

DIGBY WELLS
ENVIRONMENTAL

Xivono Weltevreden Coal Mining Project near Belfast, Mpumalanga

Rehabilitation, Decommissioning and Mine Closure Plan

Project Number:

MBU5710

Prepared for:

Xivono Mining (Pty) Ltd

Date:

November 2019

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Report Type:	Rehabilitation, Decommissioning and Mine Closure Plan
Project Name:	Xivono Weltevreden Coal Mining Project near Belfast, Mpumalanga
Project Code:	MBU5710

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DECLARATION OF INDEPENDENCE

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I, Leon Ellis as duly authorised representative of Digby Wells and Associates (South Africa) (Pty) Ltd., hereby confirm my independence (as well as that of Digby Wells and Associates (South Africa) (Pty) Ltd.) and declare that neither I nor Digby Wells and Associates (South Africa) (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Xivono Mining (Pty) Ltd, other than fair remuneration for work performed, specifically in connection with the Environmental Application Process for the proposed Weltevreden Project.

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EXECUTIVE SUMMARY

Xivono Mining (Pty) Ltd (hereinafter Xivono), a subsidiary of Mbuyelo Group (Pty) Ltd, is the holder of an approved Prospecting Right for the proposed Weltevreden Mining Project approximately 8 km south of Belfast in the Mpumalanga Province of South Africa (Figure 1-1). Xivono proposes to mine coal via two open pits.

The Prospecting Right includes Portions 28, 29, 30 and 40 of the farm Paardeplaats 380 JT, Portions 2, 3, 10, and a portion of Portions 4, 7, 9, 11, 12, 14 and the Remaining Extent of the farm Weltevreden 381 JT. The Prospecting Right will lapse on 22 August 2021 as authorised by the Department of Mineral Resources (DMR).

Xivono intends to convert the approved Prospecting Right through completing a Mining Right Application (MRA) in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). Concurrently, Xivono has initiated this Integrated Environmental Authorisation and Integrated Water Use Licence Application (IWULA) process for the MRA.

Mining Method

Mining will be done using the truck and shovel method making use of suitably sized diesel driven equipment for the production requirements. The overburden, coal and interburden will be drilled and blasted to facilitate loading, and material will be backfilled into the void as the mining window advances. Open pit benches will be established on the various coal and waste horizons. Benches which are too thick to take in one pass will have to be subdivided into sub-benches of a maximum height dependent on the equipment selection. Maximum bench heights are typically between 10m and 15m. This operation will have seven main benches of which three benches will be coal benches.

Closure Vision and Objectives

A closure vision is required to guide the closure and rehabilitation planning towards an envisioned end state of the site, preferably with a sustainable end land use. The preliminary closure is to:

“Rehabilitate the mine site to a safe and environmentally stable condition with minimum impact on the environment and surrounding communities to as far as possible achieve a sustainable post-closure land use, in a cost-effective manner”.

The mine closure vision is guided by the closure objectives focused on:

- Physical stability;
- Environmental quality;
- Health and safety;
- Land capability/land-use;

- Aesthetic quality;
- Biodiversity;
- Social; and
- Stakeholder Management.

Threats, opportunities and Uncertainties

The following has been identified, with respect to threats, opportunities and uncertainties to the compilation of this plan and to define any additional work that is needed to reduce the level of uncertainty.

- Threats:
 - All risks identified within the risk assessment;
 - Based on the mineralogy and AMD results all coal and waste rock materials are classed as potentially acid generating (PAG), potentially leading to AMD development and pollution of groundwater and surface water resources if not mitigated and managed;
 - Groundwater levels in the vicinity of the site are expected to take approximately 80 years to recover Post-Closure. However, due to the limited scale of the drawdown cone it is expected that the long-term recovery will have a minor impact;
 - The drainage line between the two pits is expected to receive an increased salt load from the contaminant plumes. This is expected to have a moderate impact on the drainage line and associated unchanneled valley bottom wetland;
 - Decant from OC1 will flow towards the tributary east of the pit; the decant from OC2 will flow towards the tributary west of the pit. Based on the calculated decant volumes and expected quality of the potential decant indicates a moderate impact if decant would occur and is not mitigated against. Any potential decant flows from the open pits should be captured and treated before it enters streams and wetlands;
 - The access road that has been constructed in the vicinity of HGM unit 20 and the proposed OC1 pit must be rehabilitated to prevent any further disturbance and degradation of the hillslope seepage wetland system, which may be regarded as ecologically significant on a catchment scale as well as important for the provision of multiple ecological services; and
 - The quantified destruction of 94.86 ha of wetland habitat due to open pit mining activities, and the unquantified destruction and degradation of the remaining wetland ecology, as well as the downstream ecology of the Klein Komati River, as a result of desiccation and decant are regarded as a fatal flaw to the proposed project in terms of the wetland and aquatic ecology of the greater area unless mitigated and offset.

■ **Uncertainties:**

- Whether enough backfill material will be available for rehabilitation of the open pit areas;
- Water treatment options, like constructed wetlands;
- Impact mining might have on the water bottling business adjacent to the mining right area;
- Whether any third-party borehole water qualities will be affected by the mining activities, such as DRIBH1; and
- Suitable wetland buffers. It is recommended that a hydro-pedological assessment be carried out for the determination of suitable wetland buffers.

■ **Opportunities**

- Integrated planning to develop a suitable and sustainable post-closure land use across the project site;
- A closure water management plan should be developed. This should assess the management of a critical water level to minimise contamination of the shallow weathered aquifer. This should all be analysed in a financial model to further inform the most effective closure water management options. The groundwater model should be used as a management tool to inform this process; and
- Benefit to the local community if they are involved in alien invasive plant (AIP) removal programmes.

Financial Provision

The financial provision is done in terms of regulation 53 and 54 of the MPRDA regulations (2004) and in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended which provides that the holder of a mining right must make full financial provision for rehabilitation of negative environmental impacts.

The financial provision has been determined for Year 1 and Life of Mine (LoM) as shown below. Once the project is approved by the DMR, the financial provision will need to be updated annually throughout the LoM with the latest information available.

Year 1	R 18,515,121
LoM	R 38,102,448

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LIST OF ABBREVIATIONS & ACRONYMS

AIP	Alien Invasive Plants
ARP	Annual Rehabilitation Plan
CEC	Cation Exchange Capacity
Digby Wells	Digby Wells Environmental
DMR	Department of Mineral Resources
EA	Environmental Assessment
ELM	Emakhazeni Local Municipality
EMF	Environmental Management Function
EMP	Environmental Management Plan
EMPr	Environmental Management Programme Report
ERR	Environmental Risk Assessment Report
FEPA	Freshwater Ecosystem Priority Areas
FY	Financial Year
GG	Government Gazette
GIS	Geographic Information System
GN R1147	Financial Provisioning Regulations, 2015 (Government Notice No. 1147 published in GG 39425)
HIRA	Hazard Identification and Risk Assessment
I&APs	Interested and Affected Parties
LM	Local Municipality
LoM	Life of Mine
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM: AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OC	Opencast
RCP	Rehabilitation, Decommissioning and Mine Closure Plan

ROM	Run of Mine
SANAS	South African National Accreditation System
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SCC	Species of Special Concern
SHEQ	Safety, Health, Environment and Quality
SLP	Social and Labour Plan
SoW	Scope of Work
ToR	Terms of Reference
VAT	Value Added Tax
WHO	World Health Organisation
WMA	Water Management Area
WULA	Water Use License Application

1 Introduction

The applicant, Xivono Mining (Pty) Ltd (hereinafter Xivono), is the holder of an approved Prospecting Right for the proposed Weltevreden Mining Project approximately 8 km south of Belfast in the Mpumalanga Province of South Africa (Figure 1-1). Xivono proposes to mine coal via two open pits.

The proposed project area is located within the Nkangala District Municipality (NDM), specifically in Ward 1 of the Emakhazeni Local Municipality (ELM). The nearest large settlements to the project area are the town of Belfast (8 km) and its township of Siyathuthuka (15 km).

The Prospecting Right includes Portions 28, 29, 30 and 40 of the farm Paardeplaats 380 JT, Portions 2, 3, 10, and a portion of Portions 4, 7, 9, 11, 12, 14 and the Remaining Extent of the farm Weltevreden 381 JT. The Prospecting Right will lapse on 22 August 2021 as authorised by the Department of Mineral Resources (DMR). All proposed mining activities will only take place on Portions 9, 12, 231 and the Remaining Extent of Portion 3 of the Farm Weltevreden 381 JT

Xivono intends to convert the approved Prospecting Right through completing a Mining Right Application (MRA) in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). Concurrently, Xivono has initiated this Integrated Environmental Authorisation and Integrated Water Use Licence Application (IWULA) process for the MRA to comply with the following legislation:

- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Waste Act, 2008 (Act No. 56 of 2008) (NEM:WA); and
- National Water Act, 1998 (Act No. 36 of 1998) (NWA).

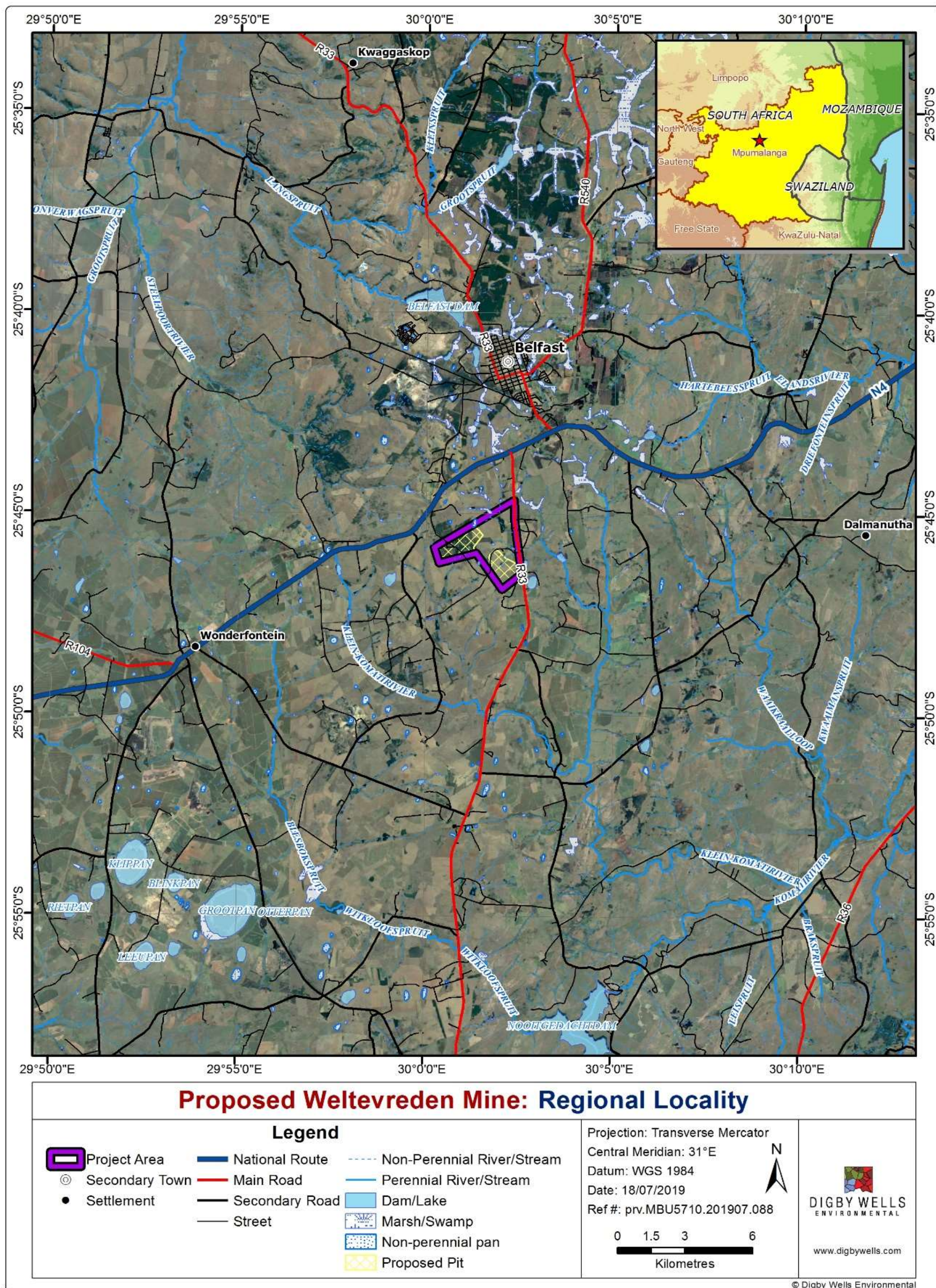


Figure 1-1: Regional Setting

2 Purpose of Report

The final Rehabilitation, Decommissioning and Mine Closure Plan (RCP) provides a plan that is measurable and auditable to the Department of Mineral Resources (DMR) that takes into consideration the proposed post-mining end land use of the affected area. It must be stated from the outset that to comply with current legislation, this rehabilitation, decommissioning and mine closure plan must be reviewed, updated and revised annually. During this process, changes in baseline information, legislative amendments, spatial developments and any other changes which may impact the closure of the mine must be incorporated to ensure the plan remains current and implementable.

This report includes information as per the guideline document pertaining to the Financial Provisioning Regulations (GN R1147), and therefore includes the definition of the closure vision, objectives and design and relinquishment criteria, indicating infrastructure and activities which will ultimately be decommissioned, closed, removed and remediated.

The Policy and Legislative context is outlined in Table 2-1.

