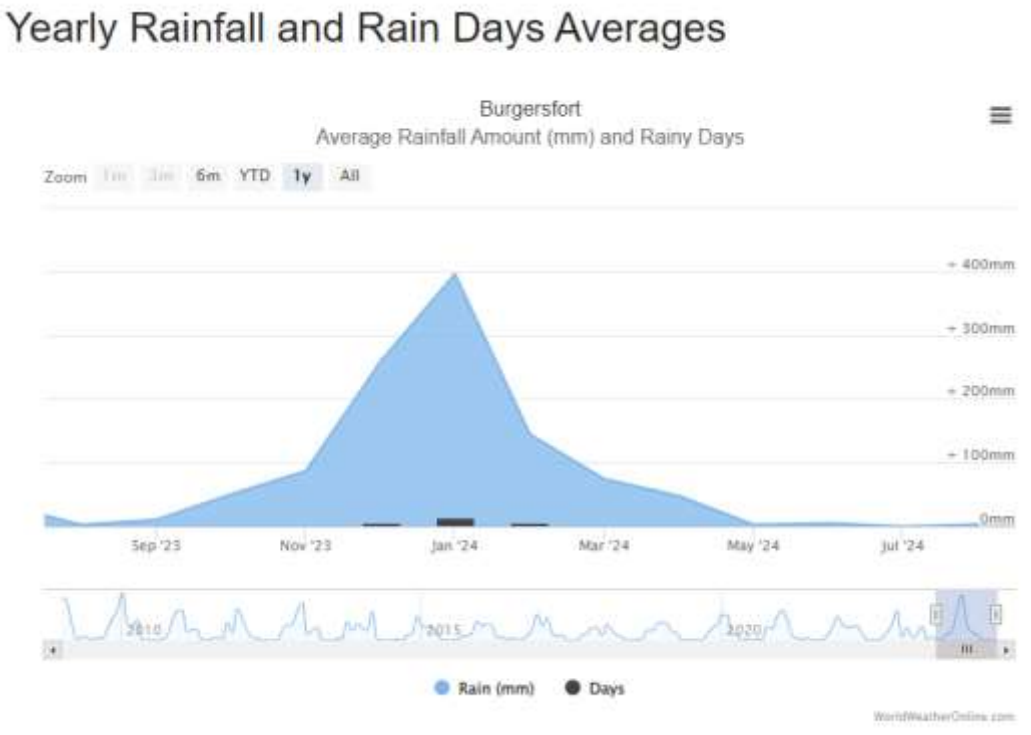
1. A verification site visit was conducted during 04 - 08 November 2024 with the objective to evaluate the results of the screening tool sensitivity rating. During the site visit, most of the dominant broad-scale habitat units were investigated by slowly traversing the study site on foot and by vehicle. At several instances digital photographs of the floristic structure, topography and general land use and land cover of the habitat units were recorded. The area was revisited during the week of the 12th of May 2025 after the area received sufficient precipitation which occurred from February to April 2025. Please note that during the November 2024 surveys the area was considerably dry with most of the basal vegetation cover being dormant. This could also affect the detectability of animal species which may also be dormant. The second survey (May 2025) was also considered as an optimal time of the year when many of the charismatic birds of prey

[3] https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pd

[4] https://dataspace.copernicus.eu/



Lebowakgomo



Burgersfort

Figure 6: Climographs of Lebowakgomo and Burgersfort, to towns to the west and east of the study area (Source: https://www.worldweatheronline.com/)

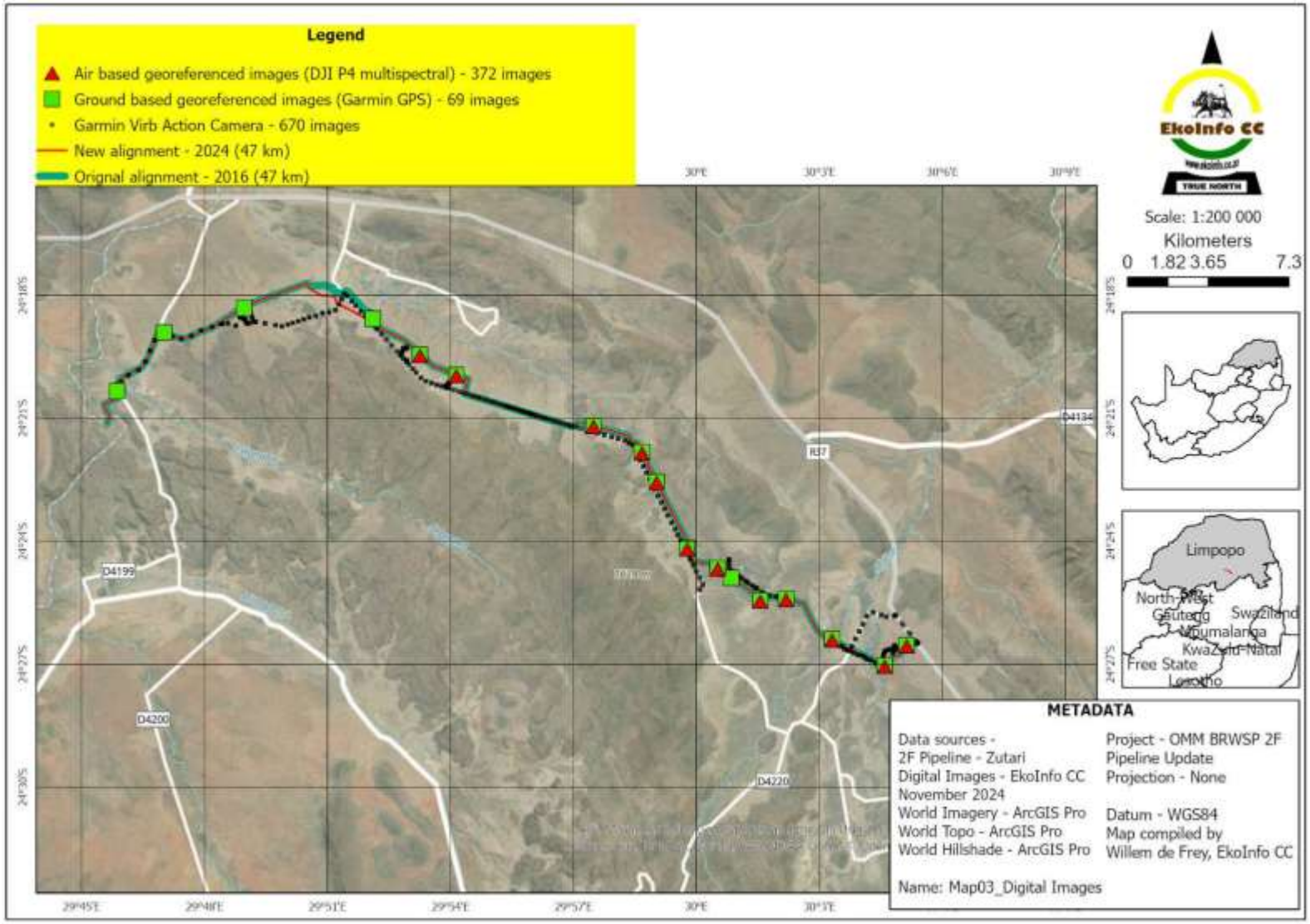


Figure 7: Distribution and sources of digital georeferenced images recorded during the site verification visit in the week of the 4th of November 2024

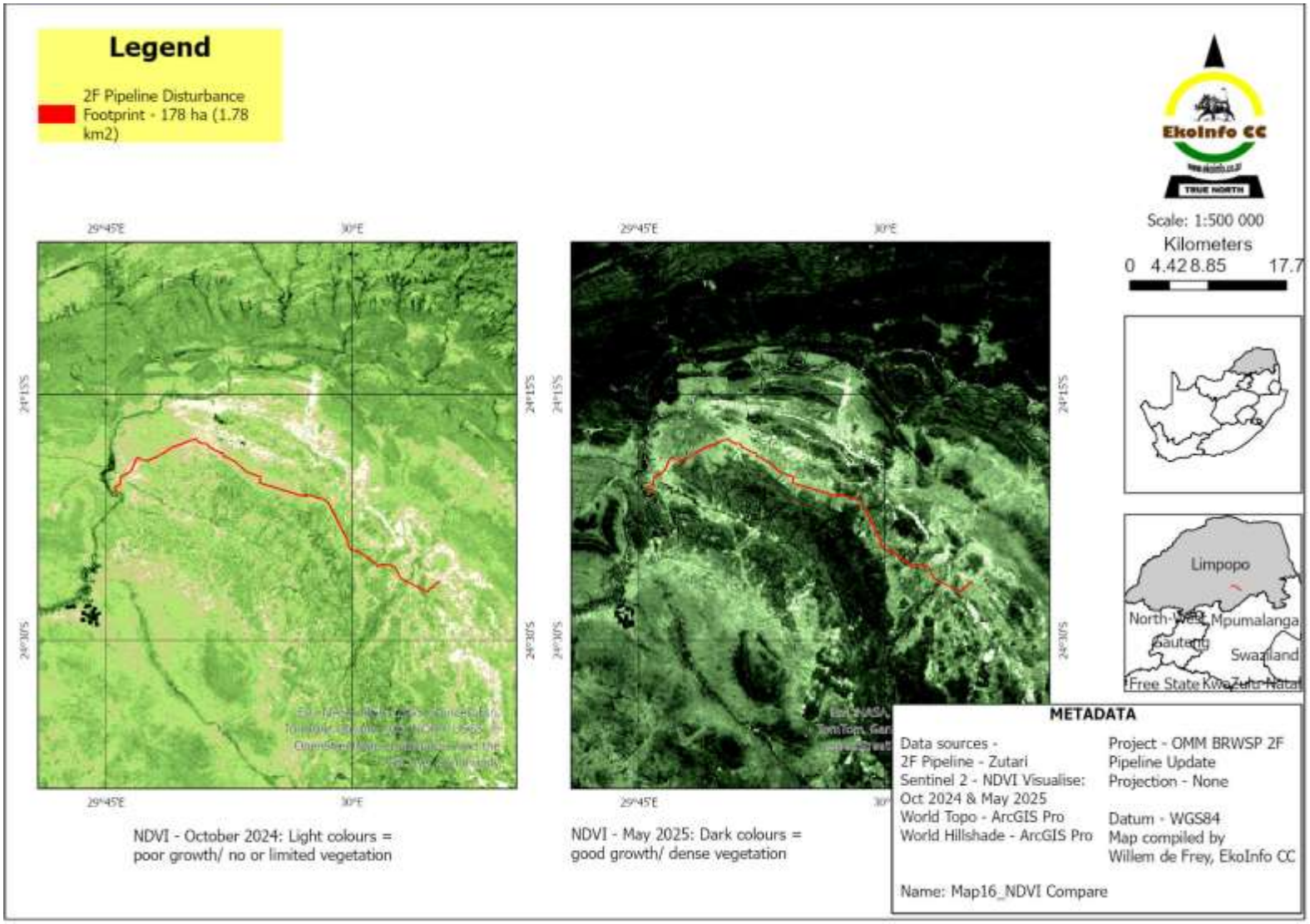


Figure 8: NDVI reflecting the difference in vegetation vigour between October 2024 and May 2025

species engage in breeding behaviour (e.g. vocal display and nest building), thereby making these species and their potential nesting sites less obscure (and easy to detect).

2. The conservation status of bird species as listed by the Screening Tool was categorised according to the global IUCN Red List of threatened species (IUCN, 2024) and the regional conservation assessment of Taylor et al. (2015).
3. Distributional data for listed bird species was sourced from the South African Bird Atlas Project (SABAP1) and verified against Harrison et al. (1997) for species corresponding to quarter-degree grid cells grid cells (QDGC) 2429BC, 2429BD and 2430AC. The information was then modified according to the prevalent habitat types present on the study area. The SABAP1 data provides a "snapshot" of the abundance and composition of species recorded within a quarter degree grid cell (QDGC) which was the sampling unit chosen (corresponding to an area of approximately 15 min latitude x 15 min longitude). It should be noted that the atlas data makes use of reporting rates that were calculated from observer cards submitted by the public as well as citizen scientists. It therefore provides an indication of the thoroughness of which the QDGCs were surveyed between 1987 and 1991.
4. Additional distributional data for listed bird species was also sourced from the SABAP2 database (http://www.sabap2.birdmap.africa). The information was then modified according to the prevalent habitat types present on the study area. Since bird distributions are dynamic (based on landscape changes such as fragmentation and climate change), SABAP2 was born (and launched in 2007) from SABAP1 with the main difference being that all sampling is done at a finer scale known as pentad grids (5 min latitude x 5 min longitude, equating to 9 pentads within a QDGC). Therefore, the data is more site-specific, recent and more comparable with observations made during the site visit (due to increased standardisation of data collection). The pentad grids relevant to the current project are 2420_2945, 2415_2945, 2415_2950, 2420_2950, 2420_2955, 2420_3000 and 2425_3000.
5. The potential occurrence and conservation status of mammal taxa as reported by the Screening Tool were based on the IUCN Red List (2024) and the national Red Data Book by Child et al. (2016), while mammalian nomenclature was informed by Stuart and Stuart (2015) and Child et al. (2016), unless otherwise indicated.
6. The historical and extant (contemporary) distribution ranges of mammal taxa sympatric to the project area as reported by the Screening Tool was sourced from MammalMap (2429BC, 2429BD and 2430AC) and various applicable field guides (in particular Stuart & Stuart (2015), Skinner & Chimimba (2005), Child et al. (2016) and Friedmann & Daly (2004)).
7. Red List categories for potential occurring reptile species (as reported by the Screening Tool) were chosen according to the conservation assessment conducted by Bates et al. (2014).
8. The distribution of reptile species was verified against the Animal Demography's (ADU) database consisting of ReptileMap for QDS 2429BC, 2429BD and 2430AC.
9. iNaturalist (https://www.inaturalist.org/places/south-africa).

4.2 International Finance Corporation's Performance Standard 6 (IFC PS 6) – Biodiversity Mapping

To assist with the IFC PS 6 mapping the whole alignment for the 2F pipeline was revisited as IFC PS 6, was not a requirement of the previous studies. In essence the IFC PS 6 guideline document requires that the following key elements be considered:

1. **Identification of Critical Habitats**: Mapping areas that qualify as critical habitats, including those with high biodiversity value or supporting rare, threatened, or endangered species. The developer must ensure that these areas are clearly marked, and conservation efforts are integrated into project planning.
2. **Habitat Assessment and Baseline Surveys**: The project should map natural and modified habitats within its area of influence. Baseline biodiversity surveys and habitat assessments are essential to understand the pre-project condition.
3. Land Use and Ownership: Mapping land use patterns, ownership, and leases are required to determine the socio-economic impact on communities, including any indigenous or local populations relying on the land for livelihoods.
4. Buffer Zones and Ecosystem Services: Developers must map buffer zones around areas of significant biodiversity and identify ecosystem services that local communities or the environment depend on. These areas should be considered for protection or restoration as part of project planning.

5. Cumulative Impact Mapping: The project must map cumulative impacts from multiple sources, including existing projects and planned developments in the region. This includes both direct and indirect impacts on biodiversity and ecosystems.
6. Stakeholder Engagement Areas: Mapping areas of community interest, such as regions used for subsistence, cultural practices, or economic activities, helps ensure inclusive stakeholder consultations. This allows for the identification of potential risks and impacts on livelihoods or ecosystem services.
7. Monitoring and Adaptive Management Areas: Regularly updating and maintaining maps that document changes in biodiversity, critical habitats, and ecosystem services throughout the project lifecycle is a part of ongoing monitoring. This aids in adaptive management to mitigate negative impacts.

The points in **bold** has relevance to the terrestrial biodiversity based on the animal and plant sensitivity themes of the National Environmental Screening tool.

To address the above requirements regarding the identification of critical habitat, habitat assessment and baseline surveys, the following small-scale datasets were used:

1. Land cover datasets – 1995, 2000, 2009, 2014, 2020 (https://egis.environment.gov.za/)
2. Limpopo Province Biodiversity Spatial Plan (2013) (https://bgis.sanbi.org/)
3. Limpopo Province Biodiversity Spatial Plan (2018) (https://bgis.sanbi.org/)
4. South Africa Centres of Floristic Endemism (ENPAT 2009, DFFE)

The following Geographical Information System (GIS) software packages were utilised in the planning and analysis of the study:

1. ArcGIS Pro
2. Idrisi Selva
3. SAGA GIS

4.3 Limitations And Assumptions

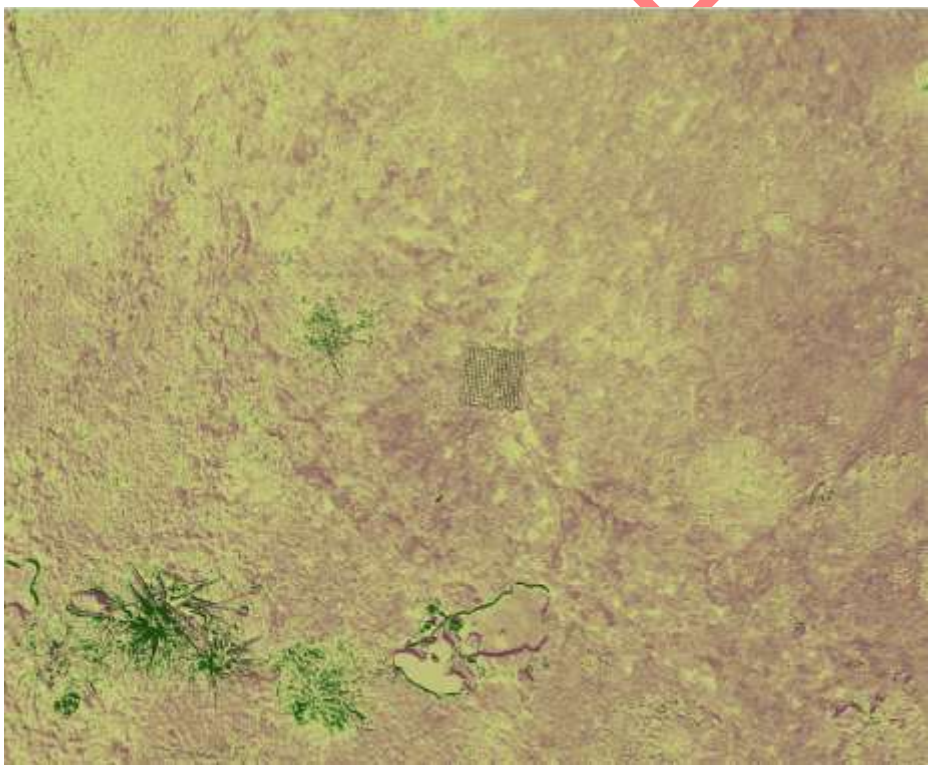
1. This document concerns an update of previous reports, and aims to supplement the previous documents, and address changes which occurred since then (2016/ 2017)
2. It does not represent detail quantitative studies, but was focused on complying with the newly promulgated screening requirements with regards to site verification
3. This document reflect the results of two independent surveys, reflecting a (1) survey conducted during November 2024, when large parts of the area was too dry to verify with confidence the absence or presence of species concern (Photo plate 1), with specific reference to the flora and certain fauna species (e.g. herpetofauna), and (2) a follow up survey in May 2025, after the northern section of South Africa received significant rainfall, resulting in sufficient regrowth in vegetation to verify the presence/ absence of species of conservation concern, with specific reference to the flora (Photo plate 2) which also allowed for an increased activity in certain fauna groups such as herpetofauna and invertebrates.
4. In the absence of an actively growing herbaceous layer (grasses and forbs) during the November 2024 survey, it was not possible to calculate the following parameters to measure rehabilitation success from the NDVI[5] analysis (Photo plate 3):
    a. % vegetation cover
    b. % bare soil cover
    c. Mean plant cover diameter (basal cover): cm
    d. Mean bare soil diameter: cm
    e. However, the follow-up survey in May 2025 addressed this shortfall, with areas targeted in the main five NDVI classes (Photo plate 4).
5. Persistent areas of natural vegetation and classified as critical biodiversity areas on provincial scale and which falls within the centre of endemism was classified as critical habitat in terms of the IFC SP 6 criteria but was not verified or surveyed in detail.
6. It is assumed that third party (government, academic institutions) information is accurate and up to date.
7. The species investigations reported by the Screening Tool only has reference to the geographic area as displayed by Figure 3, Figure 4 and Figure 5.

[5] Normalized Difference Vegetation Index (NDVI)

Photo plate 1: No herbaceous cover due to the timing of the survey in November 2024 prior to the rain

Photo plate 2: Same area in May 2025 – marked increase in vegetation cover, although already drying in anticipation of the winter dry season

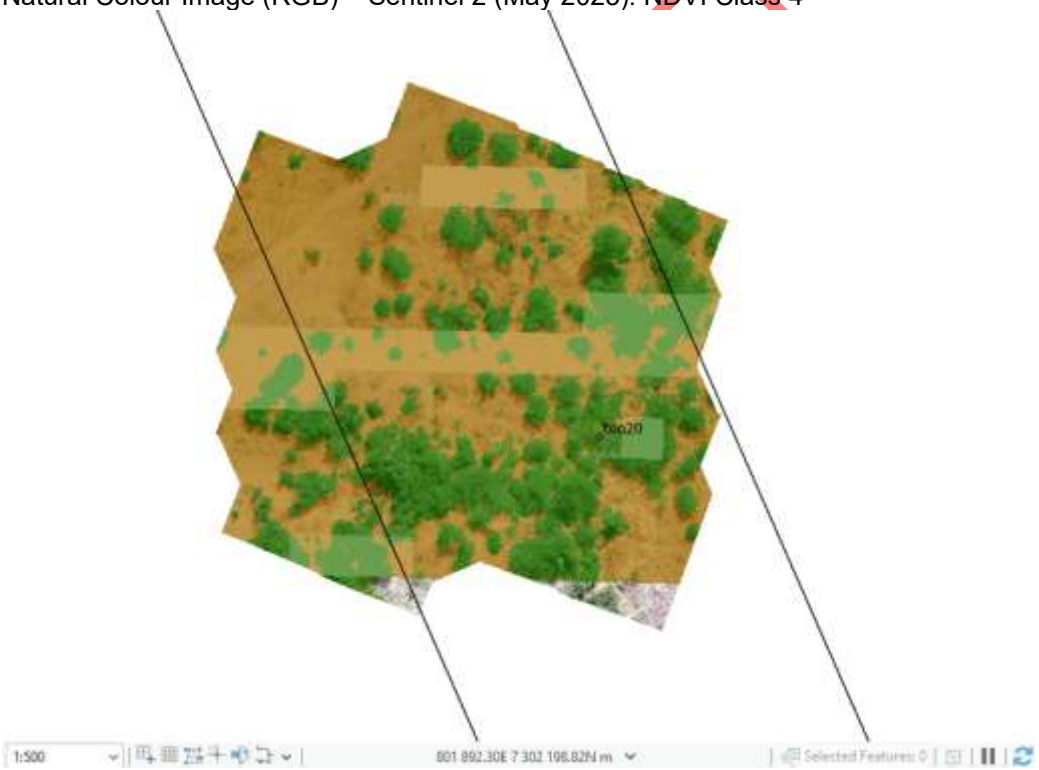
Natural colour (Red, Blue, Green) image showing the absence of herbaceous cover



NDVI (Red & Near infrared) results confirming the absence of herbaceous cover (green = actively growing plants)

Photo plate 3: Absence of herbaceous cover (forbs and grasses) does not make it possible to calculate rehabilitation criteria from the NDVI analysis

Natural Colour Image (RGB) – Sentinel 2 (May 2025): NDVI Class 4



Local NDVI (DJI P4 Multispectral drone) – Dark green = woody cover, Light green = herbaceous cover

Photo plate 4: Example of the NDVI data captured during the May 2025 survey

5 RESULTS

5.1 Flora Component

5.1.1 Persistence Analysis

5.1.1.1 Natural Vegetation/ Biodiversity Habitat

Using Idrisi Selva's land change modeller, it was possible to determine the change in the landscape from 2016 to the current (2024), using the 1995, 2000, 2009, 2014 and 2020 national land cover datasets (Figure 9).

According to the land change modeller analysis between 2014 and 2020, most of the natural areas had been lost to cultivation and transformation (human settlements) (Figure 10). In total 53 ha (30%) of natural vegetation persisted within the proposed servitude areas of the pipeline since 2014 (Table 1). Of the proposed servitude 46 ha (26%) experienced change most probably from natural vegetation to transformation (human settlement) or cultivation.

Figure 11 shows the distribution and extent of areas where the natural vegetation (biodiversity habitat) experienced gains, loses and remain persistent between 2014 and 2020. Based on this analysis, it is evident that 32 ha or 18% of the natural vegetation (biodiversity habitat) within the proposed pipeline servitude had experienced a loss since 2014, with 12% (13.1328 ha) representing a gain or secondary vegetation (Table 2).

From this analysis it is evident that the remaining natural vegetation (biodiversity habitat) in the landscape across four quaternary catchments, are not experiencing significant pressure, resulting in limited habitat fragmentation on a regional scale, which does not place populations at risk (Turner ***et. al.*** 2001, Wiens ***et. al.*** 2006). Figure 12 and Table 3 support this statement, with 29% of the landscape associated with study area representing transformed areas. In total 69% (132 706 ha) represents persistent primary/ climax vegetation, mainly associated with the high lying and steep areas in the landscape in which the pipe line is planned (Photo plate 5).

The temporary disturbance of the pipeline construction, if well rehabilitated, will affect less than 1% of the remaining persistent natural vegetation (climax biodiversity habitat) within the landscape (Table 3).

5.1.1.2 Limpopo Province Biodiversity Sector Plan 2013/ 2018

Since the 2016 assessment, the Limpopo Province Biodiversity Sector Plan had been updated, this update mainly resulted in a decrease in the Critical Biodiversity Area 2 class (Figure 13), and a substantial increase the Critical Biodiversity Area 1 class. In 2018, 32% or 61 178 ha represented Critical Biodiversity Areas (Table 4), with 54% (103 414 ha) considered to be transformed.

The temporary disturbance of the pipeline construction, if well rehabilitated, will affect less than 1% of the remaining persistent areas of conservation concern (Critical Biodiversity Areas, Ecological Support Areas) within the landscape (Table 4).

5.1.1.3 Core Climax Habitat

Core climax habitat areas are those natural vegetation areas which according to five land cover classifications from 1995 to 2020, had never been transformed, and was always classified as representing natural vegetation with a 100% confidence (Figure 15).

Once again, the proposed temporary disturbance of the pipeline during the construction phase, will affect less than 1% of these high confidence persistent land cover classes, with specific reference to climax natural areas (Table 5), if rehabilitated and restored effectively.

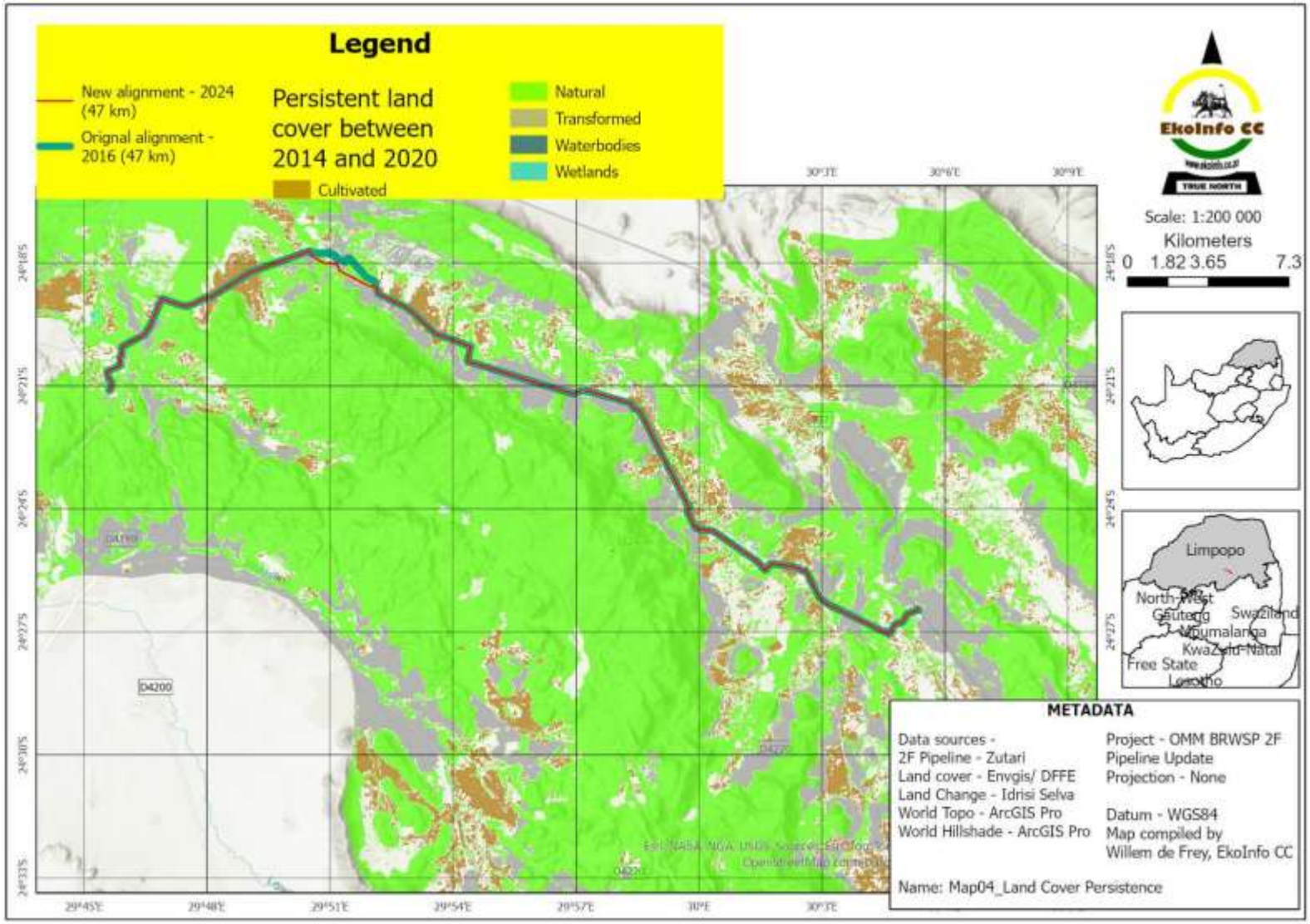


Figure 9: Distribution and extent of persistent land cover classes between 2014 and 2020

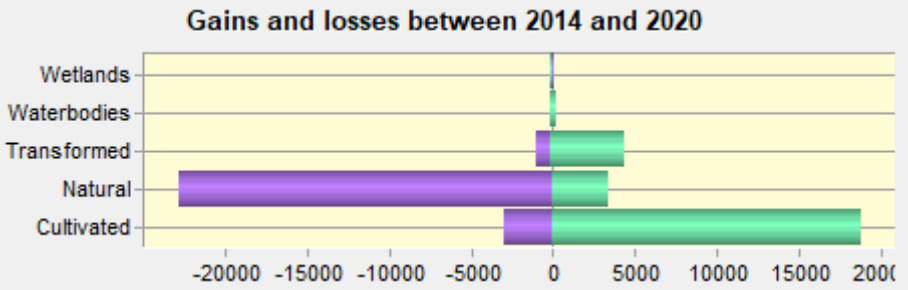


Figure 10: Histogram showing the gains and losses in land cover classes between 2014 and 2020 in hectares in the landscape

Table 1: Overview of the surface area and percentage cover of persistent land cover classes within the currently proposed pipeline's permanent and temporary servitude

Broad Land Cover Classes Derived from the 2014 and 2020 Land Cover Classes	Hectares	% cover
Cultivated fields	56.9822	32%
Natural vegetation areas	52.7113	30%
Transformed areas	22.9549	13%
Changed areas	45.5998	26%
Total permanent and temporary servitude footprint	**178.2482**	**100%**

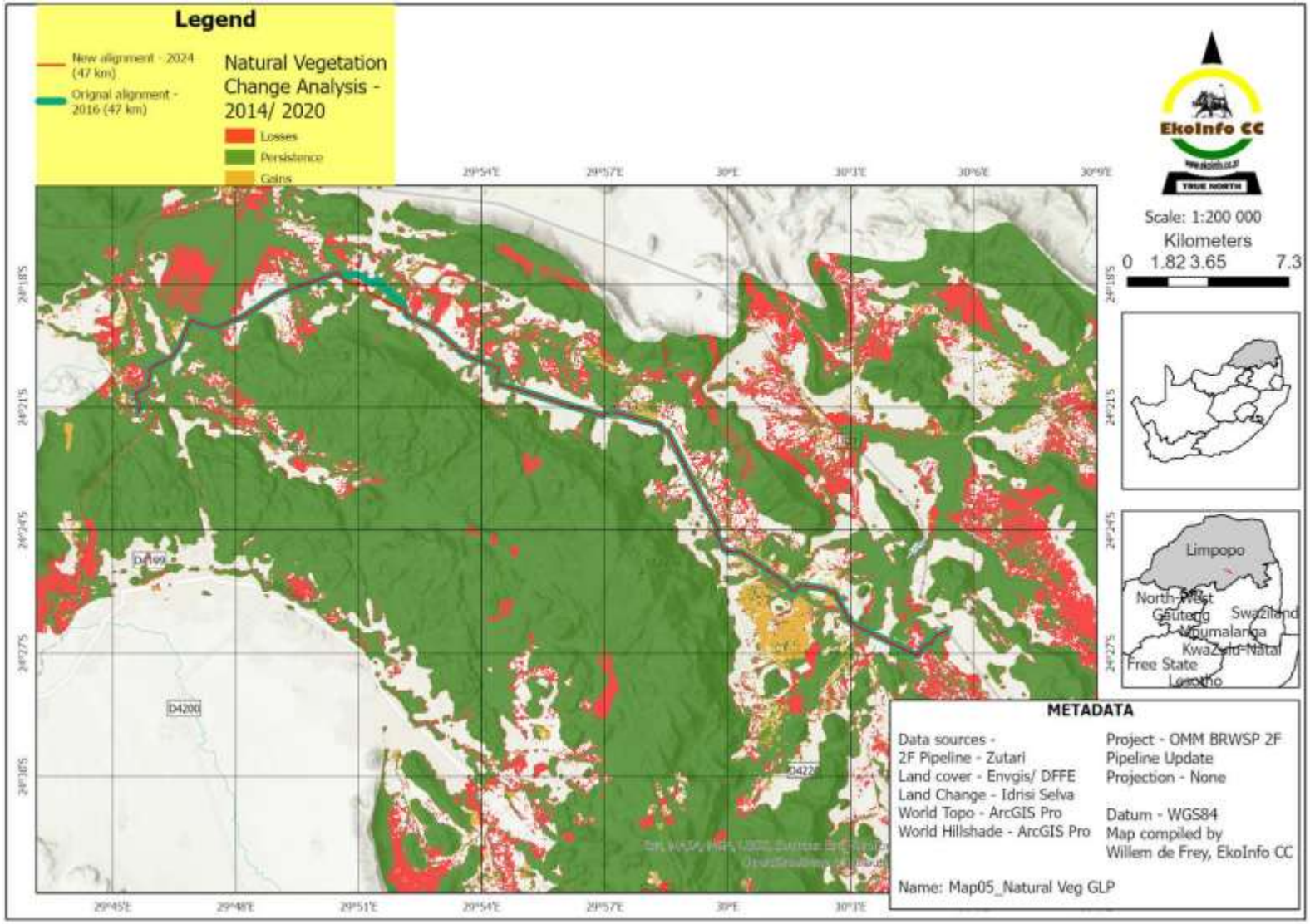


Figure 11: Distribution and extent of areas of gains, loses and persistence with regards to natural vegetation (biodiversity habitat) along the proposed current Phase 2F pipeline

Table 2: Overview of the surface area and percentage cover of natural vegetation change analysis categories within the proposed temporary servitude footprint

Natural Vegetation Change Category	Hectares	% Cover
Losses	31.5768	18%
Persistence	52.7113	30%
Gains	13.1328	7%
Other land cover classes (Cultivation, Transformation)	80.8273	45%
Total permanent and temporary servitude footprint	**178.2482**	**100%**

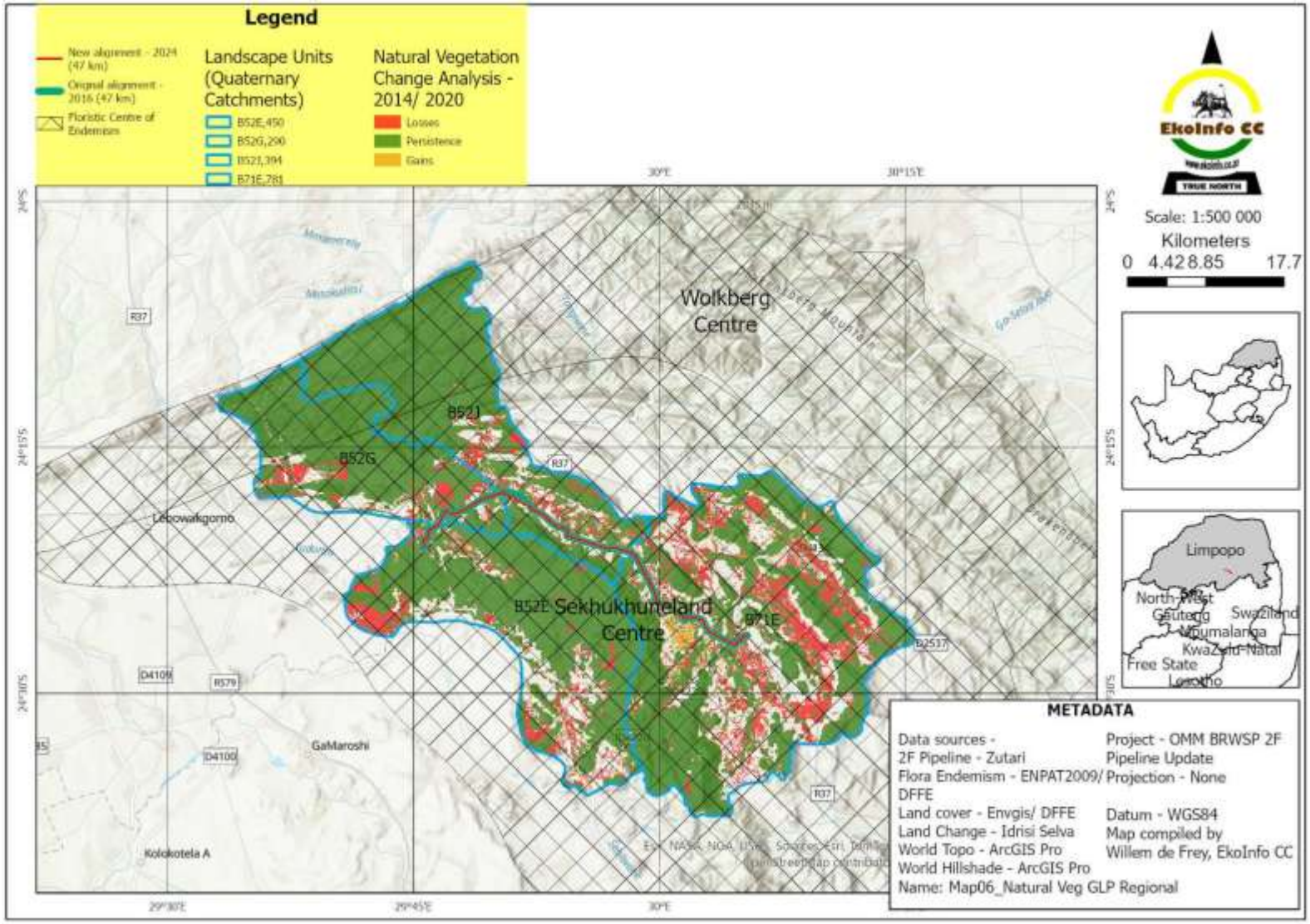


Figure 12: Overview of the level of biodiversity habitat loss within the landscape associated with the study area

Table 3: Overview of the surface area and percentage cover of natural vegetation (biodiversity habitat) within the landscape associated with the study area (Regional context)

Regional Context (Landscape level)						Temporary Pipeline Disturbance	
Natural Vegetation Change Analysis - Regional	Hectares	% Cover	Derived Ecological Status				
			Transformed (Habitat loss)	Natural Vegetation (Biodiversity Habitat)		Hectares	% of landscape
				Persistent/ Primary	Secondary		
Other land cover classes	32 666	17%	32 666			80.8273	0.25%
Losses	22 807	12%	22 807			31.5768	0.14%
Persistence	132 706	69%		132 706		52.7113	0.04%
Gains	3 321	2%			3 321	13.1328	0.40%
Landscape Level Total - Quaternary Catchment: B52E, B52G, B52J & B71E	**191 500**	**100%**	**55 473**	**132 706**	**3 321**	**178.2482**	
			29%	69%	2%		

Photo plate 5: Photographic evidence of the remaining persistent natural vegetation mainly on the high lying steep areas of the landscape

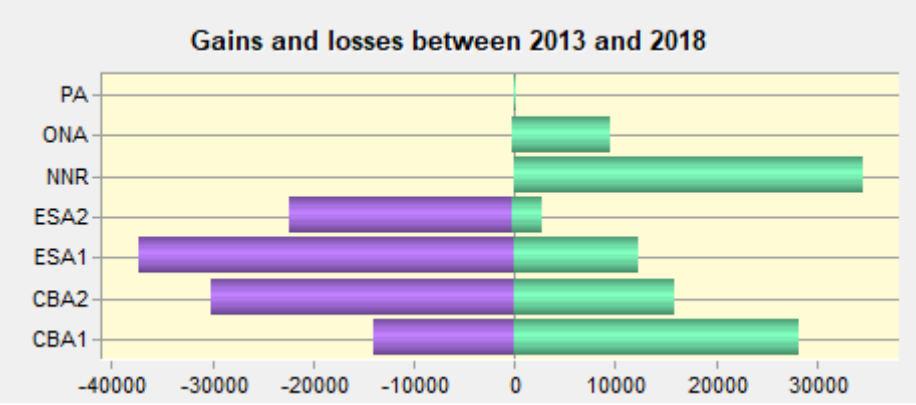


Figure 13: Histogram showing the gains and losses in Limpopo Province Biodiversity Spatial classes between 2013 and 2018 in hectares within the landscape in which the pipeline is planned