Table 2-1: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
<p><u>The Constitution of the Republic of South Africa, 1996</u></p> <p>Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that:</p> <p><i>Everyone has the right to</i></p> <p><i>(a) an environment that is not harmful to their health or well-being; and</i></p> <p><i>(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -</i></p> <p><i>(i) Prevent pollution and ecological degradation;</i></p> <p><i>(ii) Promote conservation; and</i></p> <p><i>(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.</i></p>	<p>Xivono is undertaking an EIA process to identify and determine the potential impacts associated with the Project. Mitigation measures recommended will aim to ensure that the potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.</p>
<p><u>National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (as amended in 2017)</u></p> <p>The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment.</p> <p>Section 24 (1)(a) and (b) of NEMA state that:</p> <p><i>The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.</i></p> <p>The EIA Regulation, 2014 was published under GN R 982 on 4 December 2014 (EIA Regulations) and came into operation on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended. The EIA Regulations have been made applicable to prospecting and mining activities.</p>	<p>Activities associated with the proposed mine are identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation prior to being undertaken. This Scoping Report and proceeding EIA Report will be informed by the requirements of the NEMA and Regulations thereunder.</p>
<p><u>Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) (MPRDA)</u></p> <p>The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.</p>	<p>The Applicant is the holder of a Prospecting Right and has applied for a Mining Right to mine coal on various portions the Farm Weltevreden 381 JT.</p> <p>The EIA process will be undertaken to meet the requirements of the MPRDA read with the EIA Regulations, 2014 (as amended). Financial Provisioning and Closure Costs is included in the EIA.</p>
<p><u>National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)</u></p> <p>On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following:</p> <p><u>Category A</u> describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence;</p> <p><u>Category B</u> describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and</p> <p><u>Category C</u> describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These</p>	<p>A Waste Management Licence (WML) has been applied for due to the nature of mining activities.</p>

Applicable legislation and guidelines used to compile the report	Reference where applied
<p>activities include the storage of general waste at a facility with a capacity to store in excess of 100 m³ and storage of hazardous waste in excess of 80 m³.</p> <p>The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification.</p>	
<p><u>National Water Act, 1998 (Act No. 36 of 1998) (NWA)</u></p> <p>The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.</p> <p>GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following:</p> <ol style="list-style-type: none"> Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution; Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution; Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and Regulation 7 details the requirements necessary for the protection of water resources. 	<p>An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA for the Project. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority.</p>
<p><u>DWS¹ Best Practice Guideline – G1: Storm Water Management Plan (SWMP)</u></p> <p>These are guidelines provided by the DWS for the development of a SWMP. The following will be undertaken to develop the conceptual SWMP:</p> <ol style="list-style-type: none"> Delineate the clean and dirty area contributing to runoff (based on the final layout plans) and site-specific hydrological assessments to determine volumes that require to be handled. The SWMP should ensure that temporary drainage installations should be designed, constructed, and maintained for recurrence periods of at least a 25-year, 24-hour event, while permanent drainage installations should be designed for a 50-year, 24-hour recurrence period; and Site specific assessments to establish the appropriate mitigation measures and surface water monitoring programme. 	<p>All water management infrastructure will be designed for a 1:100-year, 24-hour rainfall event.</p>
<p><u>DWS Best Practice Guideline – G4: Impact Prediction</u></p> <p>The impacts of mine activities on the groundwater environment must be assessed as part of the MRA, as well as for the IWULA. The baseline conditions must be assessed to define the current aquifer systems, groundwater use and groundwater conditions before mine commencement and to determine the extent of possible future impacts on the groundwater resources.</p>	<p>An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority.</p> <p>The EIA as part of the MRA will assess potential impacts on groundwater resources as a result of the Project.</p>
<p><u>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)</u></p> <p>The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance:</p> <ol style="list-style-type: none"> Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014); National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and 	<p>A Fauna and Flora Impact Assessment will be conducted as part of the EIA Phase which will include the characterisation of the natural habitat and provide mitigation measures that must be applied to sensitive habitats (if any are identified). Infrastructure associated with the Project has been placed on already disturbed land (associated with current farming activities) as far as possible to reduce disturbance of natural vegetation.</p>

¹ Previously the Department of Water Affairs (DWA)

Applicable legislation and guidelines used to compile the report	Reference where applied
i. National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	
<p><u>National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)</u></p> <p>The prevailing legislation in the Republic of South Africa with regards to the Air Quality field is the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). According to the Act, the DEA, the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA.</p> <p>A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured. The NEM: AQA provides for the identification of priority pollutants and the setting of ambient standards with respect to these pollutants.</p>	<p>An Air Quality Impact Assessment will be undertaken as part of the EIA Phase. The Project's activities will set out to abide by the NEM:AQA and standards set out in the NAAQS. The required mitigation will be included in the EMP as part of the EIA Phase.</p>
<p><u>National Dust Control Regulation 2013</u></p> <p>The Minister of Water and Environmental Affairs, released on the 01 November 2013 the National Dust Control Regulation, in terms of Section 53, read with Section 32 of the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)(NEM:AQA). In the published National Dust Control Regulations, terms like target, action and alert thresholds were omitted. Another notable observation was the reduction of the permissible frequency of exceedance from three to two incidences within a year. The standard actually adopted a more stringent approach than previously, and would require dedicated mitigation plans now that it is in force.</p>	<p>An Air Quality Impact Assessment will be undertaken as part of the EIA Phase. The Project's activities will set out to abide by the NEM:AQA and standards set out in the NAAQS. The required mitigation will be included in the EMP as part of the EIA Phase.</p>
<p><u>National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989)</u></p> <p>The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise.</p> <p>The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "<i>disturbs or impairs or may disturb or impair the convenience or peace of any person</i>").</p> <p>Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication.</p> <p>As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.</p>	<p>A Noise Impact Assessment, including modelling, impacts and proposed mitigation measures will be undertaken for the EIA Phase. Over and above the requirements set out in the NCR, a Blast Impact Assessment will also be undertaken.</p>
<p><u>The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)</u></p> <p>The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Gauteng (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).</p>	<p>For the Scoping Phase, a Notice of Intent to Develop (NID) was submitted to SAHRA. A Heritage Impact Assessment will form part of the EIA Phase.</p>
<p><u>GN R 1147 (Financial Provisioning Regulations), 2015</u></p> <p>The Financial Provisioning Regulations prescribe methods for determining the quantum of financial provision for rehabilitation and mechanisms for providing for it. Section 41 (1) of the MPRDA has been repealed and Section 24P of the NEMA, as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision must guarantee the availability of sufficient funds.</p>	<p>The Financial Provisioning Regulations are applicable to rehabilitation and closure plans as they prescribe the minimum content of an annual rehabilitation plan and the minimum content of a final rehabilitation, decommissioning and mine closure plan.</p>

Applicable legislation and guidelines used to compile the report	Reference where applied
<p><u>GN R 527 (MPRDA Regulations), 2004</u></p> <p>Regulation 527 (GN R. 527) specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant for a mining right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts, which must be reviewed annually. R527 provides specific principles for mine closure including safety and health, residual and latent environmental impacts etc.</p>	<p>Part of the EIA/EMP Report.</p>
<p><u>Integrated Development Plan</u></p> <p>Each municipality has an Integrated Development Plan (IDP) which considers all local municipality districts and the needs to be met in these districts.</p>	<p>The IDP for the Nkangala District Municipality is considered, specifically with reference to the Emakhazeni Local Municipality where the proposed Project is based.</p>

3 Report Structure

The remainder of the RCP is structured as follows.

Table 3-1: Minimum Requirements of RCP

Reference	Requirement	Report Section
3a	Details of- (i) the person or persons that prepared the plan; (ii) the professional registrations and experience of the preparers	Section 4
3b	The context of the project, including— (i) material information and issues that have guided the development of the plan; (ii) an overview of— (aa) the environmental context, including but not limited to air quality, quantity and quality of surface and groundwater, land, soils and biodiversity; and (bb) the social context that may influence closure activities and post-mining land use or be influenced by closure activities and post-mining land use; (iii) stakeholder issues and comments that have informed the plan; (iv) the mine plan and schedule for the full approved operations, and must include— (aa) appropriate description of the mine plan; (bb) drawings and figures to indicate how the mine develops; (cc) what areas are disturbed; and (dd) how infrastructure and structures (including ponds, residue stockpiles etc.) develops during operations;	Section 5, 6, 9 and 10
3c	Findings of an environmental risk assessment leading to the most appropriate closure strategy, including— (i) a description of the risk assessment methodology including risk identification and quantification, to be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure; (ii) an identification of indicators that are most sensitive to potential risks and the monitoring of such risks with a view to informing rehabilitation and remediation activities; (iii) an identification of conceptual closure strategies to avoid, manage and mitigate the impacts and risks; (iv) a reassessment of the risks to determine whether, after the implementation of the closure strategy, the residual risk has	Section 12

Reference	Requirement	Report Section
	<p>been avoided and / or how it has resulted in avoidance, rehabilitation and management of impacts and whether this is acceptable to the mining operation and stakeholders; and</p> <p>(v) an explanation of changes to the risk assessment results, as applicable in annual updates to the plan;</p>	
3d	<p>Design principles, including—</p> <ul style="list-style-type: none"> (i) the legal and governance framework and interpretation of these requirements for the closure design principles; (ii) closure vision, objectives and targets, which objectives and targets must reflect the local environmental and socio-economic context and reflect regulatory and corporate requirements and stakeholder expectations; (iii) a description and evaluation of alternative closure and post closure options where these exist that are practicable within the socioeconomic and environmental opportunities and constraints in which the operation is located; (iv) a motivation for the preferred closure action within the context of the risks and impacts that are being mitigated; (v) a definition and motivation of the closure and post closure period, taking cognisance of the probable need to implement post closure monitoring and maintenance for a period sufficient to demonstrate that relinquishment criteria have been achieved; (vi) details associated with any on-going research on closure options; (vii) a detailed description of the assumptions made to develop closure actions in the absence of detailed knowledge on site conditions, potential impacts, material availability, stakeholder requirements and other factors for which information is lacking; 	Section 7 and 8
3e	<p>A proposed final post-mining land use which is appropriate, feasible and possible of implementation, including—</p> <ul style="list-style-type: none"> (i) descriptions of appropriate and feasible final post-mining land use for the overall project and per infrastructure or activity and a description of the methodology used to identify final post-mining land use, including the requirements of the operations stakeholders; (ii) a map of the proposed final post-mining land use; 	Section 11
3f	<p>Closure actions, including—</p> <ul style="list-style-type: none"> (i) the development and documenting of a description of specific technical solutions related to infrastructure and facilities for the preferred closure option or options, which must include all areas, infrastructure, activities and aspects both within the 	Section 8.4 and 14

Reference	Requirement	Report Section
	<p>mine lease area and off of the mine lease area associated with mining for which the mine has the responsibility to implement closure actions;</p> <p>(ii) the development and maintenance of a list and assessment of threats and opportunities and any uncertainties associated with the preferred closure option, which list will be used to identify and define any additional work that is needed to reduce the level of uncertainty;</p>	
3g	<p>A schedule of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation, management of impacts including pumping and treatment of extraneous water—</p> <p>(i) linked to the mine works programme, if greenfields, or to the current mine plan, if brownfields;</p> <p>(ii) including assumptions and schedule drivers; and</p> <p>(iii) including a spatial map or schedule, showing planned spatial progression throughout operations;</p>	Section 8.5 and 17
3h	<p>An indication of the organisational capacity that will be put in place to implement the plan, including—</p> <p>(i) organisational structure as it pertains to the plan;</p> <p>(ii) responsibilities;</p> <p>(iii) training and capacity building that may be required to build closure competence;</p>	Section 20
3i	<p>An indication of gaps in the plan, including an auditable action plan and schedule to address the gaps;</p>	Section 7 and 18
3j	<p>Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators;</p>	Section 19
3k	<p>Closure cost estimation procedure, which ensures that identified rehabilitation, decommissioning, closure and post-closure costs, whether on-going or once-off, are realistically estimated and incorporated into the estimate, on condition that—</p> <p>(i) cost estimates for operations, or components of operations that are more than 30 years from closure will be prepared as conceptual estimates with an accuracy of ± 50 per cent. Cost estimates will have an accuracy of ± 70 per cent for operations, or components of operations, 30 or less years (but more than ten years) from closure and ± 80 per cent for operations, or components of operations ten or less years (but more than five years) from closure. Operations with 5 or less years will have an accuracy of ± 90 per cent. Motivation must be provided to indicate the accuracy in the reported number and as accuracy improves, what actions resulted in an improvement in accuracy;</p>	Section 16

Reference	Requirement	Report Section
	<ul style="list-style-type: none"> (ii) the closure cost estimation must include— <ul style="list-style-type: none"> (aa) an explanation of the closure cost methodology; (bb) auditable calculations of costs per activity or infrastructure; (cc) cost assumptions; (iii) the closure cost estimate must be updated annually during the operation's life to reflect known developments, including changes from the annual review of the closure strategy assumptions and inputs, scope changes, the effect of a further year's inflation, new regulatory requirements and any other material developments; and 	
3l	<p>Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps as a minimum and must include—</p> <ul style="list-style-type: none"> (i) a schedule outlining internal, external and legislated audits of the plan for the year, including— <ul style="list-style-type: none"> (aa) the person responsible for undertaking the audit(s); (bb) the planned date of audit and frequency of audit; (cc) an explanation of the approach that will be taken to address and close out audit results and schedule; (ii) a schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders; (iii) a monitoring plan which outlines— <ul style="list-style-type: none"> (aa) parameters to be monitored, frequency of monitoring and period of monitoring; (bb) an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities; and 	Section 18 and 19
3m	<p>Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i).</p>	Section 22.1

4 Details of Author(s)

Leon Ellis is the Mine Closure and Rehabilitation Divisional Manager at Digby Wells. Leon completed his BSc. (Hons) in Geography and Environmental Management at the University of Johannesburg (UJ) in 2009. He joined Digby Wells in January 2013. He has nine years' experience in the environmental services sector with specialised focus on Environmental Liability Assessments, Mine Closure Plans, Performance Assessments and Risk Assessments, locally and internationally. He has also been involved in the undertaking of Environmental Impact Assessments (EIAs) and Environmental Management Programmes (EMPs). Leon also completed the Environmental Risk Assessment and Management course based on ISO 31000 at the Centre of Environmental Management (North West University) in 2016.

5 Property Description

All proposed mining activities will take place on Portions 9, 12, 231 and the Remaining Extend of Portion 3 of the Farm Weltevreden 381 JT. The eastern portion of the proposed Mining Right will not be mined nor accommodate any mining-related infrastructure. Refer to Table 5-1 and Figure 5-1 depicting the property details and infrastructure layout respectively. Xivono proposes to mine two pits, OC1 (162 ha footprint) and OC2 (200 ha footprint) through open pit mining. Xivono plans to utilise containers for the mine offices and workshop infrastructure which will occupy a footprint of approximately 0.03 ha (300 m²). Other infrastructure proposed for the site includes a pollution control dams, crushing and screening plant (no washing to take place on site), Run of Mine (RoM) pad, overburden dump, stockpiles, pipelines and lined trenches.