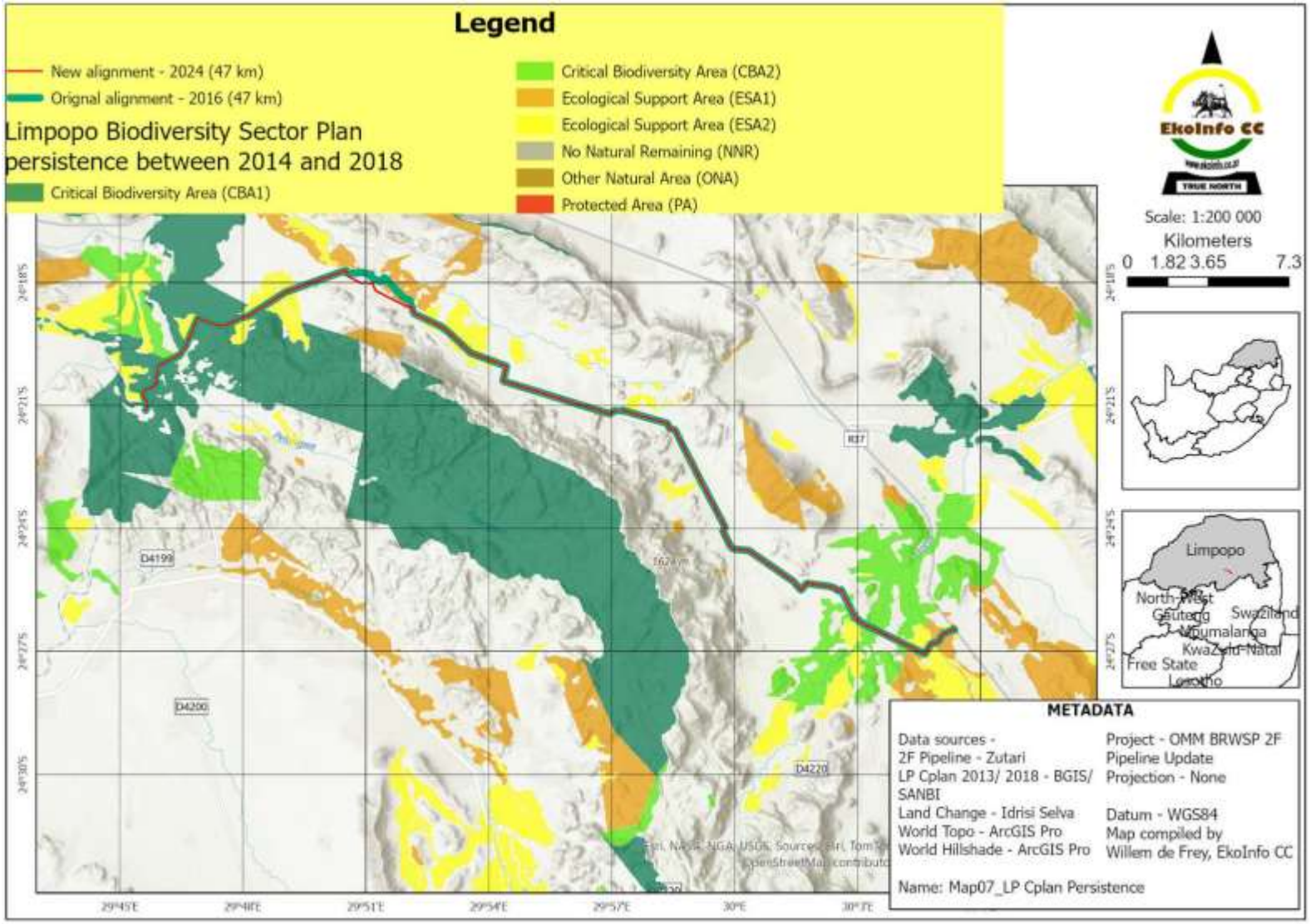


Figure 14: Distribution and extent of persistent Limpopo Province Spatial Biodiversity classes between 2013 and 2018

Table 4: Overview of the surface area and percentage cover of areas of conservation concern (Critical Biodiversity Area, Ecological Support Area) within the landscape associated with the study area (Regional context)

Regional Context (Landscape level)							Temporary Pipeline Disturbance	
Limpopo Province Biodiversity Spatial Classes	Hectares	% Cover	Natural Vegetation/ Biodiversity Habitat			Transformed Areas		
			Critical Biodiversity Areas	Ecological Support Areas	Other Natural Areas	No Natural Remaining	Hectares	% of landscape
Critical Biodiversity Area (CBA1)	38 505	20%	38 505				22.6549	0.06%
Critical Biodiversity Area (CBA2)	7 749	4%	7 749				7.0515	0.09%
Ecological Support Area (ESA1)	12 565	7%		12 565			3.6808	0.03%
Ecological Support Area (ESA2)	14 295	7%		14 295			31.7068	0.22%
Other Natural Areas (ONA)	47	0%			47			
No Natural Area Remaining (NNR)	20	0%				20		
Protected Area (PA)	14 924	8%	14 924					
Area that experienced change	103 394	54%				103 394	113.1543	0.11%
Total Landscape Area	**191 500**	**100%**	**61 178**	**26 861**	**47**	**103 414**	**178.2482**	
			32%	14%	0%	54%		

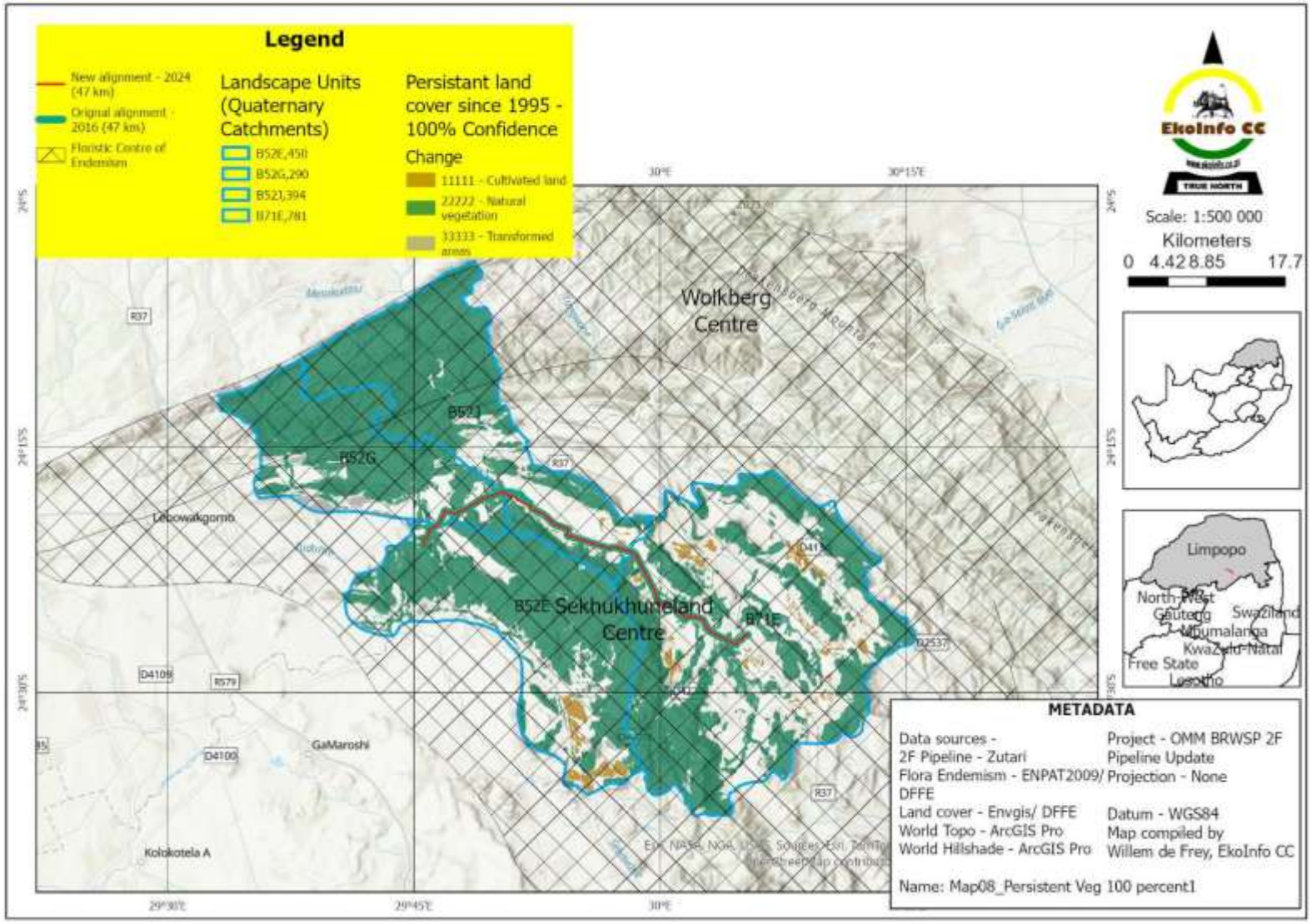


Figure 15: Distribution and extent of land cover classes which were persistent since 1995 with 100% confidence

Table 5: Overview of the surface area and percentage cover of national land cover classes which had been 100% persistent since 1995

Regional Context (Landscape level)					Temporary Pipeline Disturbance	
Land cover classes with 100% confidence since 1995	Hectares	% Cover	Derived Ecological Status		Hectares	% of landscape
			Transformed areas	Climax Natural Vegetation		
11111 - Cultivated land	2 302	1%	2 302		6.3916	0.28%
22222 - Natural vegetation	114 948	60%		114 948	20.3077	0.02%
33333 - Transformed areas	995	1%	995			
Areas who experienced change	73 255	38%	73 255		151.5489	0.21%
Total landscape area	**191 500**	**100%**	**76 552**	**114 948**	**178.2482**	
			40%	60%		

5.1.2 Species of Conservation Concern

5.1.2.1 Screening Report – Species of Conservation Concern

The screening report lists twelve plant species of conservation concern whose presence or suitable habitat had to be verified during the site visit. The identity of four of the twelve species cannot be disclosed due to potential threat to them. The one species is an herbaceous climber with a rootstock, two are succulent shrubs and the fourth is a herbaceous perennial (geophyte). The other eight species are *Asparagus fourei, Asparagus hirsutus, Asparagus sekukuniensis, Combretum petrophilum, Plectranthus venteri, Polygala sekhukhuniensis, Raphionacme villicorona* and *Seersia batophylla*. Only one of the twelve species listed is not endemic to Sekhukhuneland (Table 6), while eleven of the species are classified as being threatened Red Data plants, specifically Vulnerable (10) and Critical Endangered (1).

During the site visit, only one of the twelve species was verified, namely the shrub *Seersia batophylla*. It was recorded within three of the plots surveyed (Figure 16), but not specifically along the 2F proposed servitude. Using the available Sentinel 2A data from April 2024 and unsupervised iso cluster analysis it was possible to link these occurrences to both broad and fine clusters. Based on these models, it is evident that this species and other Sekhukuneland endemic have a very localised distribution. Photo plate 6 provides context of the habitat within which this species is associated, it is evident that they occur in association with erosion gullies/ drainage lines.

Due to the timing of the surveys (November 2024 – prior to the commencement of the rainy season - Figure 6), it was not possible to verify the absence or presence of the eleven species, with the exception of the two succulent shrubs. However, these eleven species prefer steep and rocky areas and dense vegetation cover (Figure 17), of which these habitat preferences are not prevalent along the proposed pipeline servitude. During the May 2025 survey, a greater number of plants were in flower (Photo plate 7), which improved the likelihood of observing species of conservation concern. However, no additional species were recorded. It was observed that the north-western section of the route appeared drier than expected, despite the good rainfall received in the area from February to April. This phenomenon is possibly due to the section being situated in a double rain shadow, with mountain ranges to the north/north-west and south/south-east limiting the movement of moisture-laden air into the area (Figure 1, Figure 8).

5.1.2.2 National Protected Trees

The following National Protected Trees in terms of the National Forest Act were observed within the proposed temporary disturbance servitude and surrounding landscape:

1. *Sclerocarya b*irrea subsp. *caffra* (Marula tree) (Figure 18)
2. *Balanites maughamii* subsp. *maughamii* (Torchwood) (Figure 19)
3. *Boscia albitrunca* (Shepard's Tree) (Figure 20)
4. *Combretum imberbe* (Leadwood) (Figure 21)

Both of these species have a wide potential distribution in the landscape, which explains there Least Concern conservation status in terms of the IUCN Red Data[6] list on national level (Table 7).). During the May 2025 follow up survey, an additional protected tree was noticed, namely the Red Ivorywood (*Berchemia zeyheri*) at observation plot Teo20 Its threatened status is also Least Concern. Due to the woody species having their foliage, additional occurrence of *Balanites maughamii* were noticed in the landscape at observation plot Teo24.

A permit is required for the destruction, removal or trimming of these species.

[6] http://redlist.sanbi.org/

Table 6: Overview of the five species of conservation concern listed in the screening report whose presence or suitable habitat had to be verified during the site visit.

Species	Family	Endemic Status	Threat Status	Habitat Preference	Growth Form
Asparagus fourei	Asparagaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky bushveld and grasslands	Herbaceous, spiny shrub
Asparagus hirsutus	Asparagaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky outcrops and grasslands	Shrub-like, spiny
Asparagus sekukuniensis	Asparagaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky bushveld or grasslands	Scrambling, spiny shrub
Combretum petrophilum	Combretaceae	Endemic to Sekhukhuneland	Near Threatened (NT)	Rocky outcrops, scrubby bushveld	Shrub or small tree
Sensitive species 1252	Dioscoreaceae	Not endemic (Southern Africa)	Least Concern (LC)	Forests, shaded woodlands	Climbing herb (twining vine)
Sensitive species 1033	Euphorbiaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky slopes and outcrops	Succulent shrub
Sensitive species 587	Euphorbiaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky or stony areas, bushveld	Succulent shrub
Sensitive species 303	Iridaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky hillsides, grasslands	Herbaceous perennial
Plectranthus venteri	Lamiaceae	Endemic to Sekhukhuneland	Critically Endangered (CR)	Rocky hillsides, scrubland	Shrub, herbaceous
Polygala sekhukhuniensis	Polygalaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Iron-rich soils in savanna	Herbaceous perennial
Raphionacme villicorona	Apocynaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Rocky outcrops, bushveld	Herbaceous or scrambling shrub
Searsia batophylla	Anacardiaceae	Endemic to Sekhukhuneland	Vulnerable (VU)	Dry, rocky hills and plains	Small tree or shrub

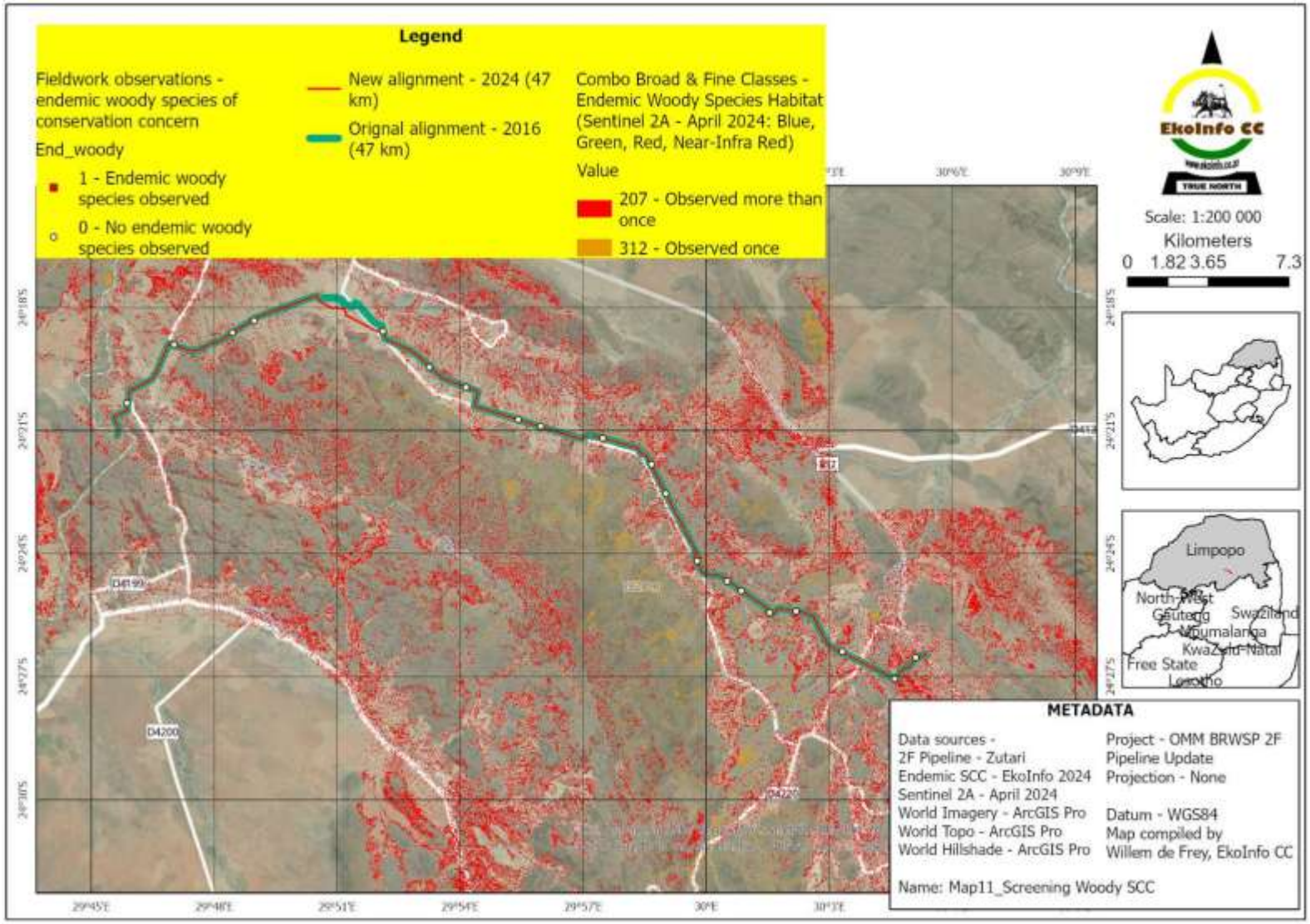


Figure 16: Distribution and extent of potential habitat for the observed Vulnerable endemic shrub *Seersia batophylla*.

Photo plate 6: Aerial based oblique images taken at the three plots where *Seersia batophylla* were observed

Photo plate 7: Collage of flowering and fruiting plants observed during the May 2025 survey

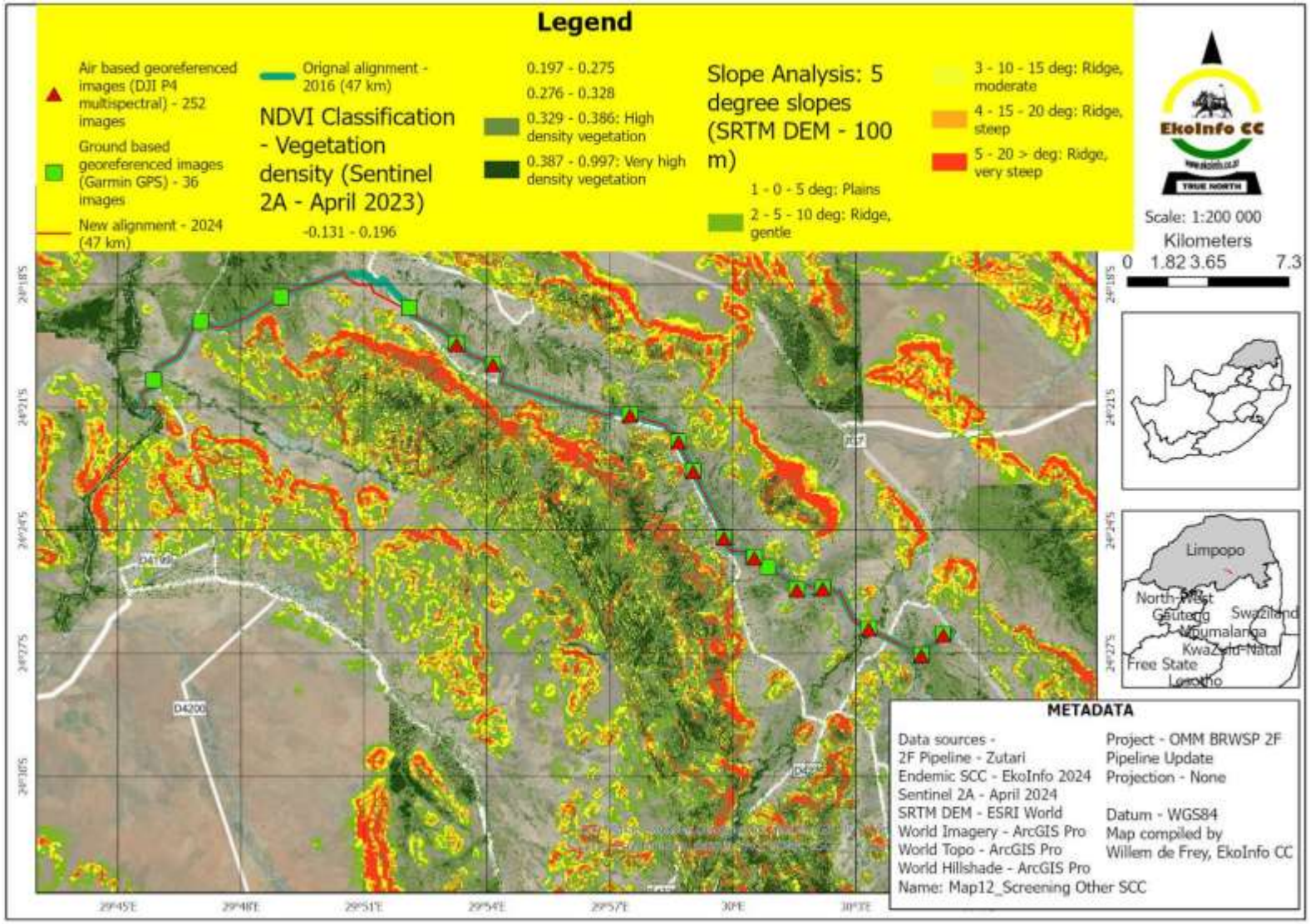


Figure 17: Distribution and extent of potential habitat for the remaining eleven plant species of conservation concern

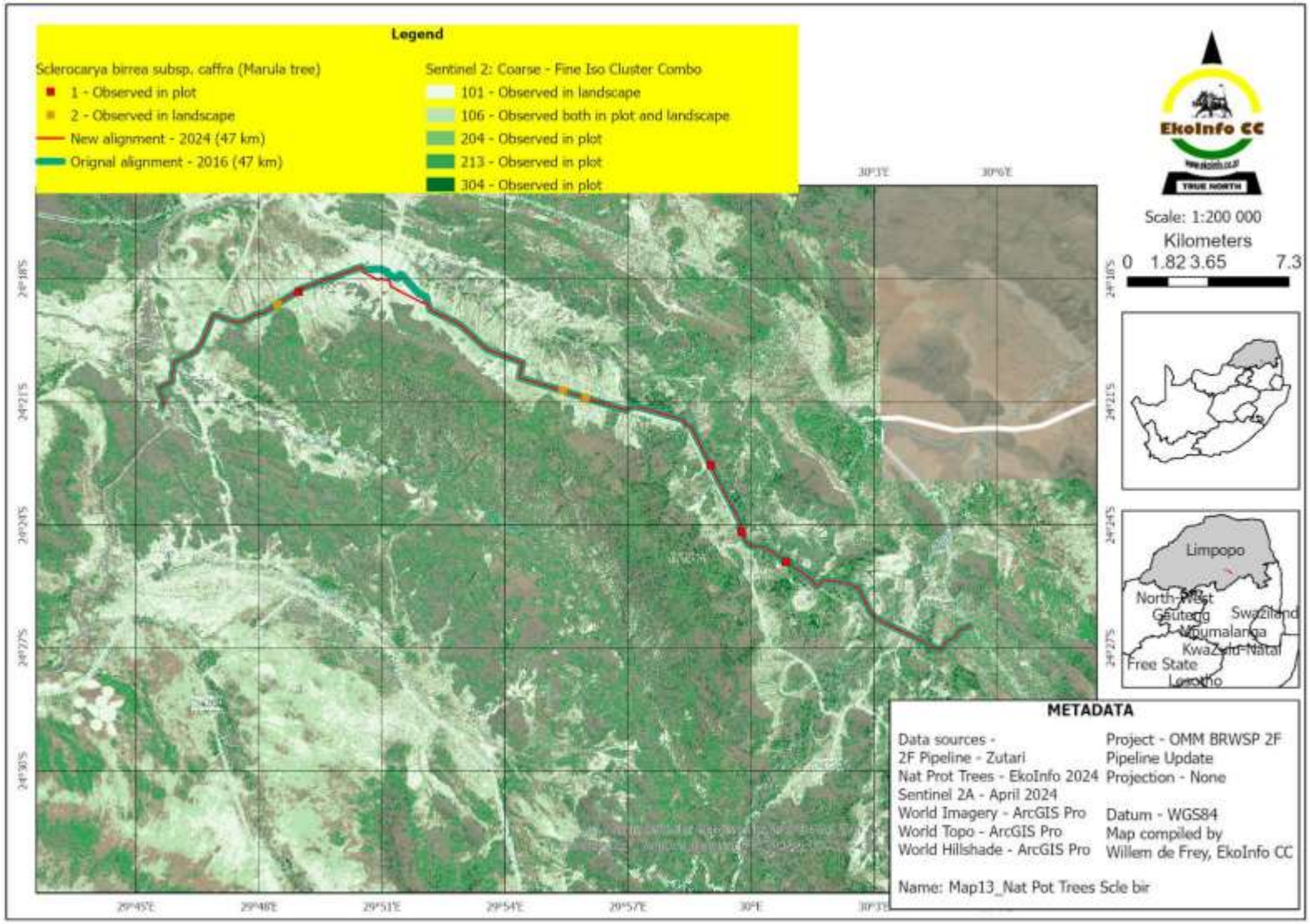


Figure 18: Sentinel 2 derived iso clusters associated with the occurrence of the National Protected Tree: *Sclerocarya birrea* subsp. *caffra*

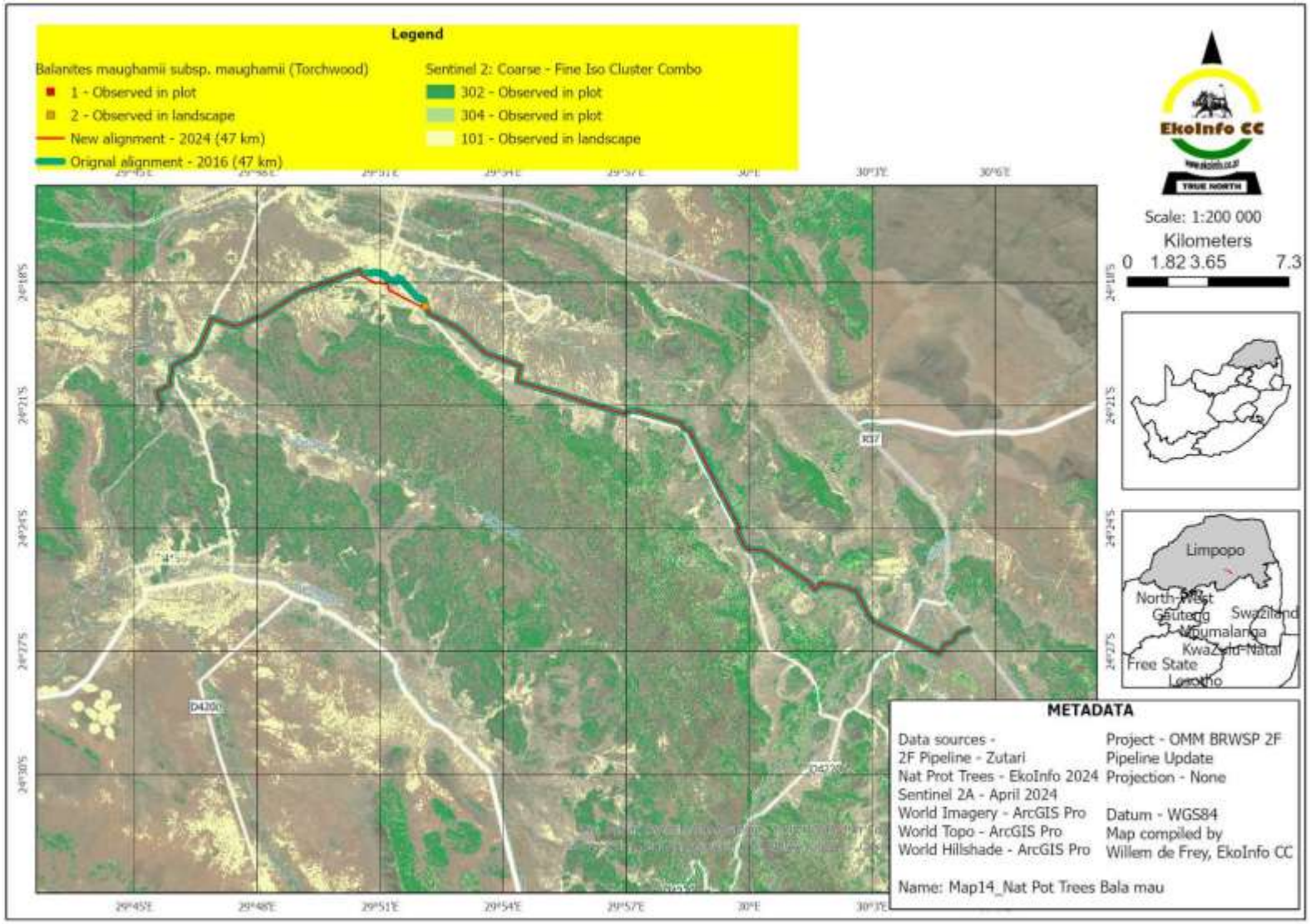


Figure 19: Sentinel 2 derived iso clusters associated with the occurrence of the National Protected Tree: *Balanites maughamii* subsp. *maughamii*

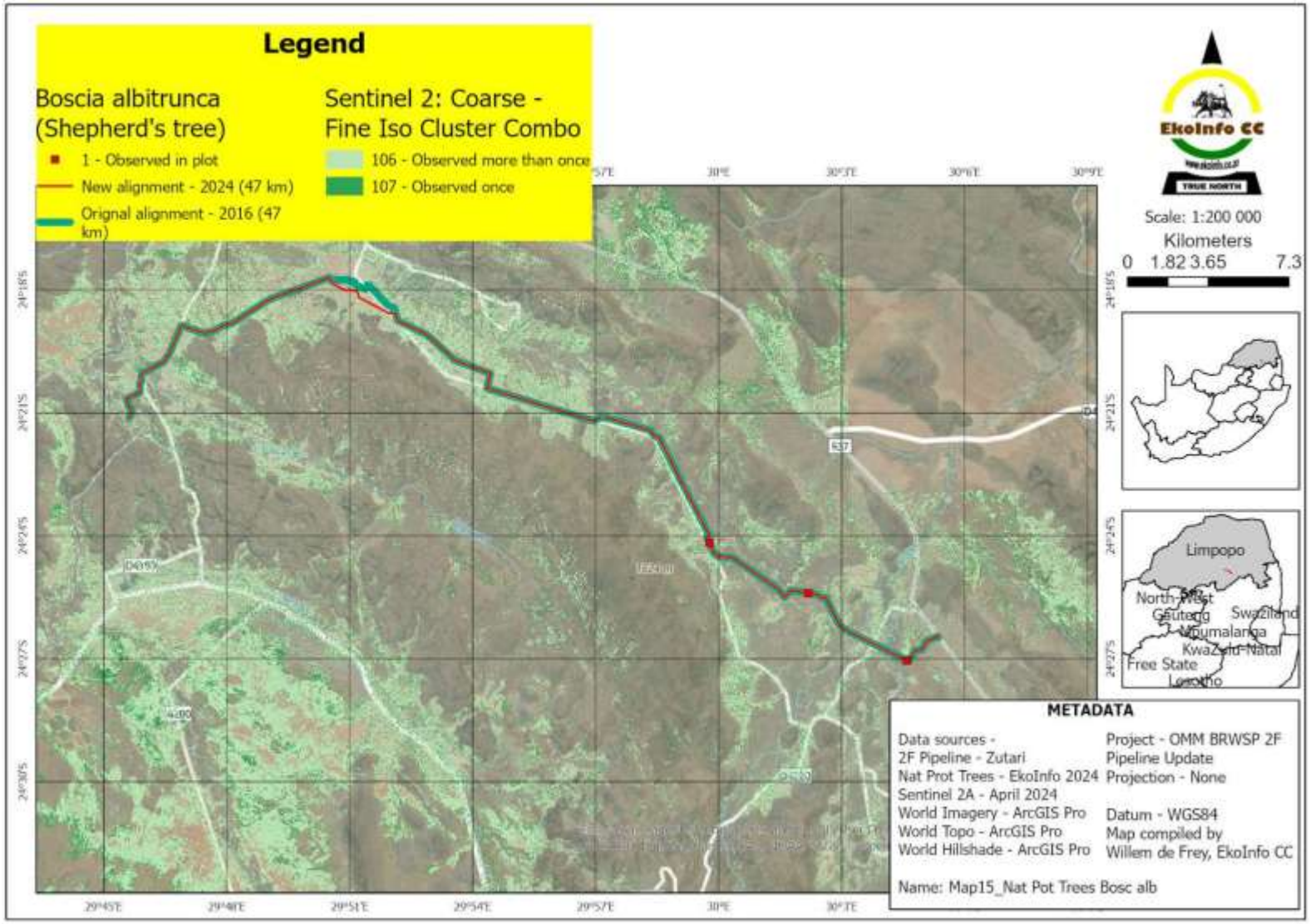


Figure 20: Sentinel 2 derived iso clusters associated with the occurrence of the National Protected Tree: *Boscia albitrunca*

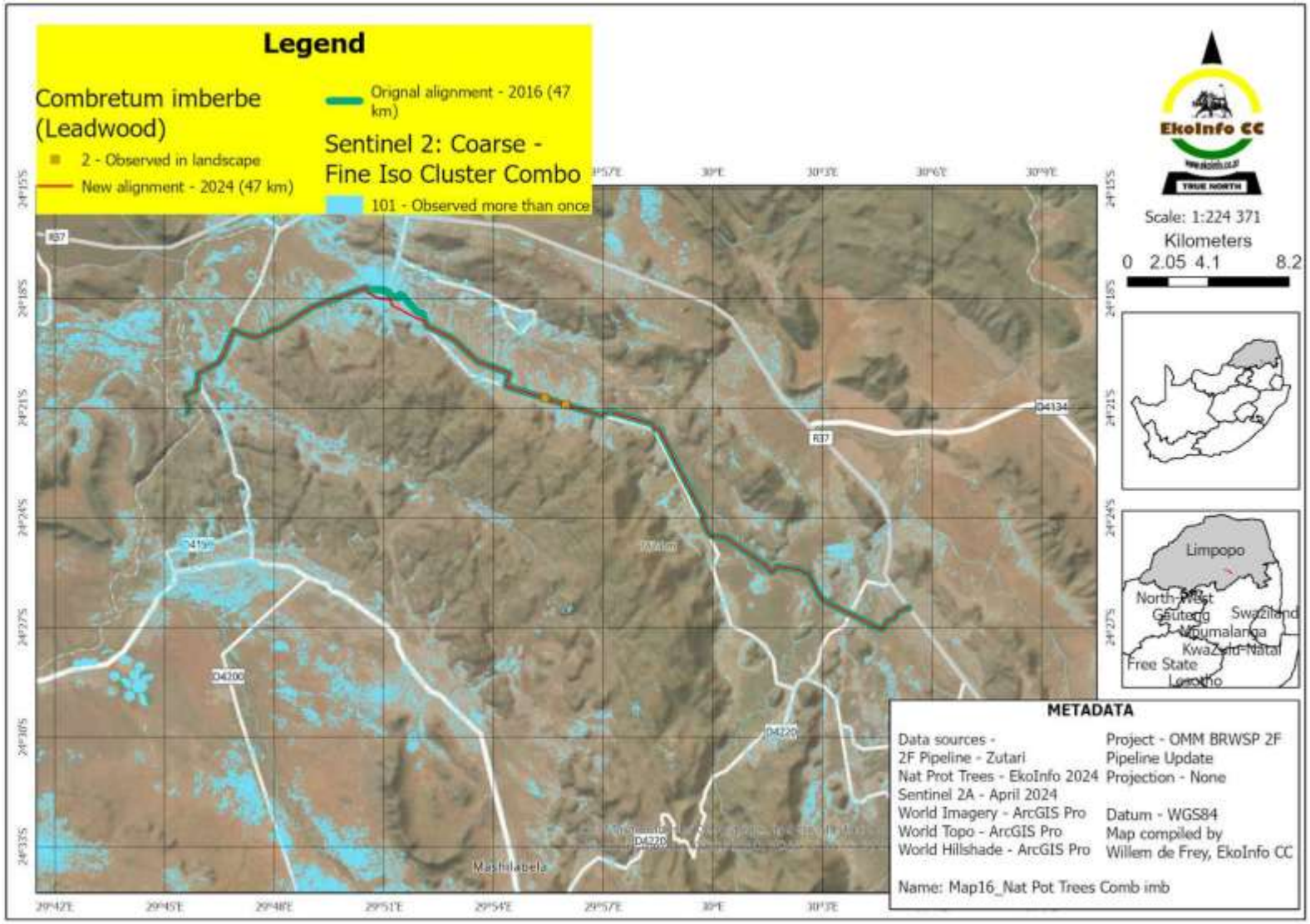


Figure 21: Sentinel 2 derived iso clusters associated with the occurrence of the National Protected Tree: *Combretum imberbe*

Table 7: Overview of the four National Protected Trees that occur within the proposed temporary servitude of the 2F pipeline and surrounding landscape.

Species	Threatened Status	Protected Status (National)	Habitat
Sclerocarya birrea subsp. caffra	Least Concern (SANBI)	Protected under National Forests Act	Prefers savanna and woodland areas, often found in sandy or loamy soils. Widely distributed in lowveld regions.
Balanites maughamii subsp. maughamii	Least Concern (SANBI)	Protected under National Forests Act (Tree #251)	Found in low-altitude woodlands and savannas, often in association with calcareous or sandy soils.
Boscia albitrunca	Least Concern (SANBI)	Protected under National Forests Act	Grows in arid to semi-arid savanna and bushveld, often in sandy or stony soils, including areas with shallow soil over rock.
Combretum imberbe	Least Concern (SANBI)	Protected under National Forests Act	Common in riverine areas and dry savannas, often near watercourses or on alluvial soils. Known for its drought and termite resistance.

5.2 Fauna Component

5.2.1.1 Screening Report – Species of Conservation Concern

The screening report lists eight animal species of conservation concern whose presence or suitable habitat had to be verified during the site visit. These include two vulnerable mammal species (Makwassie Musk Shrew *Crocidura maquassiensis* and Robert's Marsh Rat *Dasymys robertsii*), one vulnerable reptile species (Lobatse Hinged Tortoise *Kinixys lobatsiana*), the endangered Brown False Shieldback (*Aroegas fuscus*) and four threatened bird species (Lanner Falcon *Falco biarmicus*, Secretarybird *Sagittarius serpentarius*, Tawny Eagle *Aquila rapax* and African Finfoot *Podica senegalensis*).

During the May 2025 survey, especially after the area received rains during the March/April period, the probability increased for the potential to observe species of conservation concern, although no additional SCC species were recorded.

5.2.1.2 Makwassie Musk Shrew (Crocidura maquassiensis)

The taxonomic validity of *C. maquassiensis* as a species has remained questionable and it is possible that it may represent a variant of *C. cyanea* or *C. suaveolens* (Meester, 1986). It may also be part of a species complex due to ecological divergence between low-lying Sand Forest sub-populations in Maputaland and sub-populations confined to the highland grassland along the Drakensberg Escarpment (Taylor et al., 2016). It was also thought to be related to *C. pitmani* of Zambia, although its phylogenetic relationship to this species remains unresolved (Skinner & Chimimba, 2005). The type locality (from where it was described) stems from Klipkuil at Makwassie near Wolmaransstad in the North West Province (discovered in 1928).

It is a rare species and hence the sample size of morphometric data pertaining to this species is rather low. This species is extremely difficult to separate from *C. cyanea* and *C. silacea*, and the only objective means of identification entails multivariate morphometric analysis (Taylor et al., 1994). It is a very small species (c. larger than *C. fuscomurina* and smaller than *C. cyanea*) of which the condylo-incisive scull length is very small (c. mean of 18.5 mm). Adults have a total length of c. 100mm (41% 0f its tail length) and the colour of the upperparts is grey-brown, while it weights close to 6 g (making it one of the smaller *Crocidura* members in South Africa) (see Skinner & Chimimba, 2005).

Crocidura maquassiensis is globally Least Concern (Cassola, 2016) owing to its wide distribution range and since it is unlikely to decline fat enough to qualify for any threatened category. However, it is Vulnerable (B2ab(ii,iii,iv)) in South Africa when considering that this species is rare and endemic to South Africa, eSwatini and Zimbabwe. Taylor et al. (2016) applied the precautionary principle and listed this species as Vulnerable since its distribution range appears highly patchy and fragmented and since large areas of suitable habitat appear to be unoccupied by this species (e.g. not a single individual was sampled during a recent survey in the North West Province at Klipspruit. The species is currently threatened due to the loss of moist, rank grassland (along wetlands) owing to the abstraction of surface water during urban and residential expansion, as well as overgrazing in montane areas (Taylor et al, 2016).