Table 5-1: Property Description

Farm Name:	Weltevreden 381 JT
Application Area (Ha):	Approximately 800 ha
Magisterial District:	Nkangala District Municipality
Distance and direction from nearest town:	Approximately 8 km south of Belfast
21-digit Surveyor General Code for each farm portion:	T0JT00000000038100012 T0JT00000000038100003 T0JT00000000038100009 T0JS00000000038100000

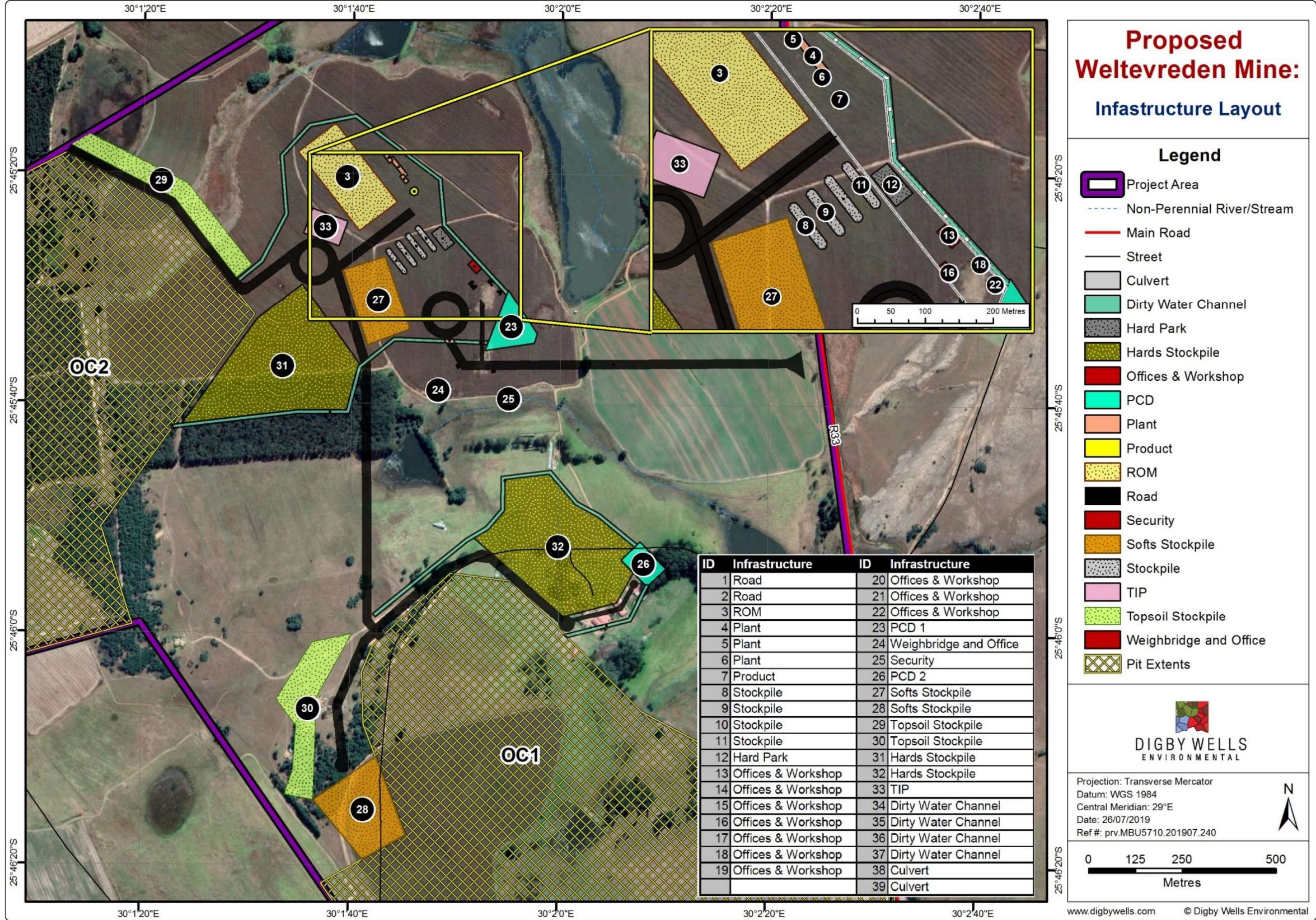


Figure 5-1: Proposed Infrastructure Layout

6 Project Description

The below sections describe the proposed activities associated with the project. Refer to Figure 6-2 below, in support of the sections below.

6.1 Reserves and Product

Xivono proposes to mine two pits namely OC1 and OC2. OC1 has in excess of 5 million tonnes of *in-situ* minable tonnes of coal at a depth of approximately 20 m below surface. OC1 will target the 2 Seam which is an average of 2.7 m thick. OC2 will target the Upper 4 Seam, Lower 4 Seam and 2 Seam which reaches a maximum depth of 30 m. OC2 will yield approximately 10 million tonnes of coal. The coal product will be for supply directly to Eskom. Coal from seams 2A, Seam 2D and Seam 2E are used as a blend to improve the inferior qualities coal from Seam 2B, 2C and Seam 4L where the blending ratio is 3:1.

6.2 Resource Access, Production and Scheduling

The total proposed quantity of coal to be extracted is approximately 15 million tonnes over a 15-year Life of Mine. Currently, OC1 will be mined first in a west-east direction and OC2 will be mined thereafter in a south-north direction, with an assumed production rate of 150 000 tonnes of coal mined per month for the total pit area. Coal crushing and screening will take place on site and trucked directly to Eskom.

The proposed LoM plan is depicted in Figure 6-1 below. The mine plan indicates that OC1 will be mined from Year 2020 to 2023 with the first box cut at OC2 commencing in 2023. OC2 will be mined through to 2029.

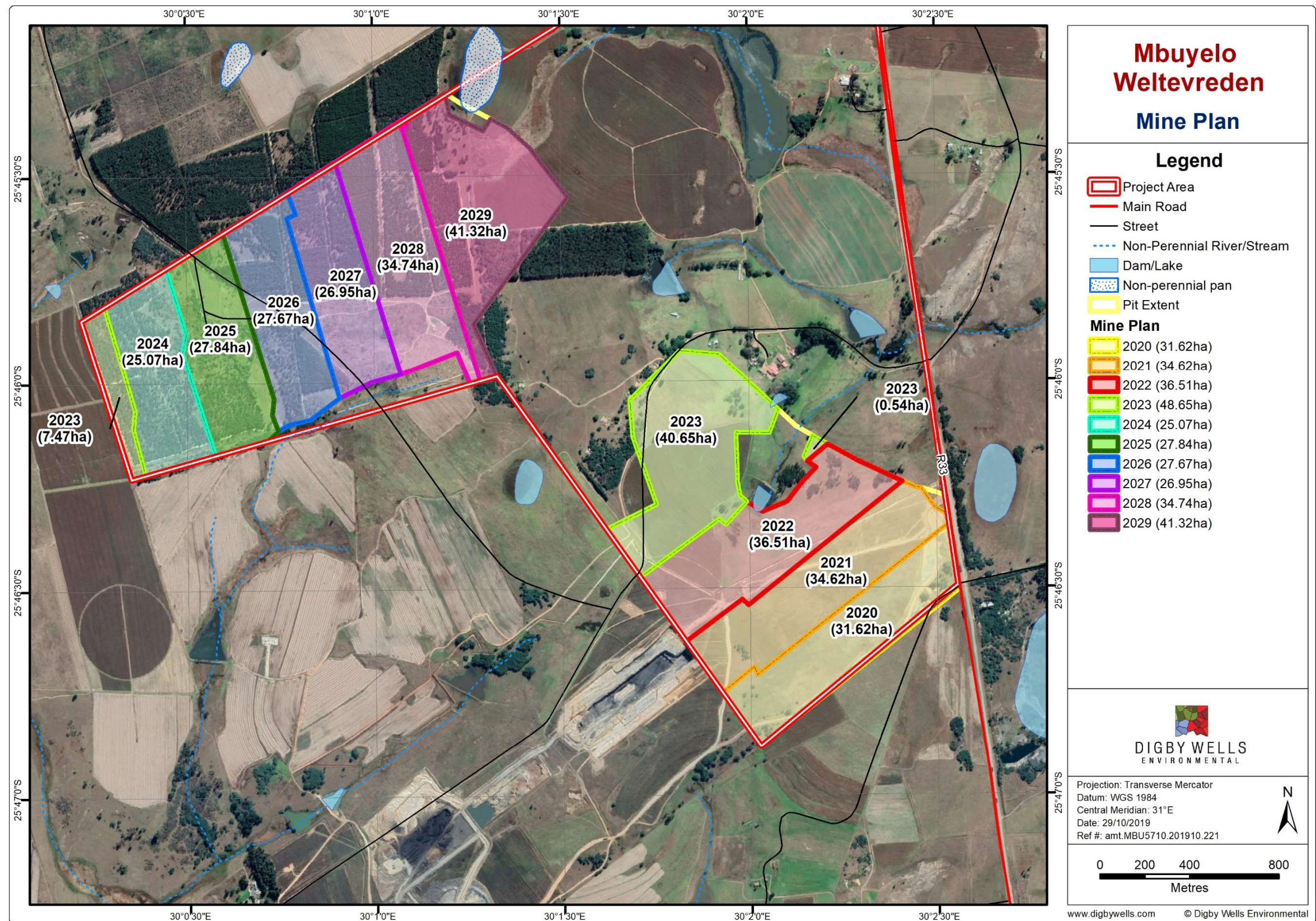


Figure 6-1: Proposed Life of Mine Plan

6.3 Mining Method

Mining will be done using the truck and shovel method making use of suitably sized diesel driven equipment for the production requirements. The overburden, coal and interburden will be drilled and blasted to facilitate loading, and material will be backfilled into the void as the mining window advances. Open pit benches will be established on the various coal and waste horizons. Benches which are too thick to take in one pass will have to be subdivided into sub-benches of a maximum height dependent on the equipment selection. Maximum bench heights are typically between 10m and 15m. This operation will have seven main benches of which three benches will be coal benches.

The open pit mining operation will be undertaken by suitably qualified and experienced mining contractors.

6.4 Infrastructure

The ancillary infrastructure associated with the project includes the following (as shown on Figure 5-1):

- Mobile facilities ("Kwikspace" type) for the mine offices and ablutions and fit for purpose workshop infrastructure;
- Pollution Control Dam (PCD);
- Crushing and screening plant (no washing will take place on site);
- Overburden dump,
- Run of Mine (ROM) pad;
- Coal stockpiles;
- Haul roads;
- Weighbridge and security office; and
- Power lines, pipelines and lined trenches.

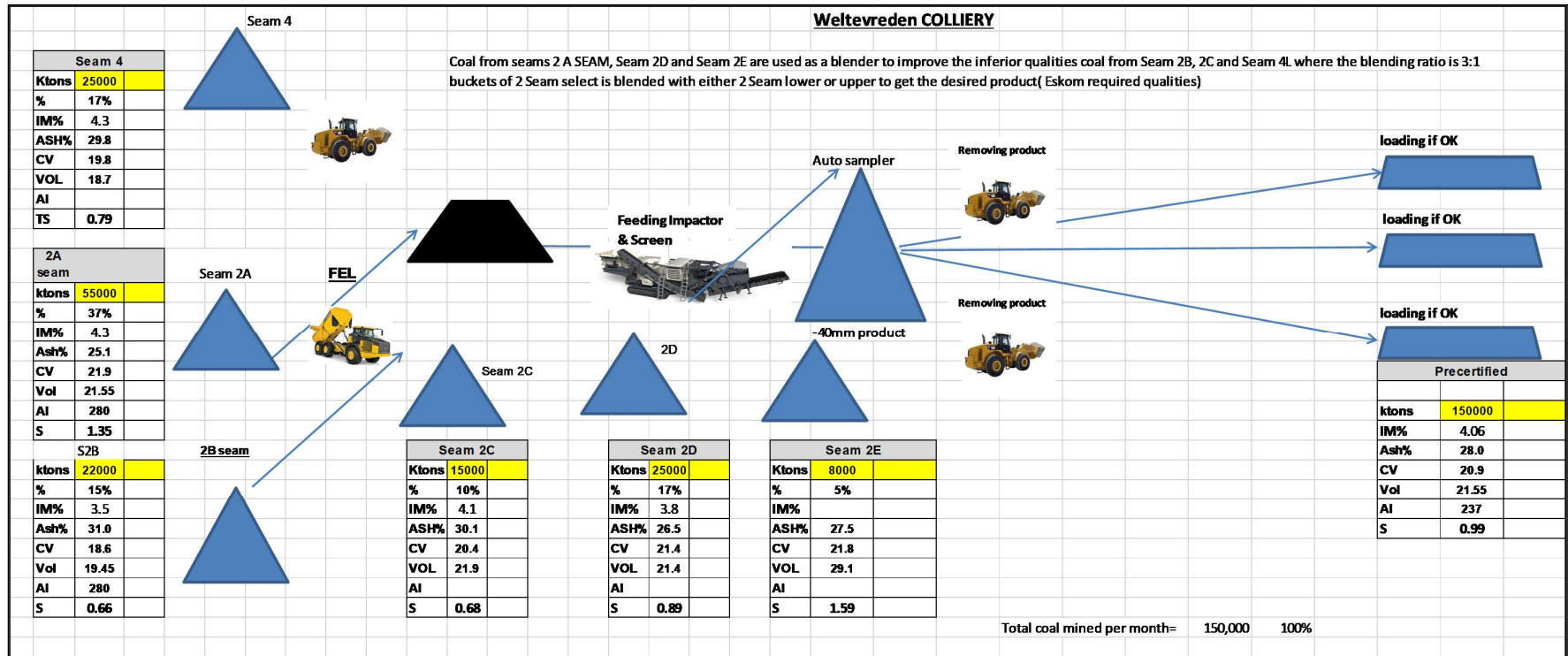


Figure 6-2: Coal Process Flow Diagram

7 Limitations and Assumptions

The compilation of this RCP is based on the following assumptions and limitations:

- Information currently available may need to be supplemented during the operational phase of the project;
- No detailed engineering designs focussed on mine closure and rehabilitation were taken into consideration;
- Concurrent rehabilitation of the open pits will continue during the mine life. At LoM, only the final mining cut will require rehabilitation;
- The closure period will commence once the last planned ton of coal has been extracted from the open pits;
- This RCP is developed based on the mine plan, designs and layouts available at the time of compiling this report;
- Water quality compliance criteria to achieve mine closure will be governed by the Water Use Licence (WUL);
- Water management infrastructure developed for the operational phase of the project will be retained for closure until it is no longer required;
- No costs associated with treatment of mine affected water is included in the financial provision. This should be assessed at a later stage once a suitable treatment option is chosen;
- At this stage, no formal agreements are in place with third-party users, hence all infrastructure will be demolished and removed from site at closure;
- The requirements of Interested and Affected Parties (I&APs), government and communities along with the likely final land use have been assumed without consultation. The impacts, mitigations and closure actions proposed in this report should be refined through consultation with the appropriate stakeholders as the closure planning progresses;
- If there is a significant change or addition of other infrastructure areas the RCP will need to be updated to cater for this change; and
- This report must be considered as a living document and should be updated as additional information becomes available and as monitoring and rehabilitation progresses.

The following aspects requiring further attention were identified during compilation of the RCP:

- Detailed landform modelling to optimise material handling activities. Aspects requiring specific attention include:
 - Optimisation of material handling;

- Optimum waste and topsoil stockpile positioning and design;
 - Size and position of the final void; and
 - Final landform modelling to ensure a sustainable landform.
-
- Water treatment requirements post-closure.
 - Some off-site mitigation might be required to compensate for the destruction of sensitive ecosystems and/or wetlands. It is assumed that this will be required during the operational phase of this project and is therefore not included in the Year 1 or LoM closure cost.

8 Mine Closure Overview

The concept of mine closure refers to the final stages of a mining activity, after production and processing have permanently ceased (decommissioning, relinquishment and rehabilitation planning) and any subsequent activities that are directly related to shutdown of the mine (site rehabilitation and ongoing monitoring). It involves preparation and considering long term physical, chemical, biological and social/land-use effects on the surrounding natural systems (aquatic, groundwater, surface water etc.) (Robertson, 2002).

Successful closure depends on setting, continually reviewing and validating; and finally meeting closure goals that align with company and stakeholder requirements. There should be minimal residual risk to the company, and the community should realise benefits that will continue to exist without further input from the company.

The vision of mine closure should be to ensure that a process is established to guide all decisions and actions during a mine's life such that:

- Future public health and safety are not compromised;
- Environmental resources are not subject to physical and chemical deterioration;
- The post-mining use of the site is beneficial and sustainable in the long-term;
- Any adverse socio-economic impacts are minimised; and
- The opportunity is taken to maximise socio-economic benefits.

It is recommended that the RCP be revised as the mine production progresses; this will ensure the operation take advances in technology and rehabilitation methods into consideration.

Figure 8-1 below depicts a general approach to mine closure planning.

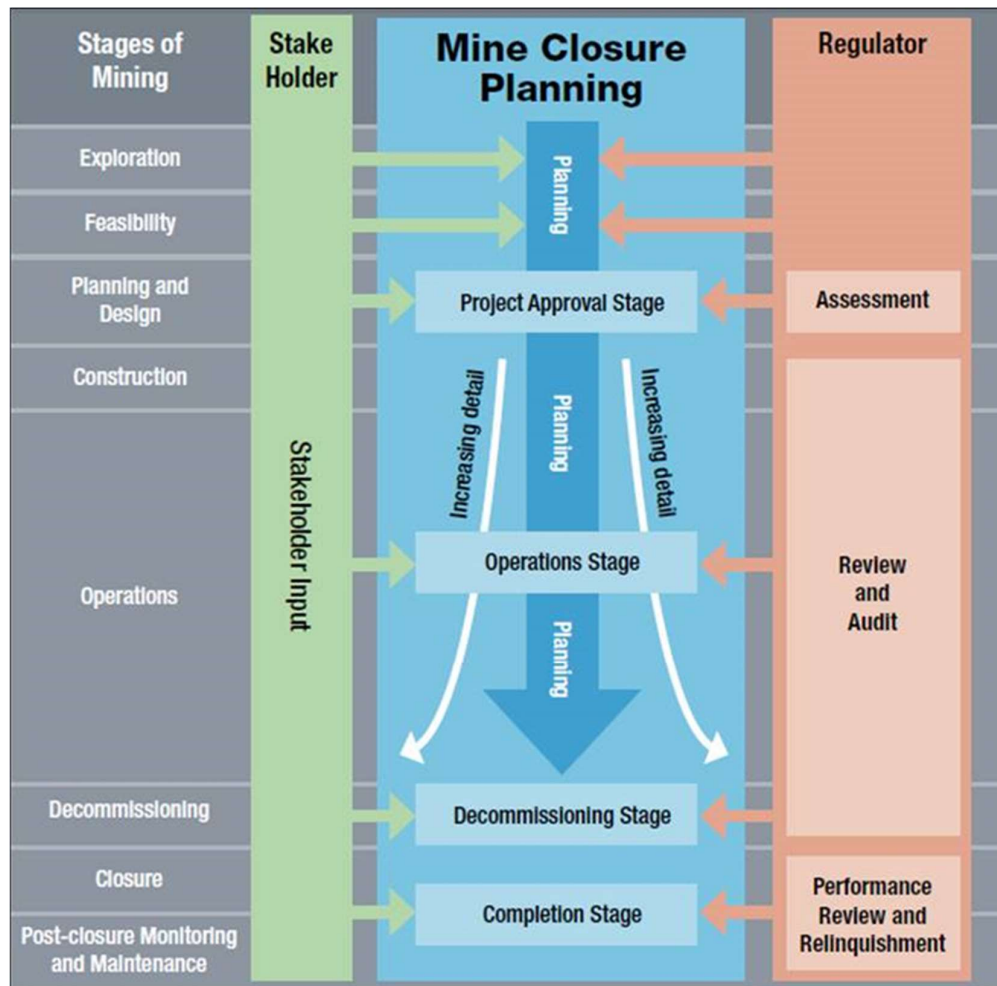


Figure 8-1: Integrating Stages of Mining and Mine Closure Planning

[Source: (DMP & EPA, 2015)]

8.1 Closure Design Principles

Designing for mine closure means integrating closure activities into the mine business plan, including the short, medium and LoM planning process, throughout the mine life considering environmental, social and economic considerations. Integrated mine closure should integrate stakeholder involvement and community consultation throughout the mining life cycle.

Mine closure is an on-going programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by mining to a state acceptable to the regulators and to post mining land users. The activities associated with mine closure are designed to prevent or minimise adverse long-term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives. The objective of mine closure is to obtain legal approval and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the company's legal liability is terminated.

Rehabilitation can be divided into two different streams, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must continue to be carried out along with mining. Concurrent rehabilitation activities should decrease the final closure costs that the mine will carry at the time of closure. This concurrent rehabilitation must be carried out within the context of the approved EMP as well as the RCP. Final rehabilitation will be carried out once the mine goes into its decommissioning and closure phase.

The primary concerns for decommissioning and rehabilitation are to ensure public safety and health, and environmentally stable conditions compatible with the surrounding environment, and consequently minimising the environmental impacts caused by mining. The overall objective is to have socially, economically, and environmentally sustainable development. The general objectives of mine closure are:

- Safety and health of animals and humans must be safeguarded;
- Environmental damage and residual impacts must be minimised to a level acceptable to all parties, i.e. avoidance of future pollution;
- Land must be rehabilitated to as close to natural state as possible, i.e. creation of a stable land surface;
- Physical and chemical stability of remaining structures must be such that they are not affected by natural elements;
- Mines are closed effectively and cost efficiently; and
- Mines are not abandoned but closed in terms of applicable legislation.

8.2 Closure Vision and Objectives

A closure vision is required to guide the closure and rehabilitation planning towards an envisioned end state of the site, preferably with a sustainable end land use. The preliminary closure is to:

“Rehabilitate the mine site to a safe and environmentally stable condition with minimum impact on the environment and surrounding communities to as far as possible achieve a sustainable post-closure land use, in a cost-effective manner”.

The mine closure vision is guided by the following closure objectives developed by Digby Wells on behalf of Xivono:

- **Physical stability** - To remove and/or stabilise surface infrastructure, rehabilitated land according to the planned land use plan after closure.
- **Environmental quality** - To manage the impact of physical effects and chemical contaminants on the environment such that the environmental quality is not adversely affected after closure.
- **Health and safety** - To limit, as far as reasonably possible, health and safety risks to humans accessing the site after closure.

- **Land capability/land-use** - To re-instate the pre-development land use through the implementation and maintenance of the post closure land-use plan.
- **Aesthetic quality** - To leave behind a site that gives an acceptable overall aesthetic appearance.
- **Biodiversity** - To encourage the re-establishment of native and/or appropriate flora and fauna on the reclaimed mine site such that the biodiversity is largely re-instated by natural succession over time.
- **Social** - To adhere to the implementation of the approved SLP that should contribute towards the socio-economic sustainability of the local communities.
- **Stakeholder Management** - To follow an appropriate stakeholder engagement process with all interested & affected parties and authorities.

8.3 Alternative Closure and Post-Closure Options

Issues generally associated with open-pit coal projects are poor final rehabilitation design impacting on land capability, wetlands, biodiversity and water resources.

A clear definition of the post-closure land use greatly facilitates closure planning. When the post-closure land use is understood, it aids not only the definition of the closure vision and closure objectives, but also the selection of closure activities and the definition of success criteria.

There is no single process to plan for post-closure land use. However, there are several principles as identified by the International Council of Mining and Metals (ICMM) that can be used to identify and evaluate closure options, and these include the following:

- **Evaluate early:** As post-closure land use will inform all aspects of closure; it should be taken into consideration from the earliest stages of closure planning. Formal structures for post-closure land use management and community and business initiatives should be considered from the early stages in approval and permitting, and in place before closure. Enough time needs to be allocated for local capacity building.
- **Use the knowledge base:** The information collected, organised and continually updated in the knowledge base will provide part of the basis for identifying and evaluating post-closure land use options.
- **Consider land capability:** The land use needs to be compatible with the suitability of the land to sustain a type of land use permanently (i.e. soil types, depth, gradient, etc). Post-closure land use will not be uniform over the entire site and will be affected by the post-closure configuration of the mined lands and waste disposal areas.
- **Involve stakeholders:** Developing the post-closure land use plan provides one of the most important opportunities to involve stakeholders. Further, a post-closure land use that has been developed with stakeholder consultation and input will be far more likely to succeed. Engage with regulators and other stakeholders including Indigenous

Peoples, government agencies, community organisations and private landowners to obtain input on the potential land use options within the bounds of predicted land capability/suitability and company capacity.

- **Map the potential land use options:** Map potential land use for the various mining areas based on the above assessments (considering both the capability of the land and the input from stakeholders). As the mine approaches closure, this map should become more detailed to include post-closure landform designs, surface drainage designs, land capabilities, landscaping designs and key features.
- **Look for beneficial uses:** Repurposing approaches have the potential to benefit mining companies and stakeholders. While not possible for all sites, repurposing options should be identified and evaluated, starting from the earliest stages of closure planning.
- **Be adaptable:** While post-closure land use will inform many aspects of the closure plan, it is important to realise that the post-closure land use may evolve due to several factors. For example, the opinions or desires of stakeholders may evolve over time, especially for mines with a lifespan that bridges a generational change. Also, innovative approaches may be developed or identified that modify the planned land use.
- **Consider the legislative framework:** Some jurisdictions may have stipulations around post-closure land use or may have regional planning/policies that should be considered for the development of post-closure land use. This extends to the legal framework around title transfer and relinquishment to third parties.
- **Identify and address failure mechanisms:** Not all attempts at repurposing or transitioning assets have worked. It is important to consider in the evaluation of options 'what could go wrong' and develop plans to address this.

A few alternative closure options to consider are provided in Figure 8-1 below.

Table 8-1: Alternative Closure Options

Aspect	Options
Open Pits	<p>Backfill the open pits concurrently during the LoM with overburden material removed during the development of the mine. This would assist in creating a free draining topography suitable for covering with a growth medium and vegetation establishment.</p> <p>Options to prevent decant flow from the pits, such as pump and treat, should be considered and alternatives compared.</p>
Mine Infrastructure	<p>Option 1: Demolish fixed mine infrastructure to 1m below ground level, bury on site or dispose of at an appropriate waste management facility, cover with growth medium and establish vegetation.</p>

Aspect	Options
	Option 2: Legally transfer usable mine infrastructure buildings to a third party and secure future tenants.
Plant Infrastructure	<p>Option 1: Demolish fixed plant infrastructure to 1m below ground level, bury on site or dispose of at an appropriate waste management facility, cover with growth medium and establish vegetation.</p> <p>Option 2: Utilise certain infrastructures for possible future power generation activities.</p>
Waste Stockpiles and Overburden Material	<p>Option 1: Use this material to backfill into the pits concurrently during the mining operation, cover with growth medium and establish vegetation.</p> <p>Option 2: Shape stockpiles, cap and cover with growth medium and establish vegetation.</p>
Decant Water Treatment	<p>Option 1: Active water treatment using a Reverse Osmosis (RO) Plant or similar.</p> <p>Option 2: Passive water treatment (i.e. constructed wetland).</p>

8.4 Preferred Closure Option

The preferred closure option at this stage is to return the site to as close as possible to the pre-mining land use as a minimum, however this RCP is a living document and should be updated and amended annually to comply with legislation and to consider changes during the LoM. During this process, changes in baseline information, legislation amendments, spatial developments and any other developments which may contribute to the closure of the mine will be incorporated to ensure that the plan remains current and implementable.

8.5 Closure and Post-Closure Period

Mine closure is not a single event but rather a process. The mine closure stages below outline the closure process which are separated by the activities within these. Closure implications for each of these periods will be considered within this plan. The mine closure stages are illustrated in Figure 8-2 and are defined below.

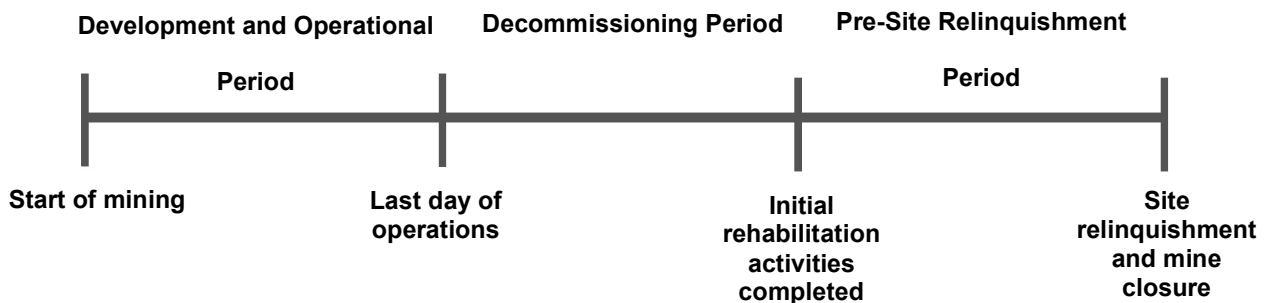


Figure 8-2: Mine Closure Stages

Development and Operational Period: This period covers the time which mining activities are expected to continue, commonly referred to as the LoM. In this period, closure planning will be refined and updated as stakeholders are engaged, studies are implemented to close knowledge gaps, technology changes or learnings from other operations are noted. Concurrent rehabilitation must also be carried out within this period to minimise the liability at the end of operations.

Decommissioning Period: The operational mining team would have left the site and the site would be handed over to closure contractors, whether these be external contractors, under the mining right holder's supervision, or in-house personnel. The closure measures would be implemented and legal transfer of possible identified infrastructure to third parties would take place as per the detailed closure plan. The initial rehabilitation measures are completed at the end of this period, but the closure process is still not completed.