C. maquassiensis is only known from a few disparate localities in South Africa, eSwatini and Zimbabwe (Figure 21). It has been recorded in Zimbabwe at Bulawayo and Inynaga and from Matenga Falls in eSwatini. In South Africa is has been recorded in the Limpopo Province (Motlateng, Blouberg and Soutpansberg Mountains), Mpumalanga (Loskop Dam), North West Province (Makwassie) and in KwaZulu-Natal (Kosi Lake, Sibaya Lake, Giants Castle, Royal Natal and Chase Valley). In Gauteng it was only confirmed from Krugersdorp, Roodeplaat Dam and Heuningklip.

Currently, C*. maquassiensis* is known to occur on grassy rocky mountainsides (where it was collected from underneath a rock at Mothlateng at 1,580m; Skinner & Chimimba, 2005), mountain grassland (at the Luvhondo Nature Reserve in the Soutpansberg Mountains; Taylor et al, 2015) and ad bracken-grassland mosaics in mountainous areas (along the Tugela River at 1,500m.a.s.l. at Royal Natal National Park), although a specimen was also collected from coastal forest (at Kosi Bay; Taylor, 1998). The Chase Valley specimen was caught by a cat in a garden on south-facing slopes. The type specimen from

Makwassie was discovered in a house. Therefore, capture localities suggest that this species may tolerate a wider range of habitat types, including urban landscapes (Taylor et al., 2016), although most of the specimens were captured from montane and/or rocky habitat at higher altitudes (>1,500m).

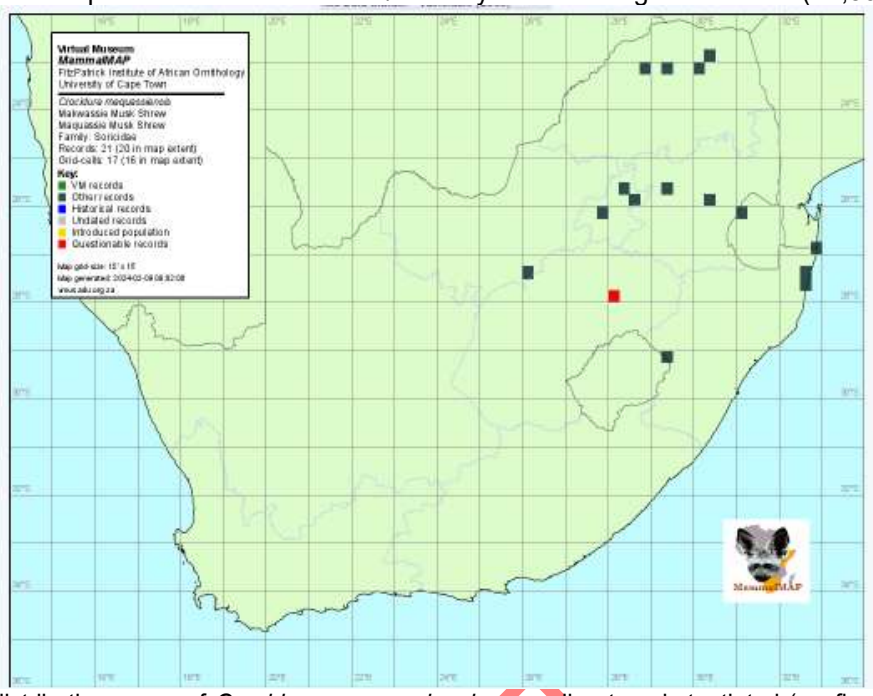


Figure 22: The distribution range of *Crocidura maquassiensis* according to substantiated (confirmed) and museum records (map courtesy and copyright of the ADU and MammalMap).

The ecological requirements and tolerances, as well as knowledge base, of the *C. maquassiensis* remains poorly known. Currently, it is known to occur on grassy rocky mountainsides and bracken-grassland mosaics in mountainous areas, although a specimen was also collected from coastal forest, thereby suggesting that this species may tolerate a wider range of habitat types, including urban landscapes (Taylor et al., 2016).

Based on current knowledge regarding this species habitat preference, is has a low probability of occurrence along the pipeline alignment owing to the absence of suitable habitat. Although many parts of the pipeline alignment were located adjacent to mountain bushveld and outcrops, these were in general highly ephemeral and “arid”, and considered to be unsuitable for this species to occupy. In addition, it has not been observed or collected from the study area (sensu MammalMap).

5.2.1.3 Robert’s Marsh Rat (Dasymys robertsi)

There are currently no recent observations of the vulnerable Robert's Marsh Rat (*Dasymys robertsii*) from the study area and immediate surroundings (sensu MammalMap), which suggest that this species could be uncommon along the pipeline alignment owing to the general absence of suitable habitat. The Robert's Marsh Rat (*Dasymys robertsii*) is listed as regionally vulnerable (sensu Child et al., 2016), although Taylor (1998) stated that it is probably not as rare as previously thought, at least within KwaZulu-Natal where the KZN population forms part of the genetically distinct species *D. cf incomtus*. Marsh rats have been recorded in a wide variety of habitat types, although it prefers well-vegetated wetland habitat. Skinner and Chimimba (2005) also reported that they also utilise reedbeds along rivers and streams. It is therefore possible that this species is easily overlooked based on its shy and elusive habits and life history traits which explains its ominous absence from many parts of South Africa.

Most of the drainage lines corresponding to the pipeline is non-perennial in nature whereby a well-defined marginal zone consisting of reedbeds and facultative wetland plant species were absent, thereby suggesting a general low probability of occurrence for this species to be present. However, the only suitable habitat was observed at the pipeline segment crossing the perennial Olifants River. This part of the Olifants River contained reedbeds along its margin which could potentially be suitable for *D. robertsii* to occur.

5.2.1.4 Lobatse Hinged Tortoise (Kinixys lobatsiana)

Kinixys lobatsiana is vulnerable and near-endemic to South Africa and Botswana where it mainly occurs in bushveld areas in the Limpopo, Gauteng and marginally also northern Mpumalanga Provinces. It also occurs in the extreme south-eastern Botswana (e.g. the type locality). In South Africa its distribution range include three primary clusters, of which the largest is located in the bushveld regions of the Waterberg and associated mountain ranges, the Bankenveld areas of Gauteng from Midrand and Centurion to Pretoria including the Bronberg Ridge, the Magaliesberg Mountain and eastern Mpumalanga, as well as bushveld areas near Zeerust. It occurs primarily in rocky hills consisting of mixed thornveld (*Vachellia* and *Senegalia* Bushveld) and *Combretum* woodland. The presence of surface rock is a critical habitat feature for this species to survive fires and to "hibernate" during the austral winter. In addition, it is invariably collected as food and for cultural purposes, which may result in local extinctions.

This species was not observed during the November site visit (owing to most individuals being dormant during the dry conditions preceding the spring rains) and was also not observed during the May site visit when conditions appeared to be more optimal for this species to be detected. However, its distribution range is sympatric to the extreme northwestern and southeastern parts of study site (c, 2429BC and 2430AC) corresponding to the many outcrops and rocky mountain bushveld located adjacent to the pipeline routes. Therefore, it is highly possible that dispersing individuals from these parts of the study site could be present on the pipeline during the construction phase. Therefore, its occurrence is regarded as high along the southeastern and northwestern sections of the pipeline route (Figure 23).

5.2.1.5 Brown False Shieldbug (Aroegas fuscus)

The Brown False Shieldbug is Endangered with an area of occurrence estimated to be 10 km^2. It is only known from two locations, and the number of locations is expected to be in decline. This species only occurs in Mesic Highveld Grasslands at an elevation above 1200 m. These areas are also suitable for cultivation with timber plantations and human development, so its distribution is likely to decrease in future. The most likely threats to the species are increased grazing by livestock, cultivation with timber plantations or non-perennial crops or human development. Due to its small body size, low motility and current distribution at high elevations, this species cannot be expected to shift its range in response to changes in its habitat.

Based on the above, the probability that this species could occur along the pipeline route is regarded as low (owing to the absence of high altitude mesic grassland habitat). In addition, most of the pipeline occurs at elevations below 1000m as opposed 1200m and higher.

5.2.1.6 Lanner Falcon (Falco biarmicus)

Falco biarmicus is a fairly common species within its global distribution range, where it occurs from south-eastern Europe to the Middle East, south-west Asia and across most of Africa (Jenkins, 2005). The global population consists of more than 30 000 breeding pairs with approximately 1,400 pairs confined to the eastern parts of South Africa (Tarboton & Allen, 1984). The national conservation status of this species was upgraded from Near threatened to Vulnerable due to persistent transformation of suitable foraging habitat (e.g. open areas) to make way for agricultural land and disturbances at nesting sites (Taylor, 2015).

This species is often associated with hills, ridges, and mountain ranges where it prefers to nest on steep and inaccessible cliffs. It prefers to forage over open terrain and will hunt indiscriminately over almost any open area with suitable prey (mainly terrestrial birds such as francolins and lapwings as well as doves and pigeons).

It was confirmed during the site visit and is regarded as a regular foraging visitor to the study site (Figure 24) and may hunt indiscriminately on all of the habitat units on the site depending on the availability of prey. However, suitable breeding habitat occurs in the surrounding mountains, whereby it is unlikely that the construction of the pipeline will impact on the breeding success of this species. However, this species was also confirmed during the May 2025 survey at the same locality where it was observed in 2024, thereby suggesting that it is partial to the area between sample sites Teo15 and Teo16.

5.2.1.7 Secretarybird (Sagittarius serpentarius)

The regional conservation status of this species was upgraded to Vulnerable since recent evidence suggests that it has experienced rapid declines across its entire range due to habitat loss, anthropogenic disturbances, and intensive grazing (Taylor, 2015). However, its global conservation status was recently uplisted from Vulnerable to Endangered since large declines have been recently reported throughout its range, which include Botswana, eSwatini and South Africa (Birdlife International, 2020). Secretarybirds are widespread in Africa south of the Sahara, but have declined over most of their geographic distribution range. Based on reporting rates, they appear to be more regularly observed in large conservation and rural areas, and this explains why reporting rates are relatively low on areas that are not statutorily conserved. Secretarybirds prefer open areas, in particular open savanna and grassland, but tend to avoid areas of dense bush or very rocky areas.

It is worth mentioning that many large terrestrial bird species, including Secretarybirds, show widespread declines in numbers, primarily due to large-scale loss of habitat, especially the loss of large patches of grassland. It is postulated that this steady decline of suitable habitat has "forced" this species to utilise other "sub-optimal" areas, many being closely associated with human settlements, where it is often confronted or threatened by human activities.

Secretarybirds are regarded as irregular foraging visitors to the study site comprising of open savannoid woodland and regenerating agricultural fields. However, due to the high frequency of anthropogenic activities and human pedestrians in the area, it is believed that this is probably displaced from many sections of the pipeline alignment. Therefore, the probability of occurrence for this species along the 2F pipeline route is medium to low.

5.2.1.8 Tawny Eagle (Aquila rapax)

The Tawny Eagle is a threatened species listed as Endangered in South Africa, while its global conservation status is listed as Vulnerable (BirdLife International, 2021). It is mainly threatened by the poisoning of mammalian carcasses and due to collisions with powerlines. It has a wide distribution range which is centred on the arid parts of the country as well as lowveld where it favours open woodland and wooded savanna. However, most of its breeding range is confined to large, protected areas where the prevalence of carrion is high. It Its diet include a wide variety of prey species, but it favours carrion and is therefore often found near or at mammalian carcasses. Therefore, its occurrence is largely dependant on the availability of carrion.

It is regarded as a highly irregular foraging visitor to the pipeline route, and its probability of occurrence is regarded as low.

5.2.1.9 African Finfoot (Podica senegalensis)

The African Finfoot is listed as Vulnerable and is a shy and elusive sedentary species. It is restricted to quiet, wooded perennial rivers and streams with dense overhanging vegetation and dense trees. However, it avoids stagnant and vary fast flowing waterways with a preference for clear rather than silted water.

The only suitable habitat for this species to occur is along the perennial Olifants River (Figure 25), whereby all the other drainage lines along the pipeline route were regarded as unsuitable due to their non-perennial and seasonal conditions. It is highly recommended that the pipeline should bridge the Olifant River and damming or the creation of weirs at the pipeline crossing of the river during construction should be avoided to allow for the dispersal of this species along the river.

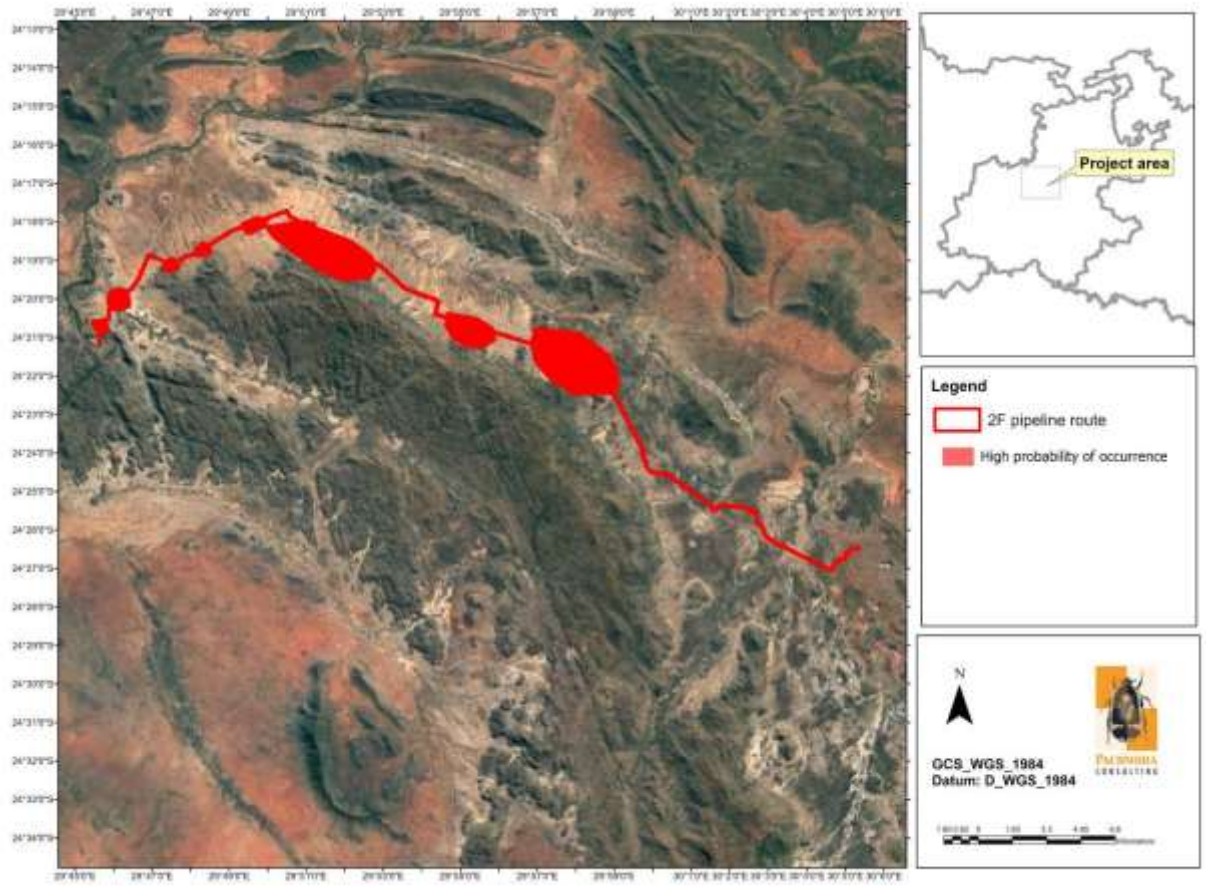


Figure 23: Potential **s**uitable habitat for the occurrence of *Kinixys lobatsiana* along the 2F pipeline route.

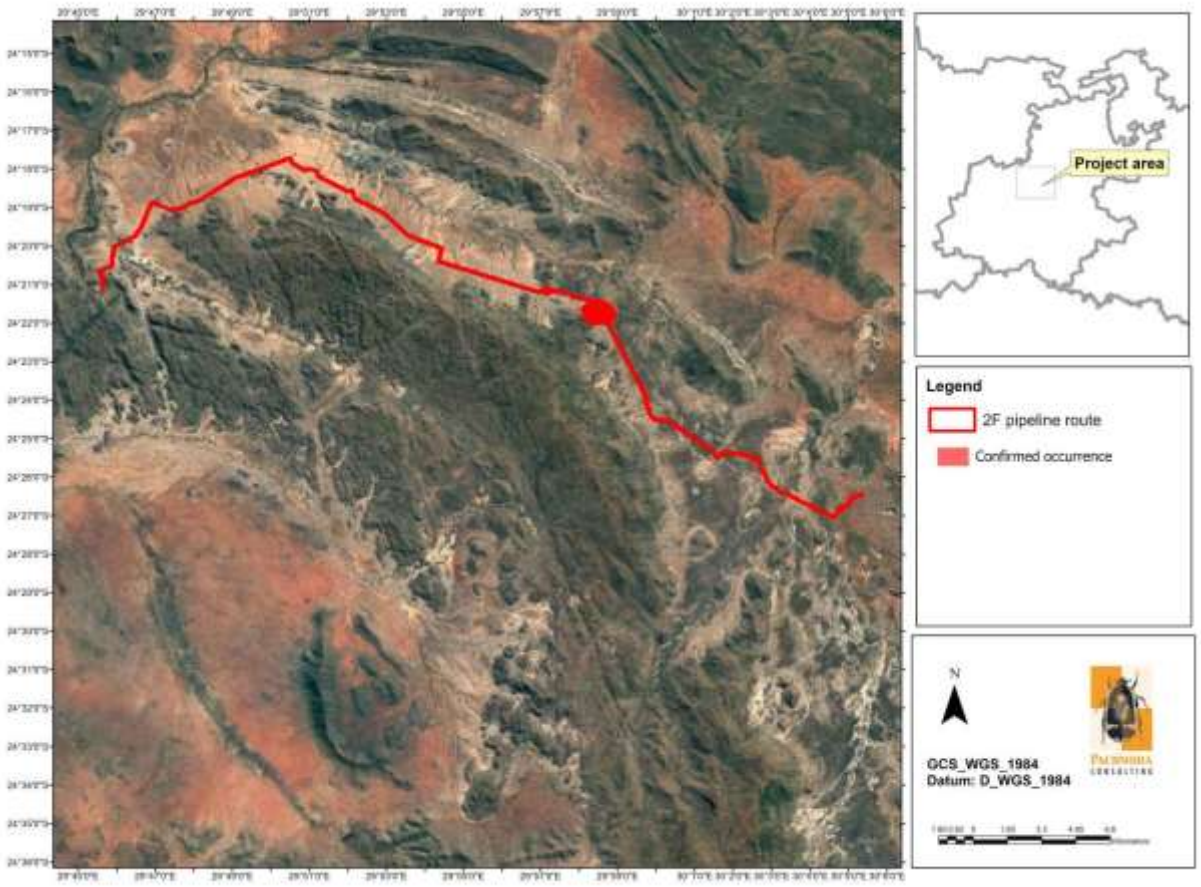


Figure 24: An example of a confirmed observation of a foraging Lanner Falcon (*Falco biarmicus*) individual along the 2F pipeline route.