Pre-Site Relinquishment Period: For a period, the closure measures and state of the site will have to be monitored and maintenance undertaken if needed to ensure that rehabilitation was completed to pre-determined targets. The closure targets or site relinquishment criteria are developed prior to closure and serve as a measure to determine whether the long-term environmental, social, physical and economic risks have been adequately addressed. Site relinquishment is when ownership and responsibility of the site can be transferred, and the mine is considered closed.

9 Environmental Context

The following information which forms the baseline for the environmental setting has been sourced from the Digby Wells specialist assessments completed as part of the project.

9.1 Topography

The topography of the project area is undulating in the west to hilly in the east and is relatively flat with some steep areas. The maximum and minimum elevations are between 1700 to 1900 mamsl (meters above mean sea level), with slopes being no greater than 4 to 8 % (percent) (Digby Wells, 2019a). The topography of the area is shown in Figure 9-1.

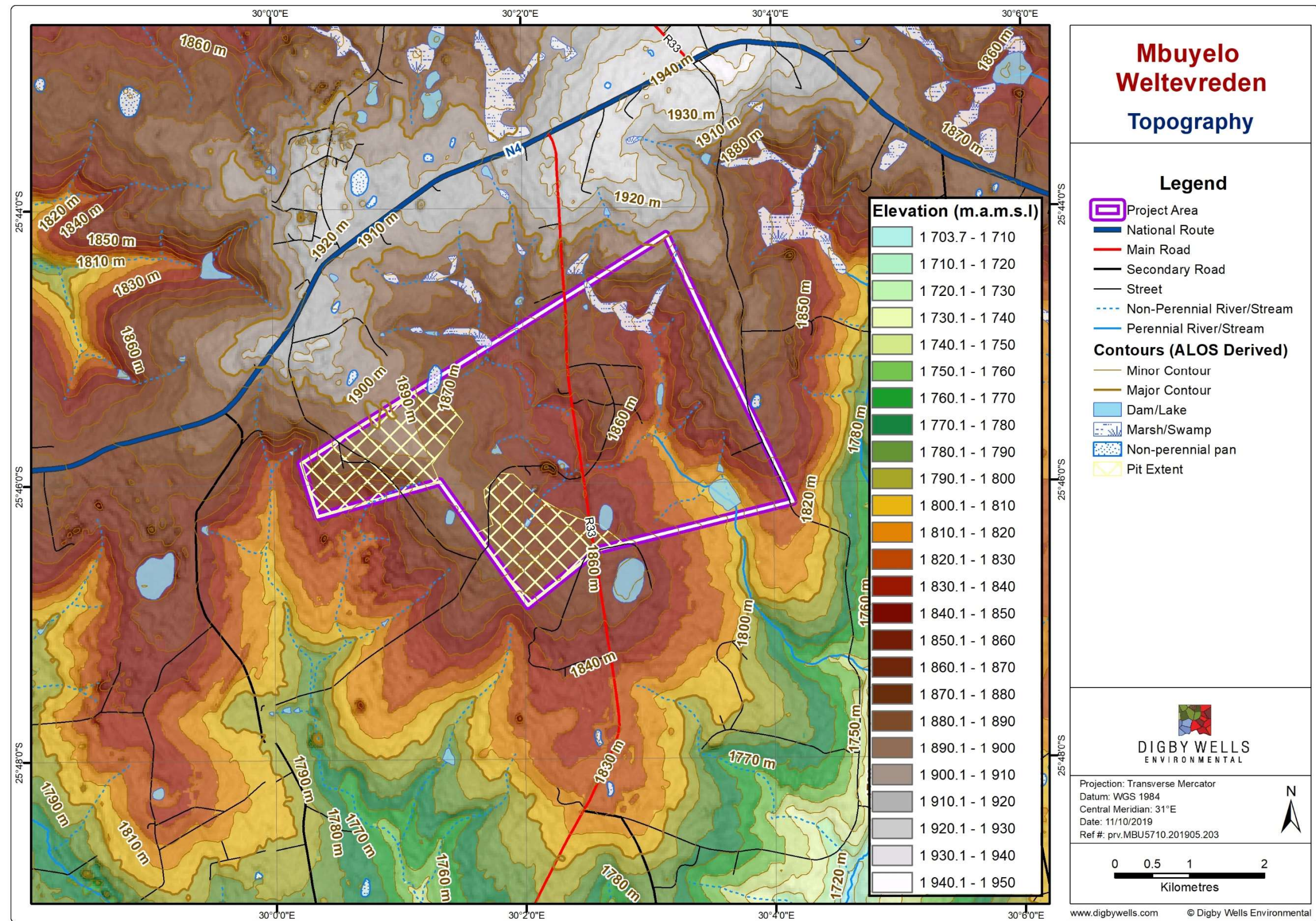


Figure 9-1: Topography

9.2 Geology

9.2.1 Regional geology

The project area is situated along the northern boundary of the Karoo basin where the major lithostratigraphic units of the Karoo Supergroup crop out. The major formation underlying the project area is the Vryheid Formation which in the project area pinches out towards the north. The uneven pre-Karoo topography along the northern margin of the basin, where the formation overlies the Dwyka Formation or pre-Karoo rocks, gives rise to marked variations in thickness (Johnson et. al, 2006).

The Vryheid Formation consists of alterations of sandstone, siltstone, mudstone, shale including several coal seams which are the primary target for coal mining in the area. As the Vryheid formation regionally pinches out towards the north, pre-Karoo rocks outcrop at surface in the region. Generally, the higher topography is underlain by sedimentary rocks of the Vryheid Formation whereas the lower lying areas, where these sediments have been eroded away, exposes the pre-Karoo (predominantly metasedimentary) rocks or diamictites of the Dwyka formation.

The project area is underlain by pre-Karoo rocks with a general SW-NE orientation which mainly belong to the Pretoria Group:

- Steenkampsberg Formation - quartzite with interlayered arenite, shale and conglomerate;
- Nederhorst Formation - hornfels overlain by arenite;
- Lakenvlei Formation - felspathic quartzite with conglomerate and grit;
- Vermont Formation - hornfels with layers of silt and sandstone, carbonate and calc-silicate rocks;
- Magaliesberg Formation - quartzite with some shale layers; and
- Lydenburg member of the Silverton Formation (shale and mudstone with interlayered carbonate layers).

The geological map furthermore indicates potential faulting and/or dykes in a SW-NE orientation and local outcrops of sill-type diabase intrusions.

9.2.2 Local geology

The project area itself is predominantly underlain by the Vryheid Formation. Exploration drilling at the site indicates the thickness of the Vryheid Formation is highly variable over short distances with depths between 21 and 81 mbgl for the north-western part of the site and between 16 and 47 mbgl for the south-western part of the site.

The targeted coal seams, as part of the Vryheid Formation, are the 2, 3, 4S and 4L seams with the 2-seam identified at the south-western part of the site and the 2, 3, 4S and 4L seams identified at the north-western part of the site. Depth to coal within the OC1 and OC2 pits are between 12 and 54 mbgl, with the deepest point towards the northern site boundary, and between 6 and 38 mbgl, with the lowest point along the south-western site boundary.

The Vryheid Formation is unconformably underlain by diamictite of the Dwyka Group, which in turn unconformably overlies Pre-Karoo rocks and diabase intrusions. It outcrops at surface to the west of the site and was intercepted at depth in most exploration holes.

Based on the exploration borehole logs lithologies underlying the Vryheid Formation were identified as diabase, granite and quartzite. Diabase is similar to dolerite and rocks of this nature indicate sill-type intrusions that occur mainly along bedding planes in the Karoo lithologies and at the contact between Karoo and pre-Karoo rocks. Sill type intrusions were also indicated on geological maps at surface north and northeast of the site (Figure 9-2). Based on the regional geology the presence of basement granites near the site is unlikely, and it could be that coarse-grained diabase or dolerite was interpreted as being granitic rock.

Outcrops of quartzite of the Lakenvlei Formation and diabase sills are present at the eastern half of the site, and exploration drilling shows quartzite underlying the Karoo lithologies along the south-eastern part of the site, in line with the presence of the Lakenvlei formation and the SW-NE orientation of the pre-karoo formations (Refer to Figure 9-2).

The presence of dyke-type intrusions was also observed by the interception of mainly dolerite in some borehole logs. The dykes will likely follow the SW-NE orientation of the geological units and linear features as indicated on the geological map (Figure 9-2).

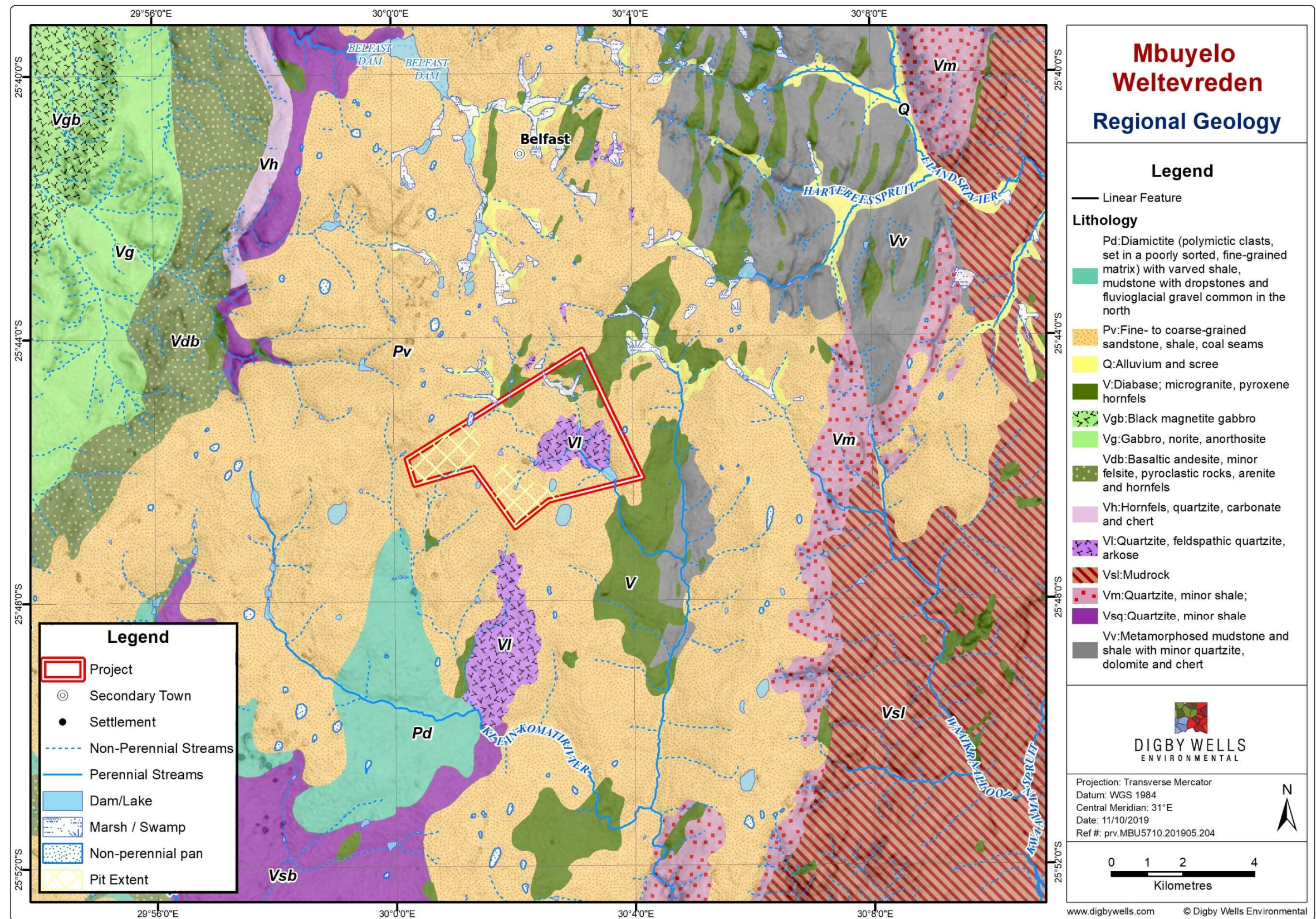


Figure 9-2: Regional Geology

9.3 Surface Water

The project area is situated within the Inkomati-Usuthu Water Management Area (WMA 3) and in quaternary catchment X11D as revised in the 2012 water management area boundary descriptions (RAS Government Gazette No. 35517, 2012). The farm Weltevreden is located on a watershed. The Klein-Komati River and its tributaries drain the area in a southerly direction joining up with the Komati River further downstream before flowing eastwards towards the Indian Ocean. The Langspruit flows to the north while the Steelpoort River flows in the northwest direction from the project area (Figure 9-3).

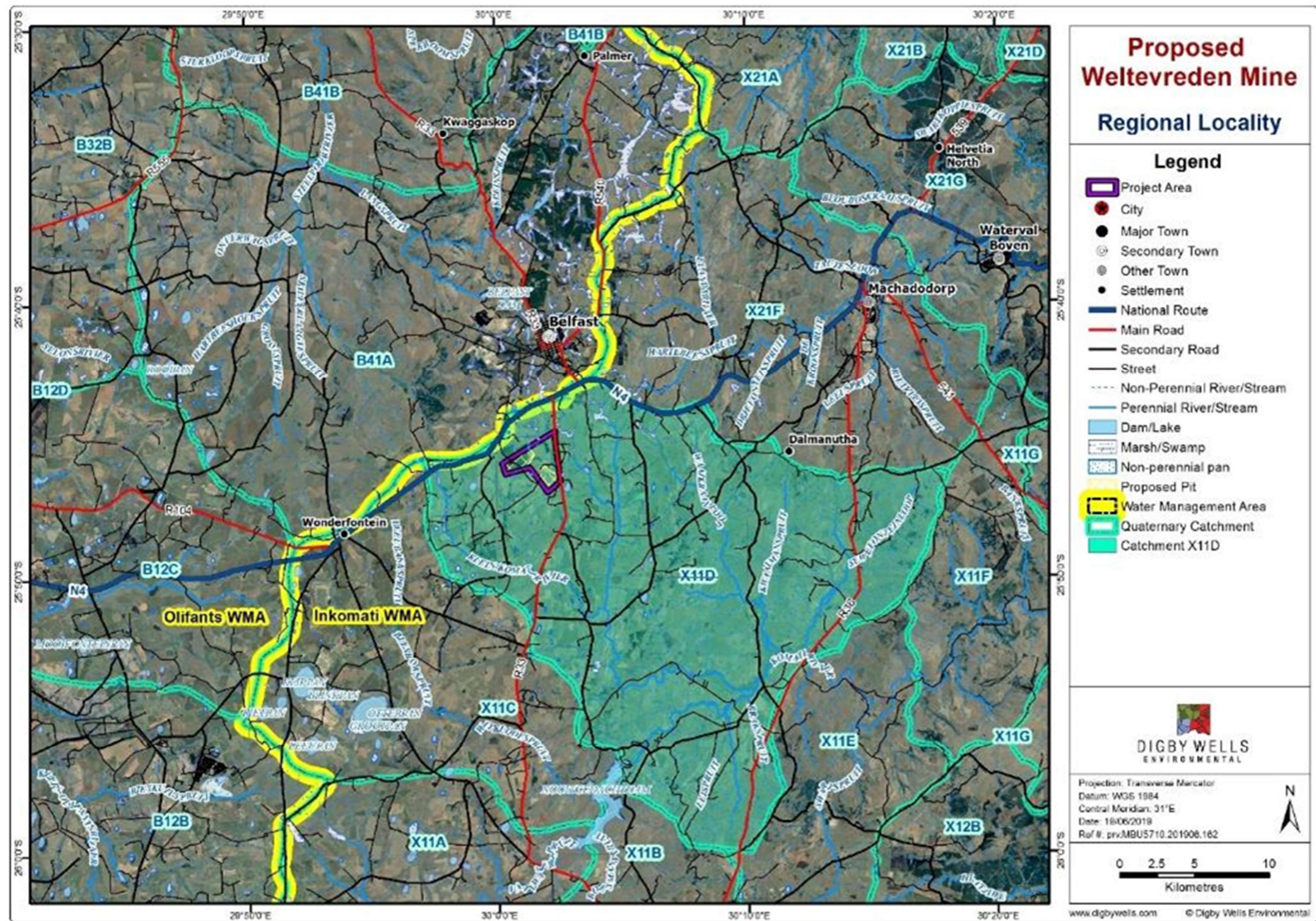


Figure 9-3: Hydrological Setting

The project area is characterised by warm and temperate climate with dry winters and warm summers. The precipitation of the driest month in winter is less than 1 tenth of the wettest month precipitation in summer (Cannon, 2011). The Mean Annual Precipitation (MAP) of region is 742 mm which is likely to be distributed as indicated in Figure 9-4. The normal rainfall (90% of the event) for the wettest month will likely not exceed 70 mm, while extreme rainfall (10% of the events) will likely not exceed 212 mm. This implies the region experiences high to moderate rainfall (Digby Wells, 2019e).

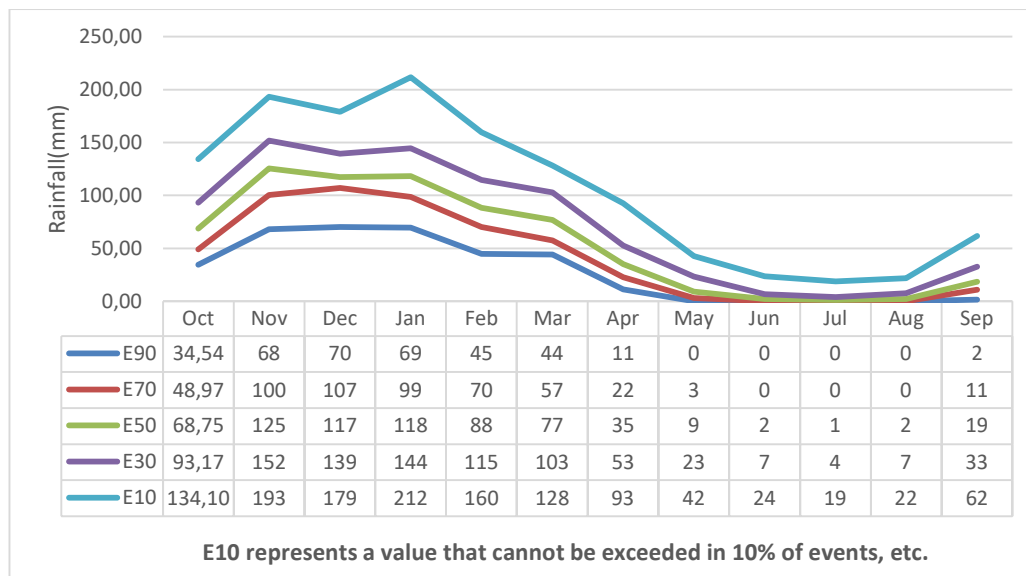


Figure 9-4: Monthly Rainfall distribution for quaternary X11D

The Mean Annual Evaporation (MAE) for the X11D quaternary catchment is 1413.5 mm (WRC, 2015). The region clearly experiences higher evaporation than precipitation, giving rise to dry winters and wet summers with a negative natural water balance. The monthly distribution of potential evaporation and rainfall can be seen in Figure 9-5.

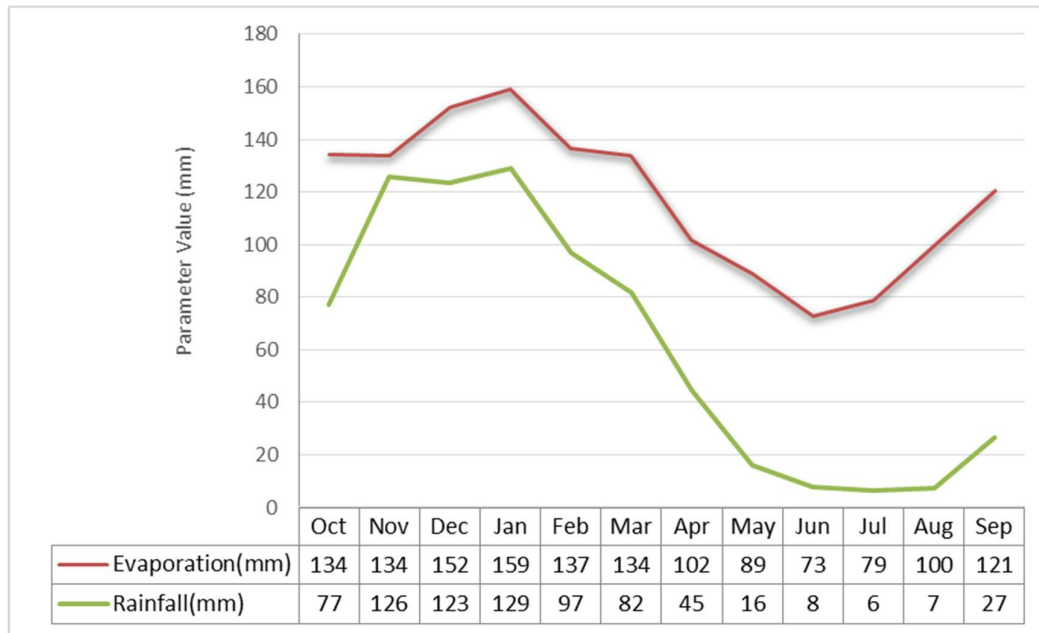


Figure 9-5: Monthly evaporation and rainfall for quaternary X11D (Digby Wells, 2019e)

The Mean Annual Runoff (MAR) depth for the area was calculated to be 80.91 mm. This runoff accounts for approximately 7.4% of the MAP for the area. Normal runoff (E70: 70% of events) and high flood flows (E10: 10% of events) during the wettest month of December will likely not exceed 3.2 mm and 22.5 mm, respectively. The MAR is likely to be distributed as indicated in Figure 9-6.

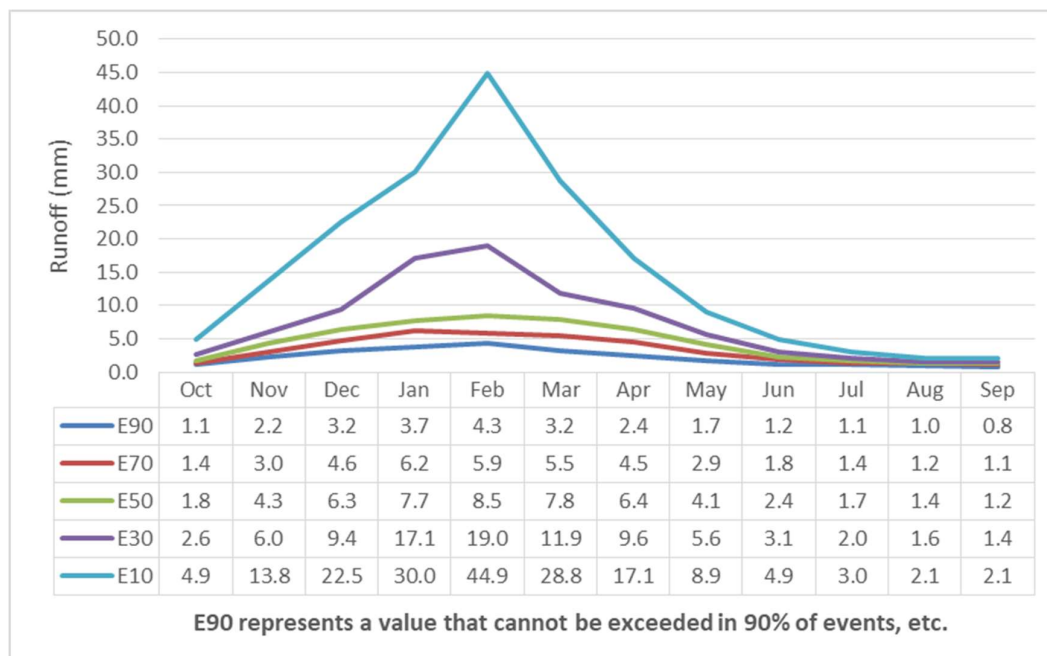


Figure 9-6: Monthly runoff distribution for quaternary X11D (Digby Wells, 2019e)

9.4 Soils

Earth Science Solutions (Pty) Ltd were appointed to conduct a soil assessment for the Weltevrede Project.

9.4.1 Dominant Soil Forms

The dominant soil forms encountered during the site investigation include those of the orthic phase Hutton, Clovelly, Griffin and the shallower Mispah and Glenrosa, with sub dominant forms that include the Glencoe and Dresden forms. In addition, and of importance to the area in question, is the significantly large proportion of the area that comprises wet based soils (Earth Science Solutions, 2019).

The hydromorphic soils range from extremes of deep Avalon, Bloomsdale, Glencoe and Pinedene forms on the transition zone terraces slopes, and shallow Avalon, Westleigh, Longlands and Katspruit Forms associated with the lower slopes and lower midslopes, to structured and gleyed soil forms (Katspruit) associated with the alluvial floodplains.

The dominant soil forms classified in the area are depicted in Figure 9-7 below. The dominant groups include, the deep sandy loams (generally >700mm) with no signs of wetness, moderately deep sandy loams and silty clay loams, shallow soils and very shallow materials, and several groups of hydromorphic soil forms that vary in depth and underlying plinthite character.

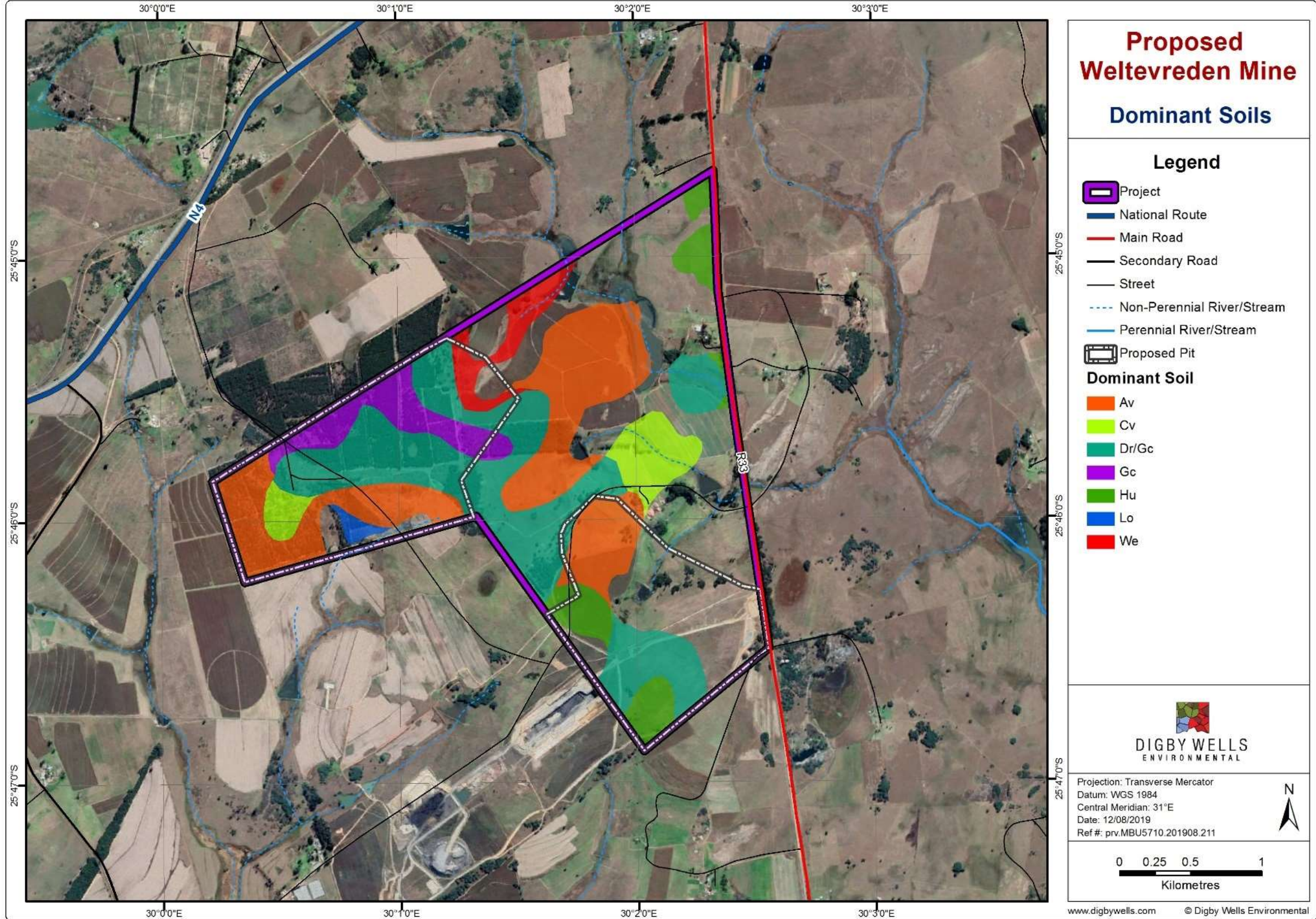


Figure 9-7: Dominant Soil Forms

9.4.1.1 Soil Chemical Characteristics

Sampling of the soils for nutrient status was confined where possible to areas of uncultivated land. However, some of the land being used for grazing may have been cultivated previously, and fertilized in the past, and thus these results may not be truly representative of the soils in their natural state (Earth Science Solutions, 2019).