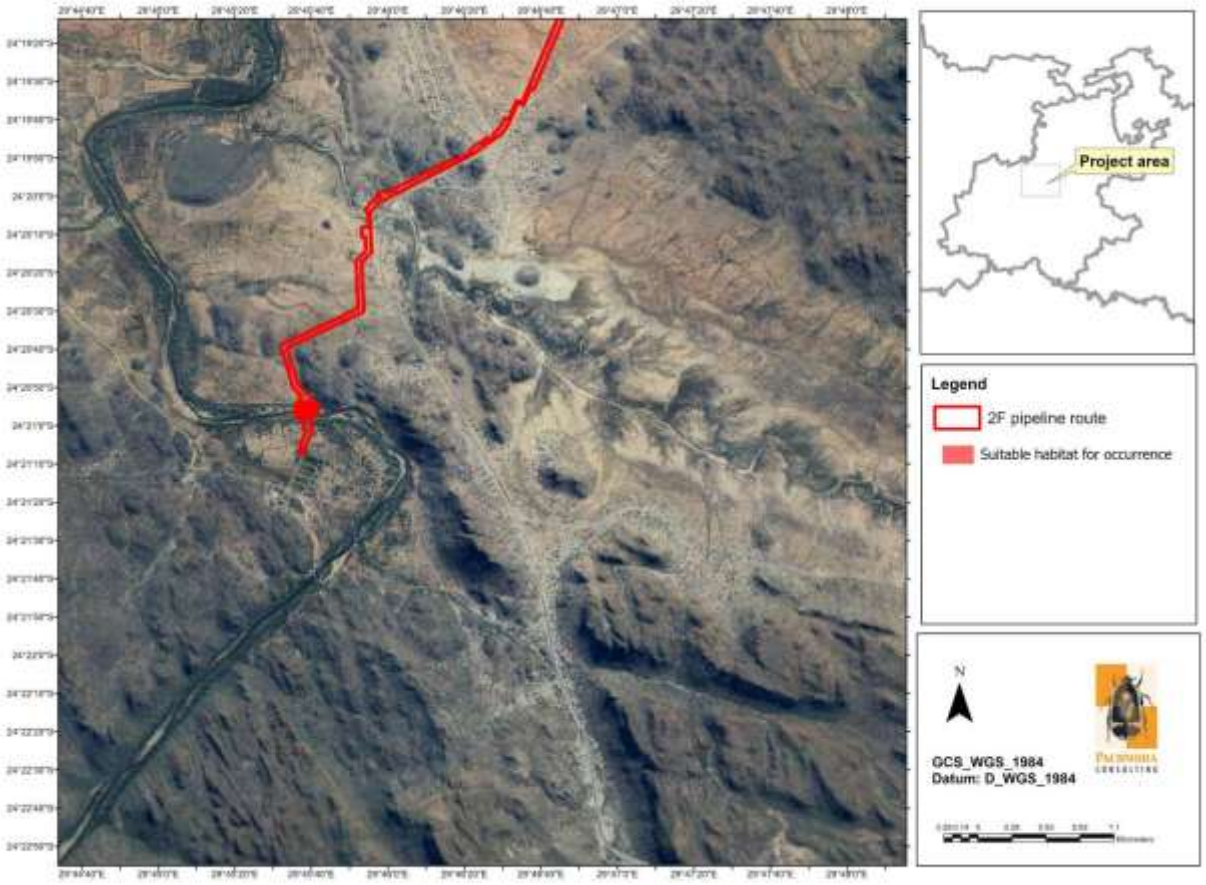


Figure 25: Potential **s**uitable habitat for the occurrence of African Finfoot (*Podica senegalensis*) along the 2F pipeline route.

5.3 IFC SP 6 Mapping Units

5.3.1 Identification of Critical Habitats

Figure 26 shows the distribution and extent of IFC PS6 critical habitat along the proposed pipeline alignment. The temporary disturbance of the pipeline servitude during the construction will affect less than 1% of the critical habitat within the landscape (Table 8).

5.3.2 Habitat Assessment and Baseline Surveys

Figure 27 shows the distribution and extent of IFC PS6 natural and modified areas along the proposed pipeline alignment. The temporary disturbance of the pipeline servitude during the construction will affect less than 1% of the remaining natural areas within the landscape (Table 9).

It is evident from this latest land cover classification from National Department of Environmental Affairs[7] that the proposed pipeline cuts mainly through a landscape which experienced 52% modification, with the pipeline servitude temporarily affecting 27% natural areas. Therefore, the temporary disturbance of the pipeline servitude if effectively rehabilitated will influence less than 1% of the landscape, which is clearly not a significant impact.

Also evident from this analysis is that currently cultivation is the main driver of habitat loss in the landscape, with 39% of the landscape modified due to cultivation (Table 9).

[7] https://egis.environment.gov.za/

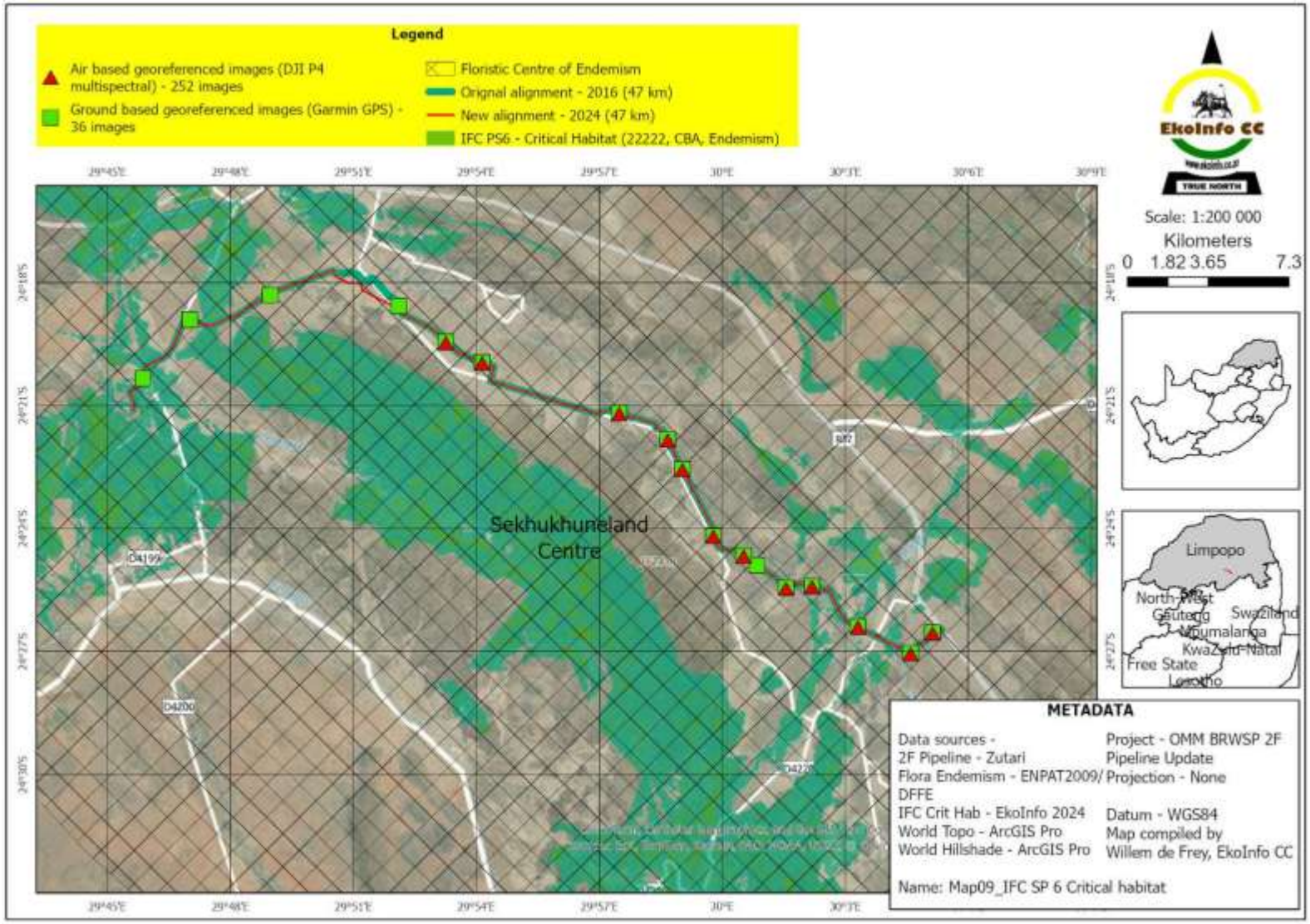


Figure 26: Distribution and extent of IFC PS6 Critical Habitat along the proposed current alignment

Table 8: Overview of the surface area and percentage cover of IFC PS6 based critical habitat within the landscape associated with the study area

Regional Context (Landscape level)			Temporary Pipeline Disturbance	
IFC PS6 Habitat Units	**Hectares**	**% Cover**	**Hectares**	**% of landscape**
Critical Habitat (22222, CBA, Endemism)	69 481	36%	10.0314	0.01%
Non-critical habitat	122 019	64%	168.2168	0.14%
Total landscape area	**191 500**	**100%**	**178.2482**	

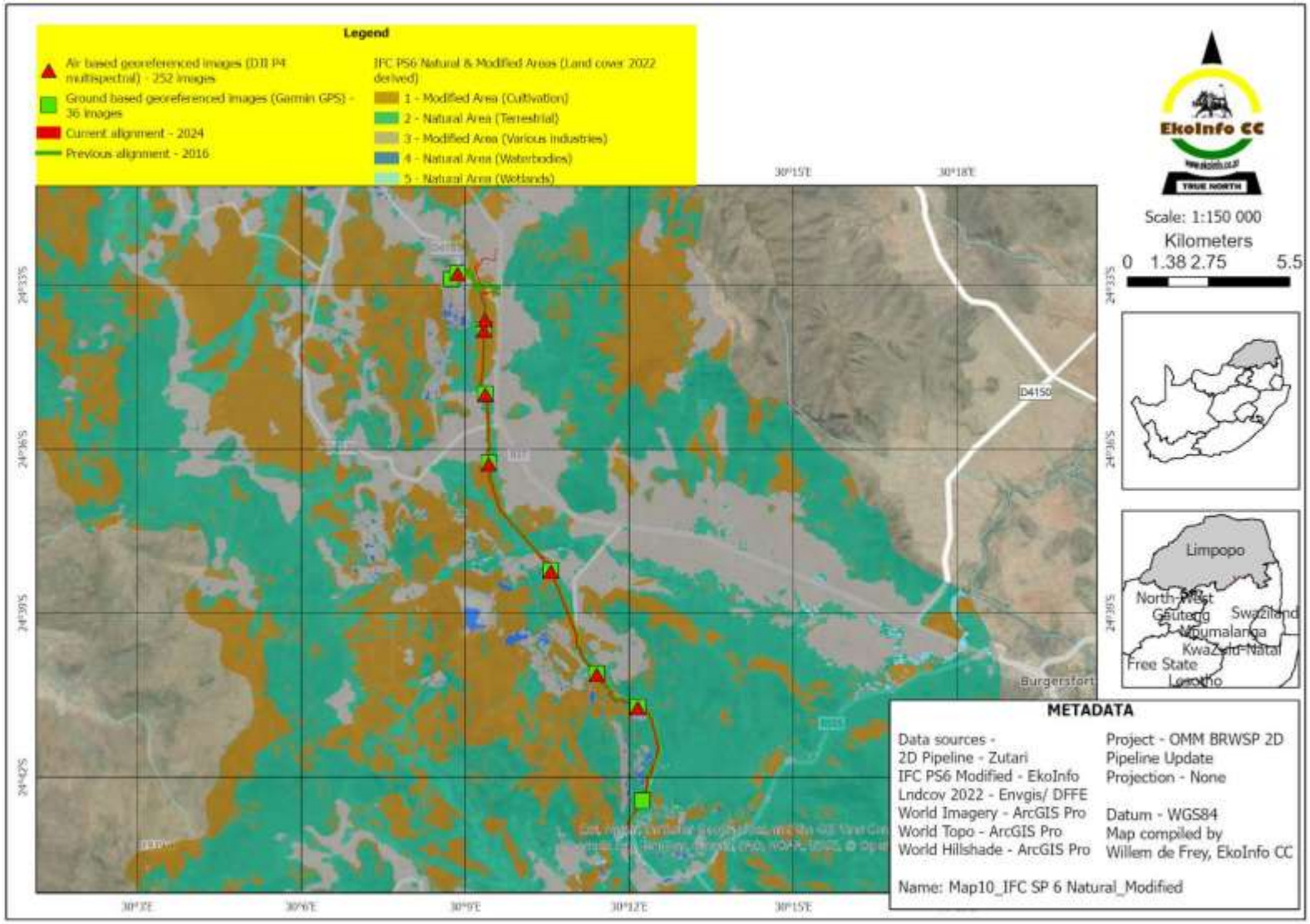


Figure 27: Distribution and extent of IFC PS6 natural and modified areas along the proposed current alignment

Table 9: Overview of the surface area and percentage cover of IFC PS6 based natural and modified areas within the landscape associated with the study area

Regional Context (Landscape level)					Temporary Pipeline Disturbance		
IFC PS6 Natural and Modified Areas (Land cover 2022 derived)	**Hectares**	**% Cover**	**IFC PS6 Mapping Units**		**Hectares**	**% Cover**	**% of landscape**
			Modified Area	**Natural Area**			
1 - Modified Area (Cultivation)	74 714	39%	74 714		102.7394	58%	0.14%
2 - Natural Area (Terrestrial)	92 182	48%		92 182	47.6440	27%	0.05%
3 - Modified Area (Human settlement)	24 257	13%	24 257		27.5115	15%	0.11%
4 - Natural Area (Waterbodies)	184	0%		184		0%	
5 - Natural Area (Wetlands)	495	0%		495	0.0895	0%	
Total landscape area	**191 500**	**100%**	**98 970**	**92 861**	**178.2482**	**100%**	
			52%	48%			

6 ENVIRONMENTAL IMPACT ASSESSMENT

6.1 Flora Component

The impacts associated with the bulk water supply line construction is localised and temporary (Photo plate 8) and will influence less than one percent of the remaining natural vegetation within the landscape, whether critical habitat or not.

If the topsoil is effectively managed, this impact will be even less as the above ground disturbance will be restored through natural succession (Photo plate 9). It is CRITICAL that the topsoil should be stored separate from the subsoils and placed on top of the subsoils. The removed topsoil should be replaced in the same vicinity from which it had been removed.

Once the topsoil had been replaced within the same area, the servitude can be maintained with local labour and soft water infiltration techniques (Photo plate 10).

If effective and DICIPLINED topsoil management can be implemented, then the system should effectively restore over time because of the seedbank and soil micro-organisms present in the system.

Use of non-regionally indigenous species and fertiliser should be limited, as it results in local livestock concentrating on these areas. In the absence of fertiliser, the domestic animals utilise the areas as normal and move on once they have removed the above ground biomass.

The section below highlights the value of effective topsoil management and risk of using pasture species and fertiliser in rehabilitation/ restoration.

6.1.1 Effective Topsoil Management in Natural Areas: Benefits and Risks in Rehabilitation

Rehabilitation and restoration of natural areas after infrastructure development, such as pipelines or construction projects, rely heavily on proper topsoil management. The careful handling of topsoil offers numerous ecological and economic benefits by preserving the natural seed bank, nutrients, and soil structure necessary for successful vegetation recovery. However, combining topsoil with pasture grasses and fertilizers introduces risks that can undermine these efforts, particularly when livestock or game are attracted to the rehabilitated area.

6.1.1.1 Benefits of Effective Topsoil Management

Preservation of Native Seed Banks

Natural topsoil contains a diverse range of indigenous plant seeds and microorganisms that are uniquely adapted to the local environment. By carefully stripping, storing, and reapplying topsoil after construction, the natural vegetation has a greater chance of re-establishing itself, reducing the need for costly reseeding or planting.

Enhanced Soil Stability and Water Retention

Reapplied topsoil provides a stable, organic-rich layer that supports root growth and reduces soil erosion. Its natural structure also improves water infiltration and retention, minimizing irrigation requirements during the early stages of rehabilitation.

Support for Biodiversity and Natural Succession

Using the existing topsoil promotes the recovery of a diverse plant community suited to the local conditions. This supports long-term ecological succession, creating a self-sustaining ecosystem that integrates seamlessly with the surrounding environment.

Photo plate 8: Images showing the construction of the bulk water supply pipeline – Phase 2C (Various sources)

Start of dragline walkway – topsoil separated from subsoil (EkoInfo CC - Aug 2019)

Topsoil returned in the same location – no fertiliser, no seed added (EkoInfo CC - Feb 2020)

Manual labour addressed surface crusting (bare patches)and alien vegetation (EkoInfo CC – Feb 2021)

Difficult to distinguish the disturbed dragline walkway from the undisturbed area (EkoInfo CC – Feb 2022)

Photo plate 9: Overview of how the effective topsoil management results in the full recovery of a disturbed areas with minimal cost

Photo plate 10: Soft manual labour-based techniques used to improve water infiltration and – retention in bare patches (EkoInfo CC Dragline walkway 2019 – 2022)

Photo plate 11: Concentration of local domestic animals on the 2C servitude post rehabilitation (EkoInfo CC 2019)

Cost-Effective Rehabilitation

By utilizing the natural resources already present in the topsoil, there is less need for imported soil amendments, fertilizers, or intensive management, resulting in significant cost savings.

6.1.1.2 Risks of Using Pasture Species and Fertilizers

While fertilizers and pasture grasses may seem like convenient tools to accelerate vegetation growth, their use in natural areas often creates significant ecological challenges:

Attraction of Livestock and Game

Fertilized areas and planted pasture species are highly palatable to livestock and wildlife. This can lead to:

- Overgrazing: Animals can quickly strip vegetation from rehabilitated areas, exposing soil to erosion and delaying recovery.
- Soil Compaction: Heavy grazing and trampling by animals compact the soil, reducing its water-holding capacity and making it harder for vegetation to re-establish.
- Localized Habitat Degradation: Concentrated grazing pressure can damage not only the rehabilitated area but also adjacent ecosystems, spreading the impact.

Proliferation of Weeds

Fertilizers often favour fast-growing, invasive species or weeds that outcompete native plants. This reduces biodiversity and prevents natural succession, resulting in a vegetation community dominated by opportunistic species.

Disruption of Native Plant Establishment

Many indigenous species are adapted to nutrient-poor soils. Excessive fertilizer use creates conditions unsuitable for these species, hindering their ability to establish and delaying the recovery of a stable native ecosystem.

Increased Maintenance Costs

The proliferation of weeds, the need to manage grazing animals, and the failure of native species to thrive may result in ongoing maintenance and higher costs over time.

6.1.1.3 Balancing Rehabilitation Practices

To maximize the benefits of topsoil management while minimizing the risks associated with fertilizers and pasture species, the following practices are recommended:

Prioritize Natural Recovery

Focus on reapplying natural topsoil to support the regrowth of indigenous vegetation without relying heavily on fertilizers or non-native species.

Use Fertilizers Sparingly

Apply only minimal amounts of fertilizer to address specific nutrient deficiencies in severely degraded areas. Avoid broad-scale fertilization to prevent weed proliferation and the disruption of native plant communities.

Manage Livestock and Game

Implement measures such as temporary fencing, rotational grazing, or exclusion zones to prevent overgrazing and soil compaction in rehabilitated areas.

Monitor and Remove Weeds

Actively monitor for the spread of invasive species or weeds and remove them early to prevent them from dominating the landscape.

Encourage Native Plant Growth

Utilize locally sourced seeds and plants that are well-adapted to the area, ensuring they can thrive in the existing soil conditions and form a stable, self-sustaining plant community.

6.1.1.4 Conclusion

Effective topsoil management is critical to the success of rehabilitation and restoration in natural areas, providing a foundation for the recovery of native vegetation and soil stability. However, the introduction of pasture species and fertilizers can attract livestock, leading to overgrazing, soil compaction, and ecological imbalance. By prioritizing natural processes, minimizing fertilizer use, and controlling grazing, rehabilitation efforts can achieve long-term ecological and economic sustainability.

6.1.2 Impact Assessment

Zutari as the lead environmental consultants provided the impact assessment methodology. The following impacts expected impacts had been evaluated (Appendix B):

1. Loss of flora diversity in natural areas
2. Loss of endemic plant species in natural areas
3. Loss of threatened plant species in natural areas
4. Alien invasive plant encroachment
5. Removal of regionally indigenous woody species
6. Removal of National Protected Trees with the servitude footprint
7. Loss of floristic microhabitat associated with outcrops

Only the construction phase is evaluated because if the nature of the disturbance is temporary in nature for most of the pipeline servitude, and if the topsoil is well managed, and effectively returned to the disturbance footprint, the need for maintenance and monitoring during the operational phase will be minimal.

It should be highlighted that the pipeline is located within the Savanna Biome of South Africa, where the dominant and prominent growth form is woody species. Therefore, working towards a post construction servitude that looks like grassland or pasture is not representative of the natural system prior to the construction of the pipeline. This is evident in the image taken of 2C pipeline post construction (Photo plate 11).

Figure 28 provides an overview of the impact risk associated with the flora component due to the bulk water supply pipeline construction without any mitigation, most of the impacts are certain to occur, with slight to high consequences. Figure 29 shows that it is very likely that the required mitigation will be implemented, and that it would result in slight to moderate consequences.

The main areas where high impacts or negative consequence can occur is in association with outcrops (boulders or sheet) and existing eroded areas with a high presence of endemic plants (Photo plate 6). Alternative construction methods as highlighted in Appendix D should be considered.