The results of the analysis returned moderate to light textured soils with a pH (KCl) and base status typical of sedimentary lithologies within the highveld coal fields of South Africa, and nutrient levels reflecting generally acceptable concentrations of calcium and magnesium, but deficiencies in the levels of potassium, phosphorous and zinc, with predictably low organic carbon matter.

The structured and basic derived soils returned values that are indicative of the higher reserves of calcium and magnesium. They are inherently low in potassium reserves and returned lower levels of zinc and phosphorous for economically acceptable agricultural growth.

The nutrient status indicates a need for fertiliser applications of “Zn” “P” and “K”.

It should be noted however, that the addition of “P”, “K” and “Zn” in the form of commercial fertilisers are potential pollutants to the riverine and groundwater environment if added in excess. This must be considered when applying these additives. Small amounts of fertilizer should be added on a regular/more frequent basis, rather than adding large quantities in one application.

Generally, the soils mapped in this area are non-saline in character but could become susceptible to an increase in salinity if their water regime is not well managed, particularly on the more clay rich materials (Rensburg and Arcadia).

Generally, the “cation exchange capacity” (CEC) values for the soils mapped in the area are moderate to low, due to the moderate clay contents but poor organic matter content.

9.4.1.2 Soil Physical Characteristics

Most of the soils mapped exhibit apedal to weak structure, moderate clay contents and mesotrophic to dystrophic characteristics.

Due to the texture and structure inherent in these soils, compaction within the “A” horizon is likely to occur if heavy machinery is used during the wet summer months over unprotected ground, while the sensitivity of the soils to erosion is a factor to be considered during the rehabilitation process.

The area is flat to undulating, with wide open drainage lines and active water ways. The natural movement of eroded materials has resulted in the distribution of differing soils associated with the midslopes and lower midslope positions. The result is a complex of differing soil forms within a relatively small spatial area.

9.4.1.3 Dryland Production Potential

The dry land production potential of the shallow soils and the more structured Forms are poor.

The deeper, and apedal soil are easier to cultivate and have a better propensity to both drainage as well as the holding of moisture within the soil that is available to the plant. These soils are more productive dry land materials that are also easier to manage.

9.4.1.4 Irrigation Potential

The irrigation potential for the soils is “moderate to good” in terms of the soil structure and drainage capability. With good water management, and adequate drainage, the deeper (>700mm) soils could be economically cultivated to irrigated crops. The spatial distribution and occurrence of these soils is limited, and it is unlikely that sufficiently large enough areas of soil are available to make the use of irrigation viable on anything other than highly intensive market gardening tunnel gardening.

Irrigation is practiced to some extent in the area of study albeit there is no irrigation on the proposed project site.

9.4.1.5 Soil Utilisation Potential

In general, the soils that will be disturbed are moderately deep to shallow, (ERD = 400mm to 800mm), moderately well drained, with a susceptibility to erosion and compaction and in a significant proportion of the study area show signs of wetness at depth (shallow or perched water table).

The wet based and structured soils will be difficult to work, both from a trafficability, workability, storage and rehabilitation point of view.

Compaction must be considered carefully as the working of the wet based and structured soils when wet (rainy season), will be detrimental and compaction will occur.

The structure of the soil will affect their workability, and provision will need to be made for the timing of the stripping and rehabilitation works to be undertaken if the structural integrity of these soils is to be maintained.

The potential for the use of the hydromorphic soils for economic crop production and/or market gardening is at best poor and should not be considered for anything other than as wilderness/conservation lands (preferred option). The less structured and non-hydromorphic soils are that cover a substantial portion of the site are considered arable class soils, and as such can be considered for use in low intensity livestock grazing and or arable crop production.

9.4.2 Land Capability

ESS (2019), classified the land capability of the proposed project site. Figure 9-8 illustrate the spatial distribution of land capability classes and Table 9-1 provides a description of the land capability classes on the proposed site.

Table 9-1: Land Capability Classes

Land Capability	Description
Arable	Significantly large portions of the study area have been cultivated and are being economically farmed to annual crops under dry land and irrigation. The percentage area of soil that classify as “arable” land is however somewhat smaller, with some of the farming being undertaken on soils that are either less than 700mm in depth, rocky and inhibited in rooting depth, are associated with the transition zone wetlands or in some cases cultivation is being undertaken in the wetland zone. The area of actual cultivated land use is therefore not the same as the “arable” land capability delineated on the map.
Grazing	A significant portion of the study area classify as grazing land potential and is used as such. These areas are generally confined to the shallower (500mm to 700mm) and transitional hydromorphic soil Forms that are moderately well drained. These soils are generally darker in colour and are not always free draining to a depth of 750mm but can sustain palatable plant species on a sustainable basis, especially since only the subsoil's (at a depth of 500mm) are periodically saturated. In addition, there should be no rocks or pedocrete fragments in the upper horizons of this soil group. If present it will limit the land capability to wilderness/conservation land.
Wilderness/Conservation	The areas that classify as either conservation or wilderness land are found associated with the more structured, and shallower rocky soils (Glenrosa and Mispah) that are associated with non-hydromorphic soils. These are for the most part evident as outcrop or shallow sub-outcrop on the lower mid-slopes, or occasionally on the crest slopes. This land capability unit is not prevalent in the area of concern.
Wetland	<p>The wetland areas are defined in terms of the wetland delineation guidelines, which use both soil, topography as well as vegetation criteria to define the domain limits.</p> <p>These zones are dominated by hydromorphic soils that are often structured and have plant life that is associated with aquatic processes.</p> <p>The soils are generally dark grey to black in the topsoil horizons, high in transported clays, and show pronounced mottling on gleyed backgrounds (pale grey colours) in the subsoils. These soils occur within the zone of groundwater influence.</p> <p>This land capability unit is very prevalent in the study area and makes up a significant proportion of the area that could potentially be impacted by the proposed development.</p>

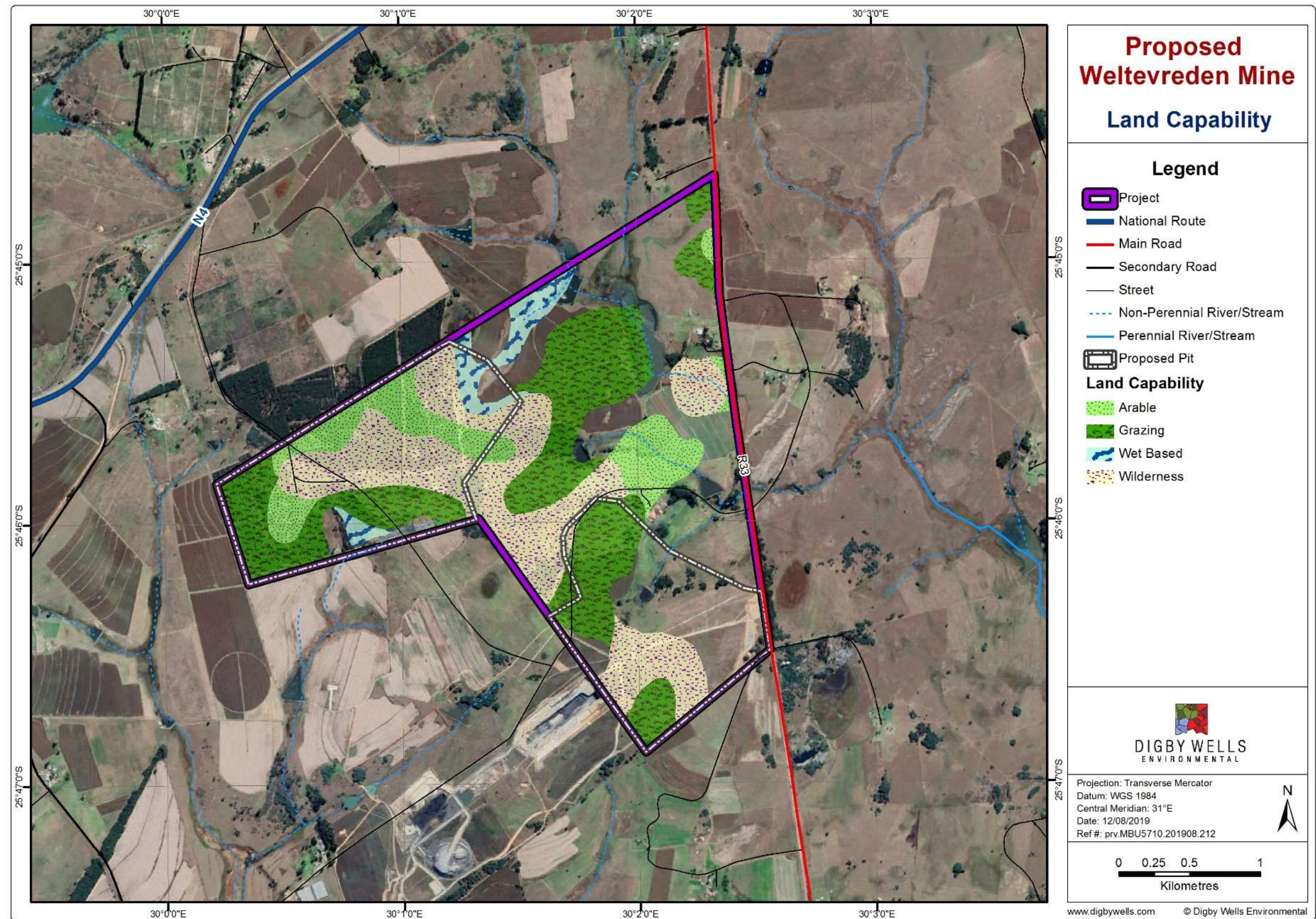


Figure 9-8: Land Capability Plan

9.5 Groundwater

Digby Wells undertook a Groundwater Impact Assessment (Digby Wells, 2019d) for the proposed project. This section details findings of the assessment.

Groundwater is the main source of drinking water supply in and around the proposed mining area and is abstracted with the use of submersible pumps and in one instance a windmill, supplemented by several handpumps which are mainly used for domestic purposes by local communities.

In general groundwater levels are shallow, mostly less than ~10 mbgl near the site and mainly located within the shallow weathered aquifer. Deeper groundwater levels measured at two boreholes (HADECBH1 and BLYBH4) are most likely dynamic water levels due to active pumping from the boreholes. Groundwater levels mainly follow topography and the main surface water drainage directions with the main groundwater flow direction to the south towards the Nkomati River.

The groundwater in the area is predominantly of a Mg-HCO_3 type, with a few instances of Ca-HCO_3 and Na-SO_4 , Na-Cl and Mg-Cl . The groundwater in the area is of good quality with no parameters exceeding any of the limits as per the South African National Standards (SANS) and World Health Organisation (WHO) drinking water guidelines.

The following aquifer units were discerned in the conceptual model: shallow weathered and fractured rock aquifer units in the Karoo sedimentary lithologies and in the Dwyka and Lakenvlei Formations. Locally dolerite or diabase sills outcrop at surface where poor aquifers form due to low to moderate weathering of the sills.

The weathered aquifer units are mainly the sandstone, siltstone and shale of the Vryheid Formation, quartzite of the Lakenvlei Formation and dolerite sills. At the site the weathered rocks are predominantly overlain by orthic soil types and hydromorphic soil types mainly related with wetlands.

The weathered zone depth at the site is expected to be between 3.20 mbgl with an average of ~8 mbgl and hydraulic conductivities in the range of 10^{-1} - 10^{-2} m/d. The fractured rock units mainly consist of the fractured Vryheid Formation and pre-Karoo Formations with hydraulic conductivities for the fractured zone in the order of 10^{-2} - 10^{-3} m/d.

Recharge values for Karoo lithologies are generally low, mainly between 1-3% of MAP. Recharge rates for the Vryheid, Dwyka, Lakenvlei and sills in the conceptual model are all expected to have relatively low recharge rates with values ranging between ~0.5 to 1.5% of MAP.

Potential groundwater impacts are described in Section 12.1.

9.6 Wetlands

450.43 ha of wetland areas were identified within the proposed project area and its associated 500 m zone of regulation with 225.89 ha within the proposed project area, of which 94.86 ha are

affected by the proposed OC1 and OC2 pits and the proposed surface infrastructure. Thirty hydro-geomorphic (HGM) units were identified and categorized based on terrain units. These included pans, hillslope seeps, unchannelled valley bottoms and channelled valley bottoms. Table 9-2 indicates the extent of the various HGM types within the proposed project area. Figure 9-9 indicates the location of each in relation to the surrounding landscape (Digby Wells, 2019f). A summary of the Wetland Health and Integrity (Wet-Health) and ecological importance and sensitivity (EIS) is also provided in Table 9-2.

9.6.1 Ecological Importance and Sensitivity

The ecological importance and sensitivity (EIS) of the various HGM units were regarded as largely dependent on their respective locations in the landscape, the surrounding landscape uses and activities and the HGM unit type. The level of resilience and the anthropogenic impacts affecting each HGM unit was also considered.

The majority wetlands present within the proposed project area and its 500 m zone of regulation were regarded as of *moderate* ecological importance and sensitivity, except for HGM units 5, 16, 18, 19 and 30, which were regarded as *high*, and 10, which was regarded as *low*. HGM units 5, 16, 18, 19 and 30 were regarded as important for the maintenance of biodiversity as well as for streamflow regulation and flood attenuation (Digby Wells, 2019f).

The health and integrity of each of the HGM units present varied considerably, with anthropogenic disturbances being the most significant driver of change to date. These disturbances were related largely to plantations, agropastoral activities and linear infrastructures traversing the proposed project area, with an isolated portion in the south-east of the proposed project area affected by mining activities (Digby Wells, 2019f).