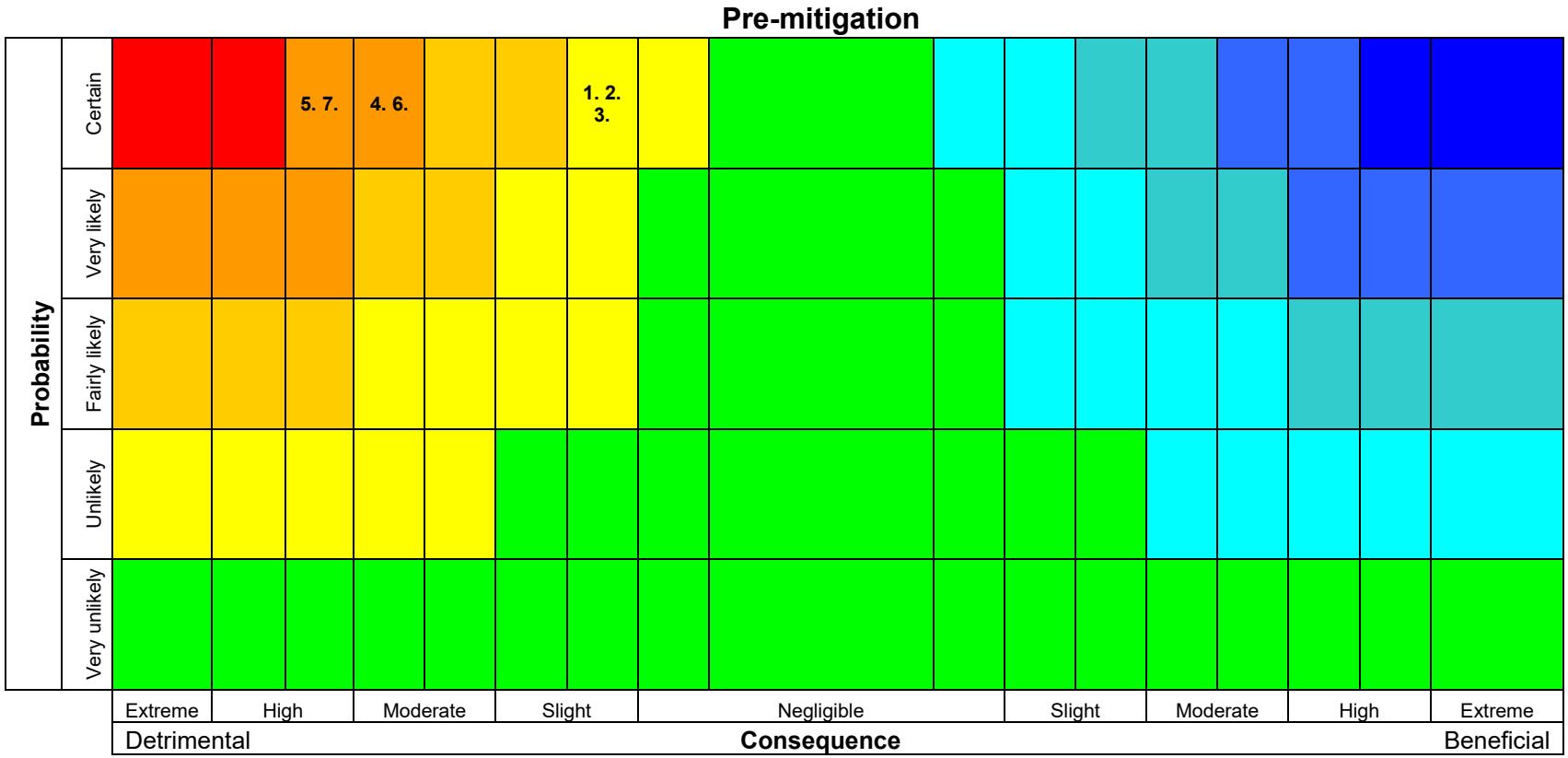


Figure 28: Overview of the impact risks associated with the flora component prior to mitigation

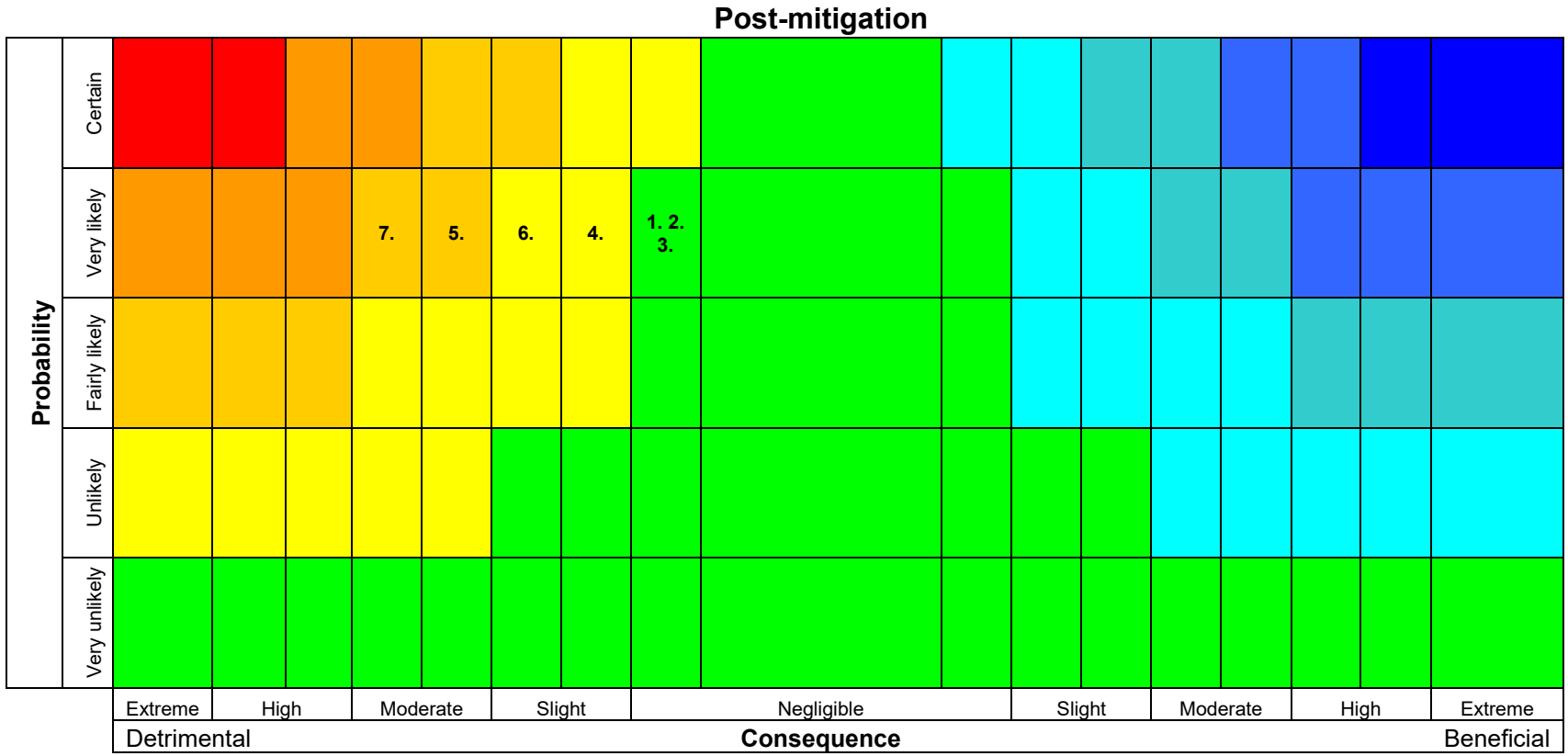


Figure 29: Overview of the impact risks associated with the flora component post mitigation

6.2 Fauna Component

The impacts associated with the bulk water supply line construction is localised and temporary and will influence less than one percent of the remaining natural habitat units within the landscape, whether critical habitat or not (see Appendix C).

It is especially small and less mobile species that depend on specific habitats for food, shelter, and breeding. Such species are particularly vulnerable to habitat destruction, fragmentation, and direct disturbances caused by construction activities.

6.2.1.1 Loss of habitat and displacement of fauna taxa

The proposed construction of the pipe will result in the loss and clearing of natural vegetation.
In general, the impact caused by opencast mining and the loss of habitat will be of high significance on habitat with high sensitivities. The only option within the mitigation hierarchy that could reduce the impact significance on habitat of high importance (e.g. donga structures and wetland features) would be Avoidance, which would reduce the impact significance.

Recommended Mitigation measures

No plausible mitigation is possible to prevent the direct loss of habitat and subsequent loss and displacement of faunal species of conservation concern. The only viable option within the Mitigation Hierarchy is Avoidance and or by placing the pipeline above ground on sensitive areas.

Mitigation of residual impacts persisting after Avoidance:

- Implement a rehabilitation management plan with the objective to manage rehabilitated sections after construction through conservative grazing, fire management and continual eradication of alien plant species. Sustainable grazing at conservative stocking rates (by domestic livestock or game) is an essential environmental factor in maintaining veld condition and floristic diversity. Overgrazing can however be detrimental to the vegetation, and carrying capacity of the such areas of the rehabilitated areas should be estimated to ensure that overgrazing is prevented.
- Landscaping should make use of indigenous plant species, and preferably of species native to the project area and immediate surroundings. The plant species selected should strive to represent habitat types typical of the ecological landscape prior to construction.
- If any faunal species of conservation concern (especially Kinixys lobatsiana) are exposed during the construction phase, a natural scientific professional registered in the field of zoological science and/ or ecological science who specialise in the species of concern will be appointed to assist with its capture, translocation and safe release to nearby suitable habitat with the relevant permits obtained from the authority.
- Screen sections of pipeline prior to construction for individuals of *Kinixys lobatsiana* - if found these should be released into suitable habitat adjacent to the pipeline property
- All domestic waste generated (if present) during construction should be removed from the project area as soon as possible and be disposed at an authorised landfill to reduce the risk of colonization by feral mammals, scavengers or competitively superior bird species (e.g. Pied Crows *Corvus albus*).
- Personnel and staff should be advised by means of environmental awareness training on the biodiversity importance of the area. The intentional killing of any faunal species (in particular invertebrates, reptiles and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of conservation issues pertaining to the taxa occurring on the project area.

6.2.1.2 Disruption of ecological connectivity and faunal dispersal

Construction activities could aggravate fragmentation and the disruption of natural ecological corridors in the area, thereby impeding the dispersal of faunal species as well as the potential for re-colonisation and recruitment of fauna species to the project area during rehabilitation. It is especially sub-populations of

large-bodied mammal species that are at risk of becoming fragmented if natural connectivity is disrupted and when the surface area of natural corridors is reduced to the point that these animals can no longer disperse across the project area.

Recommended Mitigation measures

- Ensure that construction activities do not overspill onto adjacent natural habitat in order to provide displaced fauna the opportunity to disperse into suitable habitat (although potential dispersal by small animals is highly limited).
- The construction area should be barricaded with permeable fencing to allow for the free movement of animal species.
- It is recommended that prior to commencement of barricading, to ensured that the no animal species are trapped within any fenced area.

6.2.1.3 Illegal utilization of faunal resources

The presence of a labour within the project area during mining activities will increase the risk of illegal utilization of fauna resources, such as hunting of small antelope and trapping of small mammals and birds. It is assumed that labour will be accommodated in nearby towns/villages and not on site, which would lower this risk of hunting and poaching considerably.

In addition, the project may also result in increased utilisation of natural resources due to potential human encroachment and accessibility to the project area owing to people seeking jobs. This could result in the establishment of illegal settlements on areas consisting of natural habitat on the project area where active construction is absent.

Recommended Mitigation measures

- Contractors and labour should be accommodated off-site (in order words NOT on the project area), reducing the risk of illegal harvesting of natural resources.
- Labour supervisors and SHE officials should monitor the activities of labourers when working away from infrastructure in natural habitat.
- Personnel and staff should be advised by means of environmental awareness training on the biodiversity importance of the area. The intentional killing of any faunal species (in particular invertebrates, reptiles and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of conservation issues pertaining to the taxa occurring on the project area.
- Regular monitoring of the project area, especially areas of natural habitat where active construction/rehabilitation activities are absent, is advised to identify areas where illegal settlement may occur. If any illegal erecting of housing occurs, the mine's public liaising officer should immediately advice on a resolution, which may involve a re-location strategy.

6.2.1.4 Direct faunal mortalities

Construction of the pipeline will result in the creation of deep trenches that could result in "death" traps for smaller less mobile animals (e.g. reptiles and frogs). Any animal that is may have fallen into the pipeline trench could perish over time if not rescued.

Recommended Mitigation measures

- Implement daily (preferably in the morning) checks of exposed trenches for animals species that may have fallen into the trench. If so, such animals should be captured and safely released into suitable adjacent habitat by the ECO.
- If any venomous snake species is trapped within the pipeline trench, then the services of a certified snake handler should be seeked for the safe capture and release of the snake.
- Personnel and staff should be advised by means of environmental awareness training on the biodiversity importance of the area. The intentional killing of any faunal species (in particular invertebrates, reptiles and snakes) should be avoided by means of awareness programmes

presented to the labour force. The labour force should be made aware of conservation issues pertaining to the taxa occurring on the project area.

- Regular monitoring of the project area, especially areas of natural habitat where active construction/rehabilitation activities are absent, is advised to identify areas where illegal settlement may occur. If any illegal erecting of housing occurs, the mine's public liaising officer should immediately advice on a resolution, which may involve a re-location strategy.

Figure 29 provides an overview of the impact risk associated with the fauna component due to the bulk water supply pipeline construction without any mitigation, most of the impacts are certain to occur, with slight to high consequences. Figure 30 shows that it is very likely that the required mitigation will be implemented, and that it would result in slight to moderate to low consequences.

The main areas where high impacts or negative consequence can occur is in association with outcrops (boulders or sheet) and existing eroded areas with a high presence of species of conservation concern. Alternative construction methods as highlighted in Appendix D should be considered.

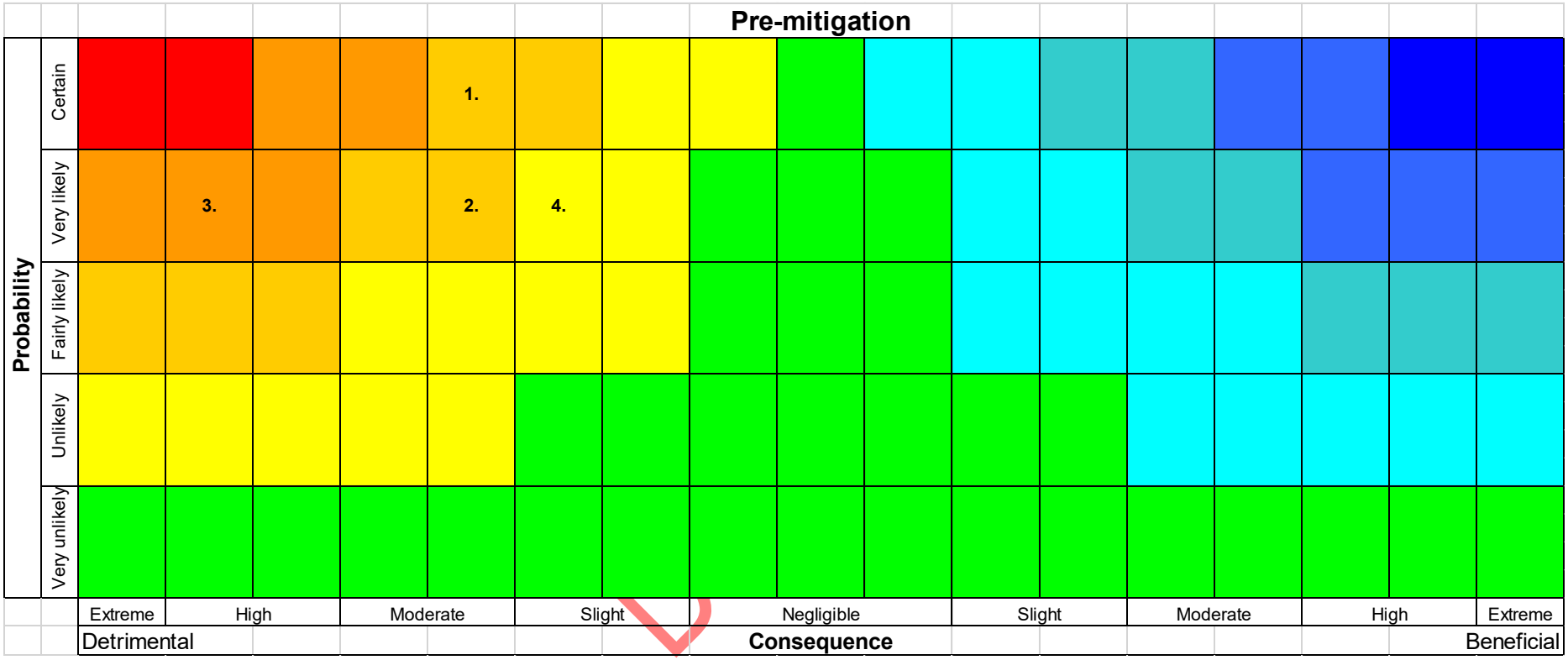


Figure 30: Overview of the impact risks associated with the fauna component prior to mitigation

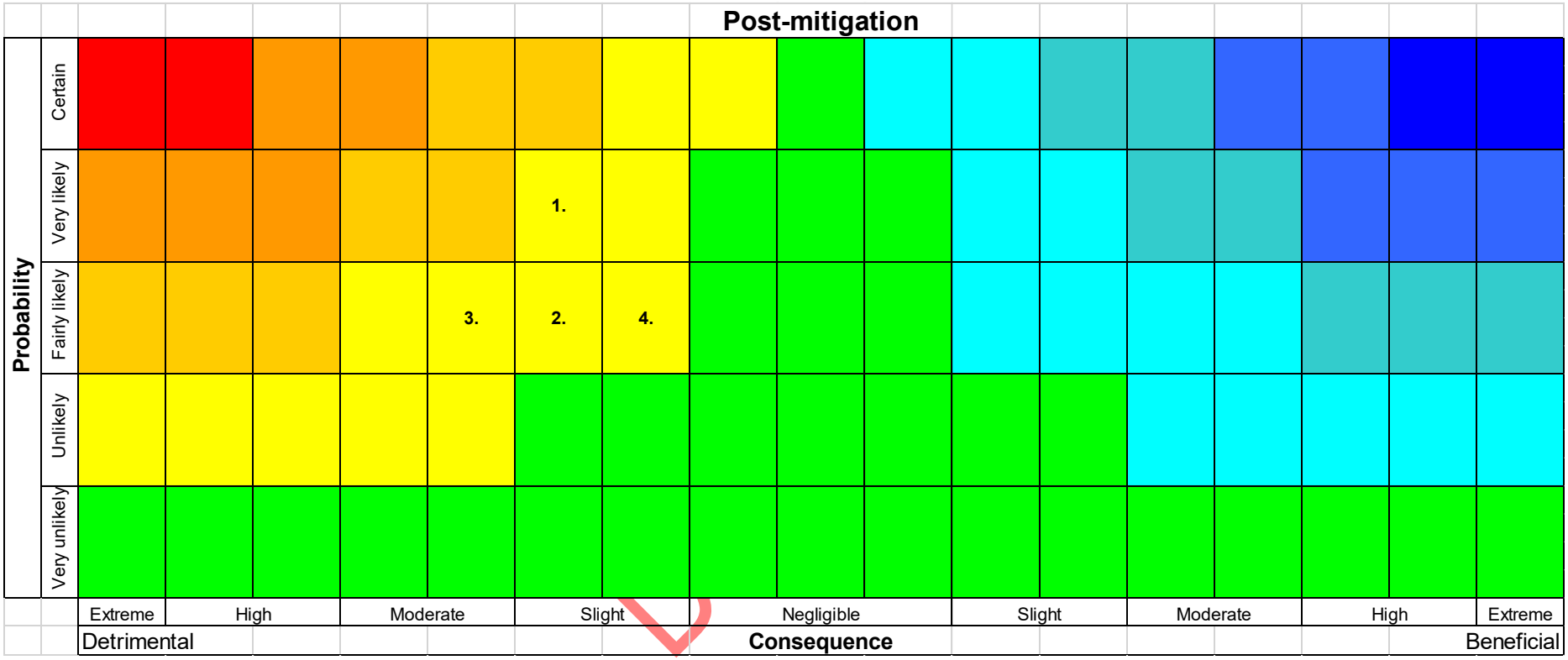


Figure 31: Overview of the impact risks associated with the fauna component post mitigation

7 RECOMMENDATIONS

7.1 Flora Component

The following recommendations are made:

1. A detailed rehabilitation plan should be compiled showing areas where topsoil management is critical and non-negotiable for example natural areas, potential critical habitats (eroded areas) and outcrops (boulders and sheet). The rehabilitation plan should be compiled by a registered scientific professional in the fields of botanical science and/ or ecological science with experience in botany and plant rehabilitation/ restoration with a minimum of 10 years' experience. This will require detail mapping at a scale of 1: 10 000 or larger along the approved pipeline servitude.
    a. The mapping should form part of the pre-construction baseline, and the following areas within the natural areas should be highlighted:
        i. Eroded areas
        ii. Stream/ river crossing
        iii. Wetlands
        iv. Steep areas – more than 8% or 5° slopes
        v. Outcrops – boulders and sheets
    b. The mapping should be done during the optimal flowering time from January to March (Figure 6)
    c. The rehabilitation plan should incorporate the results of the soil assessment with regards to soil form, soil texture and soil depth.
2. To apply for the removal of national protected trees a registered scientific professional in the field of ecological science with a minimum of 5 years' experience should do surveys along the approved pipeline servitude using plotless methods to document the height of the individuals in the following height classes up to a distance of 50 m along the centre of the permanent servitude:
    - Seedlings: 0 – 0.5 m
    - Juveniles: 0.5 – 1 m
    - Young adults: 1 – 3 m
    - Mature adults: 3 – 6 m (Fire tolerant)
    - Reproductive adults: 6 m > (Fire tolerant)
    - The survey should be done during the optimal flowering time from January to March (Figure 6)
    - The survey plots should be at least 250 m apart within natural areas or at least one plot per 2 ha of remaining natural vegetation (Table 4 – CBA, ESA, ONA) within the approved temporary and permanent servitude
3. Areas with permanent footprints (valve chambers, scour chambers) exceeding 1 ha **within natural areas** should be surveyed in detail for species of concern as indicated in the screening report during the optimal flowering time from January to March (Figure 6).

7.2 Fauna Component

The following recommendations are made:

1. Implement a rehabilitation management plan with the objective to manage rehabilitated sections after construction through conservative grazing, fire management and continual eradication of alien plant species. Sustainable grazing at conservative stocking rates (by domestic livestock or game) is an essential environmental factor in maintaining veld condition and floristic diversity. Overgrazing can however be detrimental to the vegetation, and carrying capacity of the such areas of the rehabilitated areas should be estimated to ensure that overgrazing is prevented.
2. Landscaping should make use of indigenous plant species, and preferably of species native to the project area and immediate surroundings. The plant species selected should strive to represent habitat types typical of the ecological landscape prior to construction.
3. If any faunal species of conservation concern (especially *Kinixys lobatsiana*) are exposed during the construction phase, a natural scientific professional registered in the field of zoological science and/ or ecological science who specialise in the species of concern will be appointed to assist with its capture, translocation and safe release to nearby suitable habitat with the relevant permits obtained from the authority. Please refer to proposed fauna mitigation above.

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8.2 Fauna Component

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9 APPENDIX A – ABRIDGE CV, PRINCIPLE CONSULTANT

Name of firm: EkoInfo cc Environmental and Wildlife Management Consultancy
Name of staff: WILLEM HENDRIK DE FREY
Profession: Environmental and Wildlife Management consultant
Years with firm: Since 1995
Nationality: RSA
Membership of professional societies:
The South African Council for Natural Scientific Professions (Reg no 400100/02)
Categories: Botanical Science and Ecological Science
Currently in the process of affiliating to:
South African Association of Botanist (SAAB)
Grassland Society of Southern Africa
South African Institute of Ecologist and Environmental Scientists (SAIE)

KEY QUALIFICATIONS:

Mr W de Frey has been involved in the discipline of ecology since 1989. During this period he prepared himself for a profession in environmental and wildlife management, by attending courses in chemistry, geology, pedology and statistics, while majoring in Botany and Zoology. His working knowledge was obtained while completing projects for his post-graduate studies in wildlife management in both the Savanna and Grassland Biomes. In addition to his academic publications, he has contributed to numerous reports regarding EMPR's, EIA's, vegetation - and soil surveys and monitoring since the registration of his own consultation close corporation in 1995. He is actively involved in the management and marketing of his close corporation while completing tasks in his field of expertise namely soil, vegetation science and Geographical Information Systems. Mr W de Frey is task orientated with consideration of people's needs and safety. He beliefs in a holistic approach to environmental and wildlife management and has therefore established a network with individuals in related fields. He is also assisting previously disadvantaged persons in establishing a presence in the environmental industry, namely Lordwick Makhura of Baagi Environmental Consultancy CC and a joint venture company Bonolo Biodiversity And Environmental Management consisting of Baagi Environmental Consultancy CC and Disa Mphago Community Helpers CC.

EDUCATION:

1992 BSc Botany & Zoology, University of Pretoria

Course	Content	Level
Chemistry	Organic and Inorganic chemistry	1st year
Geology	Introduction/ Geomorphology, Stratigraphy, Structural, Sedimentology Palaeontology, Crystallography	1st and 2nd year
Pedology	Introduction, soil classification, soil fertility, soil ecology, soil physics	1st and 2nd year
Botany	Morphology, Anatomy, Physiology, Taxonomy, Mycology, Ecology, Reproductive biology	1st, 2nd and 3rd year
Zoology	Taxonomy (Vertebrates and Invertebrates), Physiology (mainly vertebrates), Ecology (mainly vertebrates), Animal behaviour (mainly vertebrates)	1st, 2nd and 3rd year
Statistics	Sampling methods, Statistical Analysis, Probabilities	1st year

1993 BSc (Hons) (Cum laude) Wildlife Management, University of Pretoria
Dissertation: 'N HOLISTIESE EKOLOGIESE BENADERING TOT DIE DRAKRAGBEPALING VAN 'N GEMENGDE WILD- EN BEESBOERDERY IN DIE UBOMBO DISTRIK, MET ENKELE BESTUURS AANBEVELINGS, 1993
1999 MSc (Cum laude) Wildlife Management, University of Pretoria
Thesis: PHYTOSOCIOLOGY OF THE MPUMALANGA HIGH ALTITUDE GRASSLANDS, 1999

COURSES/ WORKSHOPS ATTENDED

1. Red List And Threatened Species Assessment Training Workshop, Hosted by the Conservation Breeding Specialist Group Southern Africa & Endangered Wildlife Trust, December 2003
2. National State of the Environment Workshop, Hosted by DEAT and SRK, ESKOM Convention Centre – November 2004
3. Gauteng Red Data Flora Workshop, Hosted by SANBI and GDACE – November 2005
4. Gauteng Flora Minimum Requirement Workshop, Hosted by GDACE Nature Conservation – August 2007

EMPLOYMENT RECORD:

1986 – 1987
5 Signals Regiment, SADF

1998 – 1993 – Partime
Council of Geoscience, Palaeontology Section
University of Pretoria, Botany Department
Academy of Marksmanship, Range Officer
U Huisoppasser, Own enterprise
1994 – 1995
University of Pretoria, Botany Department, Assistant researcher

1995 – present

EkoInfo cc Environmental and Wildlife Management Consultancy, Founding member and consultant

Overall EkoInfo CC's principal consultant completed or administrated more than 58 vegetation studies as part of Environmental Impact Assessments within all of South Africa's nine provinces and adjacent countries such as Botswana and Mozambique with a focus on either terrestrial vegetation and/ or wetlands. Some projects were on provincial level such as the Mpumalanga and Gauteng Degradation Projects coordinated by the Institute for Soil, Climate and Water and sponsored by National Department of Agriculture. The majority of projects were on local scale from 5 ha to 50 000 ha or more for local developers and corporate institutions (SASOL, Anglo Coal, BHP Billington, Ingwe Coal, Deneys Rietz Attorneys, ESKOM) facilitated independently or as a subcontractor/ specialist for the following institutions: Oryx Environmental CC, African EPA, Arcuss Gibb, Digby Wells and Associates, Nature and Business Alliance and Eyethu Engineers, Strategic Environmental Focus.

COMMUNITY SERVICE

1. Substitute lecture – 2nd & 3rd year Botany Practical (Vegetation Survey Methods), University of Pretoria -1994 & 1995
2. Guest lecture – Wetland Vegetation Communities (2nd year students), Department of Landscape Architecture, University of Pretoria – 1996 & 1997
3. Guest lecture – Principles of Ecology (1st year students), Department of Landscape Architecture, University of Pretoria – 2002
4. Guest lecture – Principles of vegetation survey and mapping for EIA's (3rd year students), Department of Landscape Architecture, University of Pretoria – 2003
5. Referee – ILASA Merits Awards (Environmental Planning), Institute for Landscape Architects of South Africa - 2003

LANGUAGES:

Language	Capability
English & Afrikaans	Speak, Read, Write - sufficient
Sepedi (Northern Sotho)	Speak, Read, Write – insufficient

10 APPENDIX B – FLORA IMPACT TABELS

1

IMPACT DESCRIPTION: Loss of flora diversity in natural areas				
Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Plants to be removed with soils		
Probability	Certain	Had been done previously on 2C pipeline		
MITIGATION:				
Mitigation success lies in the effective topsoil management. The topsoil in natural areas contains the seedbank for the future rehabilitation and restoration of the servitude. Topsoil and subsoil should be separated, STORED separately and replaced in the SAME sequence - subsoil at the bottom, topsoil on top. When done correctly and within a 3 month window, the natural vegetation will recover, with limited human intervention required. Please refer to images in report.				
POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	Only during construction < 5 years	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Low - negative	Plants will return from WELL MANAGED and PLACED topsoil		
Probability	Very likely	Evidence from other projects.		

2

IMPACT DESCRIPTION: Loss of endemic plant species in natural areas				
Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Plants to be removed with soils		
Probability	Certain	Had been done previously on 2C pipeline		
MITIGATION:				
Mitigation success lies in the effective topsoil management. The topsoil in natural areas contains the seedbank for the future rehabilitation and restoration of the servitude. Topsoil and subsoil should be separated, STORED separately and replaced in the SAME sequence - subsoil at the bottom, topsoil on top. When done correctly and within a 3 month window, the natural vegetation will recover, with limited human intervention required. Please refer to images in report.				
POST-MITIGATION				

Dimension	Rating	Motivation		
Duration	Short-term	Only during construction < 5 years	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Low - negative	Endemic plants will return from WELL MANAGED and PLACED topsoil		
Probability	Very likely	Evidence from other projects.		

3

IMPACT DESCRIPTION: Loss of threatened plant species in natural areas				
Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning

PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Plants to be removed with soils		
Probability	Certain	Had been done previously on 2C pipeline		

MITIGATION:

Mitigation success lies in the effective topsoil management. The topsoil in natural areas contains the seedbank for the future rehabilitation and restoration of the servitude. Topsoil and subsoil should be separated, STORED separately and replaced in the SAME sequence - subsoil at the bottom, topsoil on top. When done correctly and within a 3 month window, the natural vegetation will recover, with limited human intervention required. Please refer to images in report.

POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	Only during construction < 5 years	Consequence: Negligible	Significance: Very low
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Low - negative	Threatened plants will return from WELL MANAGED and PLACED topsoil		
Probability	Very likely	Evidence from other projects.		

4

IMPACT DESCRIPTION: Alien invasive plant encroachment				
Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning

PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Long-term	Alien weeds if left unmanaged would be a source area for future infestations	Consequence: Moderately detrimental	Significance: High - negative
Extent	Site-specific	Originally willl only occur within the servitude, especially if fertiliser is used		
Intensity	High - negative	Will displace regional indigenous species, reduce livestock feeding potential		

Probability	Certain	Was observed on the 2C servitude post construction		
MITIGATION:				
Declared alien invasive species are present in the landscape, and was documented within the plots surveyed, the prominent species are Cactaceae and Datura species. If the topsoil is effectively managed, and only topsoil which had been locally removed, returned, then few alien invasive species will germinate, especially if the use of fertiliser is avoided. These can be removed using manual methods and manual labour, and areas of dense seedlings can be sprayed using a drone, ensuring an even and controlled application of herbicide. If the infestation become severe it is recommended that an alien invasive plan is compiled and implemented for the duration of the construction phase and a year post construction.				
POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Short-term	If the alien invasive plants are effectively controlled for the duration of the construction phase and subsequent rehabilitation, they should disappear within 5 years when the regional indigenous species dominate	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within the servitude if effectively eradicated or controlled		
Intensity	Moderate - negative	Declared alien invasive species might return once the project ends and the maintenance of the servitude is concluded		
Probability	Very likely	Was observed on the 2C servitude post construction		

5	**IMPACT DESCRIPTION: Removal of regionally indigenous woody species**				
	Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning
	PRE-MITIGATION				
	Dimension	**Rating**	**Motivation**		
	Duration	Long-term	Regionally indigenous trees are removed, and servitude is rehabilitated as if it is pasture, resulting in Grassland rather than Savanna	Consequence: Highly detrimental	Significance: High - negative
	Extent	Site-specific	Most of the areas where there is natural vegetation remaining, regional indigenous trees are the dominant growth form		
	Intensity	Very high - negative	The pipelines are located in the Savanna Biome of South Africa, if trees are not restored the ecological function of the landscape is affected		
	Probability	Certain	Was observed on the 2C servitude post construction		
	MITIGATION:				

Effective management of the topsoil, placing the locally removed topsoil back in the SAME landscape, will ensure that only regional indigenous trees will re-establish. The topsoil contains a mixture of pioneer, subclimax and climax woody species. The trees provide microhabitat for especially the herbaceous layer to recover, and therefore is key to the succession in the landscape.

POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Eventually the post construction servitude will be re-colonised by regionally indigenous woody species, most probably by encroachers such as *Dichrostachys cinerea, Vachellia tortilis* and *Vachellia nilotica* which will respond to excessive use of fertiliser, forming monoculture stands (Loss of species richness)	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Site-specific	Mainly within the temporary and permanent servitude footprints, will be similar in appearance to abandoned cultivated fields		
Intensity	High - negative	Loss of species richness and livestock utilisation potential whether domestic or game		
Probability	Very likely	Was observed throughout the study area in abandoned cultivated fields.		

6

IMPACT DESCRIPTION: Removal of National Protected Trees with the servitude footprint				
Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Long-term	Regionally indigenous trees are removed, and servitude is rehabilitated as if it is pasture, resulting in Grassland rather than Savanna	Consequence: Moderately detrimental	Significance: High - negative
Extent	Site-specific	Most of the areas where there is natural vegetation remaining, regional indigenous trees are the dominant growth form		
Intensity	High - negative	The pipelines are located in the Savanna Biome of South Africa, if trees are not restored the ecological function of the landscape is affected		
Probability	Certain	Some individuals were lost during construction		
MITIGATION:				

The National Protected Trees recorded with the proposed temporary and permanent servitude footprint, are all Least Concern, and therefore not threatened, they occur frequently in the landscape, and because of their use in the community are conserved by the community. They can also be propagated and can be re-introduced into areas where they had been removed. However, their removal requires a permit from National Department of Forestry. It is STRONLGY advised where the removal of these species, especially large (mature: 3 m >, diameter: 50 cm >) individuals can be avoided, it should be considered.

POST-MITIGATION

Dimension	Rating	Motivation		
Duration	Medium-term	It is highly likely that these protected trees would be able to re-colonise the servitude areas over time, as there is sufficient source areas in the landscape	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Most of the areas where there is natural vegetation remaining, regional indigenous trees are the dominant growth form		
Intensity	Moderate - negative	Community members would have to travel further to harvest products related to these species in the landscape		
Probability	Very likely	Few individuals were recorded in the 2C servitude post construction		

7

IMPACT DESCRIPTION: Loss of floristic microhabitat associated with outcrops

Predicted for project phase:	Pre-construction	**Construction**	Operation	Decommissioning

PRE-MITIGATION

Dimension	Rating	Motivation		
Duration	Long-term	To bury the pipe, a trench is created which requires the removal of outcrops	Consequence: Highly detrimental	Significance: High - negative
Extent	Site-specific	Affects both the temporary and permanent servitude		
Intensity	Very high - negative	Outcrops provide microhabitat, which result in higher plant diversity/ increased species richness		
Probability	Certain	Was observed in the 2C pipeline servitude		

MITIGATION:

Although the proposed pipeline servitude mainly follows plains, some outcrops are encountered, these consist either of boulders (castle kopjes) or rock sheets. Irrespective of the nature of the outcrop, they present microhabitat, with a subsequent increase in plant species richness or change in floristic composition. The replacement of the topsoil without the rock component reduces the microhabitat potential, and therefore the potential of the species to return, and the area will most probably be colonised by more general species from plains. Where possible alternatives to trenching should be considered (Appendix B)

POST-MITIGATION

Dimension	Rating	Motivation		
Duration	Long-term	Unless alternative methods to trenching is considered the impact would be long term	Consequence: Moderately detrimental	Significance: Moderate - negative

Extent	Site-specific	Will mainly affect the permanent servitude		
Intensity	High - negative	The outcrops will be loosed but represents a limited percentage of the total servitude and landscape		
Probability	Very likely	Was observed on the 2C servitude post construction		

11 APPENDIX C – FAUNA IMPACT TABELS

1

IMPACT DESCRIPTION: Loss of habitat and fauna displacement				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Only during construction < 5 years	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Most mobile animals will temporary vacate the area, but sessile/fossorial animals will perish		
Probability	Certain	Been done for previously on 2C pipeline		
MITIGATION:				
No plausible mitigation is possible to prevent the direct loss of habitat and subsequent loss and displacement of faunal species of conservation concern. The only viable option within the Mitigation Hierarchy is Avoidance and or by placing the pipeline above ground on sensitive areas. If any faunal species of conservation concern (especially Kinixys lobatsiana) are exposed during the construction phase, the ECO shall be informed, who shall then issue instructions for its capture, translocation and safe release to nearby suitable habitat with the relevant permits obtained from the authority. Screen sections of pipeline prior to construction for individuals of Kinixys lobatsiana - if found these should be released into suitable habitat adjacent to the pipeline property.				
POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Animals will return afte proper rehabilitation		
Probability	Very likely	Evidence from other pipeline projrcts		

2

IMPACT DESCRIPTION: Disruption of ecological connectivity and faunal dispersal				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Only during construction < 5 years	Consequence: Moderately detrimental	Significance: Moderate - negative
Extent	Local	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Animals will return afte proper rehabilitation		
Probability	Very likely	Been done for previously on 2C pipeline		
MITIGATION:				
Ensure that construction activities do not overspill onto adjacent natural habitat in order to provide displaced fauna the opportunity to disperse into suitable habitat (although potential dispersal by small animals is highly limited)				
POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Only during construction < 5	Consequence:	Significance:

		years	Slightly detrimental	Low - negative
Extent	Site-specific	Only within temporary and permanent servitude		
Intensity	Moderate - negative	Animals will return afte proper rehabilitation		
Probability	Fairly likely	Evidence from other pipeline projrcts		

3

IMPACT DESCRIPTION: Illegal utilization of faunal resources				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Long-term	Could persists after construction	Consequence: Highly detrimental	Significance: High - negative
Extent	Regional	Could expand to areas further afield		
Intensity	High - negative	Could expand to areas further afield		
Probability	Very likely	Evidence from similar projects		
MITIGATION:				
It is assumed that labour will be accommodated in nearby towns/villages and not on site, which would lower this risk of hunting and poaching considerably. • Labour supervisors and SHE officials should monitor the activities of labourers when working away from infrastructure in natural habitat				
POST-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Could persists after construction	Consequence: Moderately detrimental	Significance: Low - negative
Extent	Local	Could expand to areas further afield		
Intensity	Moderate - negative	Could expand to areas further afield		
Probability	Fairly likely	Evidence from similar projects		

4

IMPACT DESCRIPTION: Direct faunal mortalities				
Predicted for project phase:	Pre-construction	Construction	Operation	Decommissioning
PRE-MITIGATION				
Dimension	**Rating**	**Motivation**		
Duration	Medium-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary servitude		
Intensity	Moderate - negative	Animals could get trapped within trenches		
Probability	Very likely	Been done for previously on 2C pipeline		
MITIGATION:				
Implement daily (preferably in the morning) checks of exposed trenches for animals species that may have fallen into the trench. If so, such animals should be captured and safely released into suitable adjacent habitat by the ECO				
POST-MITIGATION				

Dimension	Rating	Motivation		
Duration	Medium-term	Only during construction < 5 years	Consequence: Slightly detrimental	Significance: Low - negative
Extent	Site-specific	Only within temporary servitude		
Intensity	Low - negative	Animals could get trapped within trenches		
Probability	Fairly likely	Been done for previously on 2C pipeline		

12 APPENDIX D – CONSTRUCTION ALTERNATIVES TO TRENCHING

A consolidated table combining construction alternatives for bulk water supply lines with suitable pipe diameters, specifically tailored to South Africa's arid and semi-arid regions, including the OMM BRWSP project.

Construction Method	Description	Suitable Pipe Diameters	Specific Application
Above-Ground Installation	Pipes laid on supports above ground, avoiding trenching.	600 mm - 1,200 mm	Rocky outcrops and eroded zones (e.g., Karoo, Kalahari).
Horizontal Directional Drilling (HDD)	Subsurface drilling beneath obstacles like rivers or rocky terrain.	800 mm - 1,600 mm	Under waterbodies, ephemeral rivers (e.g., Limpopo River crossings).
Bridge-Supported Pipelines	Pipes mounted on or integrated with bridge structures.	400 mm - 1,000 mm	Crossing eroded valleys, dry rivers (e.g., Steelpoort).
Pipe Jacking / Microtunneling	Pipes pushed through pre-drilled tunnels under obstacles.	800 mm - 1,400 mm	Beneath major rivers or infrastructure, particularly in Limpopo.
Elevated Pipelines (Standoff Poles)	Lightweight pipes mounted on poles, avoiding contact with uneven terrain.	300 mm - 800 mm	Loose soils in semi-arid areas (e.g., Kalahari sand dunes).
Rock Anchoring Systems	Pipes anchored to rocky surfaces with clamps and brackets.	400 mm - 1,000 mm	Richtersveld or Namaqualand granite outcrops.
Controlled Blasting and Trenching	Blasting rock for trenches to partially bury pipes.	600 mm - 1,200 mm	Karoo and Northern Cape areas with hard bedrock.
Flexible/Collapsible Pipelines	Temporary or flexible pipelines for rapid deployment in emergency water supply.	200 mm - 600 mm	Emergency or seasonal water needs in arid zones (e.g., isolated rural communities in Limpopo).

This table integrates practical construction alternatives with pipe diameter ranges typical for high-capacity bulk water supply projects in South Africa, including the specifications suggested by the OMM BRWSP

Sources:
Infrastructure news
Lebalelo Water User Association L W U A
Mining Weekly
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