Table 9-2: HGM Units within the proposed Project area within 500m zone of regulation and WET-Health and EIS

HGM unit name	HGM unit type	Area (Ha)	WET-Health	EIS
1	Unchannelled valley bottom	1.33	C (3.22)	Moderate (1.5)
2	Unchannelled valley bottom	16.23	D (5.19)	Moderate (1.8)
3	Hillslope seep	1.97	C (3.57)	Moderate (1.4)
4	Hillslope seep	0.74	C (3.39)	Moderate (1.4)
5	Unchannelled valley bottom	4.46	C (3.96)	High (2.3)
6	Unchannelled valley bottom	9.43	D (4.86)	Moderate (1.3)
7	Unchannelled valley bottom	4.68	C (2.83)	Moderate (1.5)
8	Hillslope seep	34.74	C (3.27)	Moderate (1.6)
9	Pan	9.49	B (1.97)	Moderate (1.7)
10	Unchannelled valley bottom	1.89	D (4.71)	Low (0.8)

HGM unit name	HGM unit type	Area (Ha)	WET-Health	EIS
11	Hillslope seep	11.31	C (3.27)	Moderate (1.6)
12	Unchannelled valley bottom	4.63	D (4.54)	Moderate (1.6)
13	Pan	0.65	D (4.97)	Moderate (1.7)
14	Pan	12.92	D (5.23)	Moderate (1.7)
15	Pan	8.79	C (3.26)	Moderate (1.7)
16	Unchannelled valley bottom	96.65	D (4.91)	High (2.2)
17	Hillslope seep	22.83	C (3.24)	Moderate (1.4)
18	Unchannelled valley bottom	23.35	D (4.96)	High (2.2)
19	Unchannelled valley bottom	34.35	C (3.89)	High (2.2)
20	Hillslope seep	58.65	C (2.12)	Moderate (1.8)
21	Channelled valley bottom	7.33	C (3.11)	Moderate (1.5)
22	Hillslope seep	3.58	A (0.71)	Moderate (1.7)
23	Pan	10.46	B (1.97)	Moderate (1.8)
24	Pan	2.83	B (1.92)	Moderate (1.7)
25	Hillslope seep	16.86	C (2.16)	Moderate (1.6)
26	Hillslope seep	5.35	C (2.96)	Moderate (1.6)
27	Unchannelled valley bottom	12.63	C (3.11)	Moderate (1.6)
28	Hillslope seep	20.32	C (3.53)	Moderate (1.6)
29	Hillslope seep	4.91	C (3.41)	Moderate (1.6)
30	Unchannelled valley bottom	7.05	C (2.7)	High (2.2)
TOTAL		450.43		

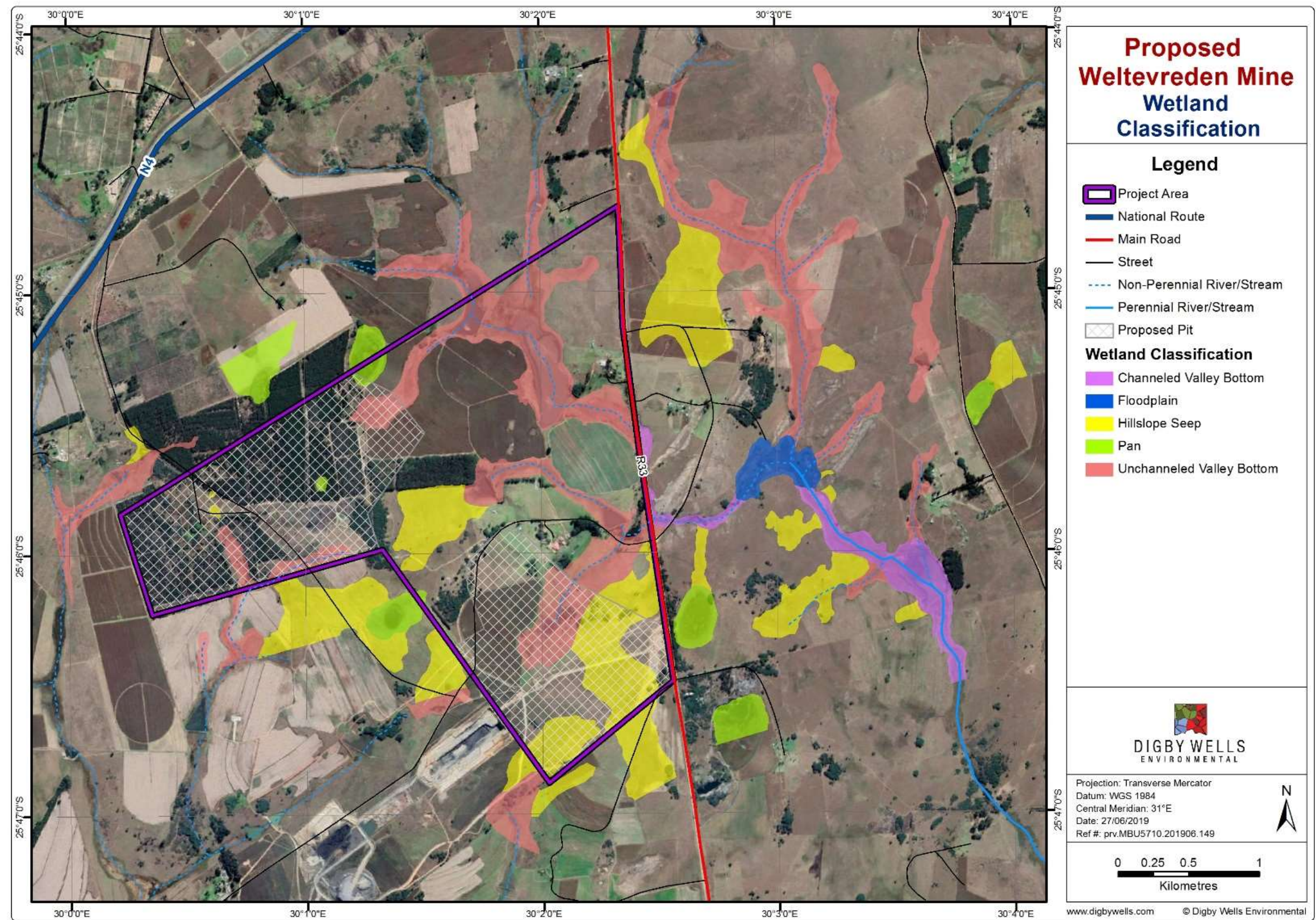


Figure 9-9: Wetland Delineation

9.7 Flora

According to Mucina and Rutherford (Mucina, 2012), the proposed Weltevreden Project is in areas classified as Eastern Highveld Grassland (Gm 12).

The Grassland Biome covers roughly a third of the country. It occurs across six provinces and is the second largest of South Africa's nine biomes, covering an area of 339 237.68 km² (SANBI, 2016).

The term 'grassland' creates the impression that the biome consists only of grass species. In fact, it is a complex ecosystem, including rivers and wetlands, where only one in six plant species are grasses.

Thirty percent of the biome has been irreversibly transformed and only 1,9% is formally conserved. As a result, the National Biodiversity Strategy and Action Plan has identified the grasslands biome as one of the spatial priorities for conservation action (SANBI, 2016). The important biodiversity contained within the grasslands, which underpins life, is being eroded to such an extent that human wellbeing is threatened.

The Eastern Highveld Grassland is found on slightly to moderately undulating plains, including some low hills and pan depressions and consist of short, dense grassland, dominated by the usual Highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*, etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (Mucina & Rutherford; 2006). Woody species include *Senegalia caffra*, *Celtis africana*, *Diospyros lycioides subsp. lycioides*, *Parinari capensis*, *Protea caffra* and *Searsia magalismsontana*.

The Eastern Highveld grassland is classified as an endangered vegetation type (Rouget *et al.*, 2004; Mucina & Rutherford, 2012, Ferrar & Lötter, 2007) due to mining activities within the provinces, with a conservation target of 24% (NSBAR, 2004). Approximately 44% of the Eastern Highveld Grassland has been transformed, primarily by cultivation, plantations, mining, urbanization and building of dams (Mucina & Rutherford; 2012). Erosion is very low, and no serious alien infestation is reported, although species such as *Acacia mearnsii* can become dominant in disturbed places.

Portions of the study area had been altered from its natural state (Mesic Highveld Grassland) due to current and historical land use, and these variations were used as a basis of stratification. Owing to the effects of fragmentation, as well as the impacts of grazing livestock, primarily cattle, especially close to homesteads, much of the remaining natural vegetation on site had been altered and modified with alien plant species (Digby Wells, 2019a).

The alien tree plantations (formally planted), which counts Black Wattle (*Acacia mearnsii*), Red River Gum (*Eucalyptus camaldulensis*) and English Oak (*Quercus robur*) as the majority of the species planted is, regarded as a primary threat to the riparian and grassland areas and the native species dependant on these landscapes (Table 9-3).

Further to this, heavy grazing results in a loss of palatable species and an increase in non-palatable ones. This decreases the carrying capacity of the veld and increases the likelihood of alien vegetation dominating the landscape.

The study area was divided into six primary vegetation units or land management units, namely: Agricultural Areas, Alien Bushclumps, Secondary Grassland, Mesic Highveld Grassland, Rocky Outcrops and Transformed Areas. The vegetation units are represented in Figure 9-10. Eighty plant species were recorded on site, as listed in Appendix B. The delineated vegetation units are displayed below in Table 9-3, the transformed and agricultural areas are included.

Table 9-3: Vegetation types encountered (Digby Wells(a), 2019)

Name	Sensitivity	Area (Ha)	Area (%)
Agriculture	Low	74.970	15.310
Alien Invasive Plant	Low	169.907	34.698
Mesic Grassland	High	6.300	1.287
Old Plantation	Low	26.491	5.410
Pan	High	1.593	0.325
Secondary Grassland / Pastures	Medium	122.089	24.933
Wetland	High	88.321	18.037
Total		<u>489.670</u>	<u>100</u>

The most important vegetation/habitat type that dominates the project site that would have been the most extensive as well, if it wasn't for anthropogenic impacts are the Grasslands. The characteristics of Mesic Highveld Grassland are listed and discussed in the Fauna and Flora report, in addition the main issues, vulnerabilities and pressures are listed.

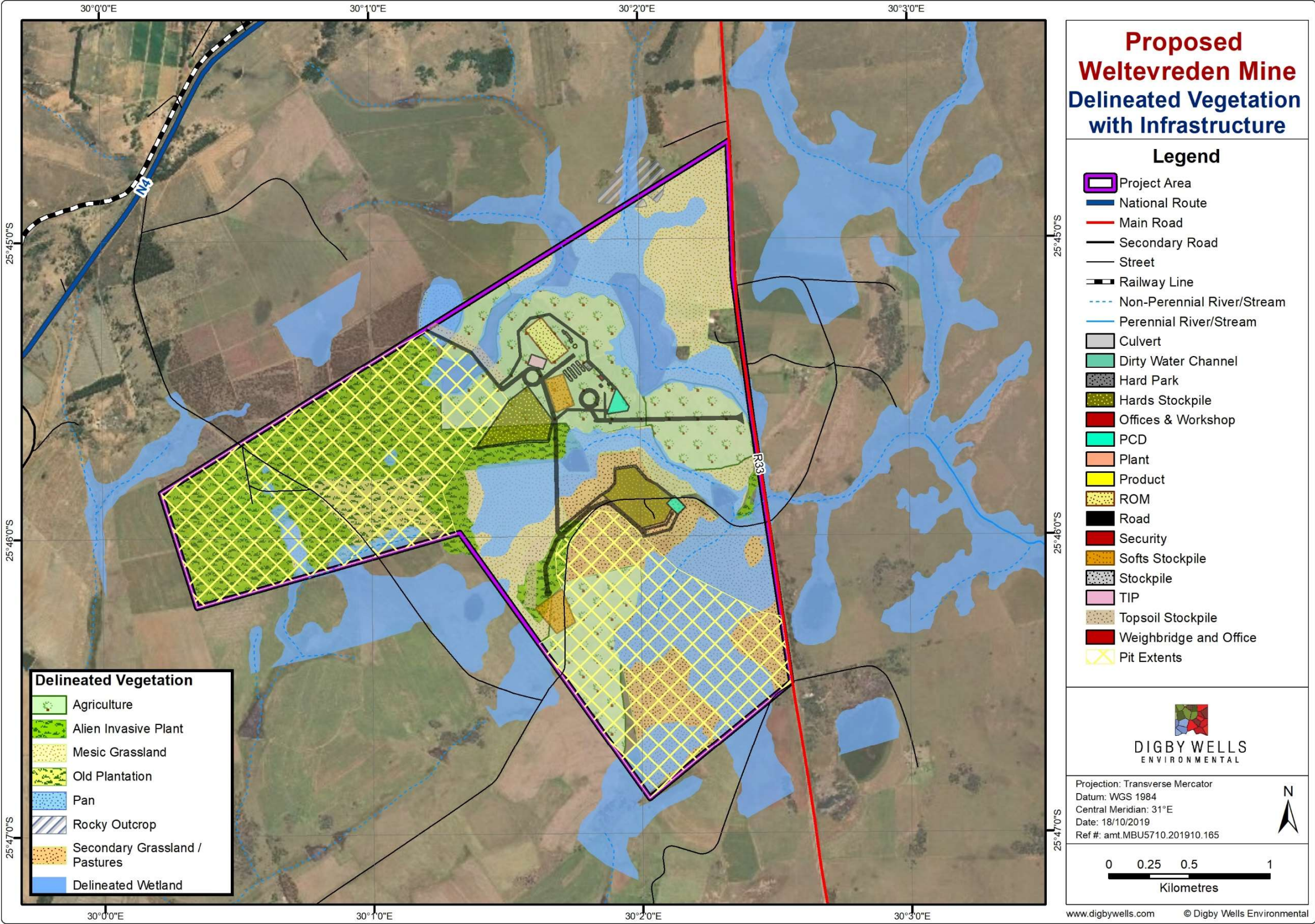


Figure 9-10: Vegetation Delineations

9.8 Fauna

Fauna occurring on site include assemblages within terrestrial and wetland ecosystems, these include mammals, birds, reptiles, amphibians and invertebrates. As described in the floral section (Section 9.4.1.1), mesic grasslands, wetlands and plantations are the main habitats available to fauna. Grassland is the dominant habitat and the grassland that remains intact on site showed a marked reduction in plant diversity from the former reference state (Digby Wells, 2019a).

9.8.1 Mammals

Three rodents were caught in the Sherman traps, these species were Swamp Musk Shrew, (*Crocidura mariquensis*) Striped Mouse (*Rhabdomys pumilio*) and Pouched Mouse (*Saccostomus campestris*). All these rodent species are listed as Least Concern in the Red Data classification system.

Small mammal species recorded from the study area include Cape Clawless Otter (*Aonyx capensis*), Common Duiker (*Sylvicapra grimmia*), African Civet (*Civettictis civetta*), Scrub Hare (*Lepus saxatilis*), Water Mongoose (*Atilax paludinosus*), Yellow Mongoose (*Cynictis penicillata*) and Porcupine (*Hystrix africaeaustralis*). Serval (*Felis serval*) was recorded however Large-spotted Genet (*Genetta tigrina*), are expected to occur in the project area, but was not recorded.

9.8.2 Avifauna

A total of 36 of the 260 bird species expected in the area were observed during the surveys.

The central parts of the project site which were dominated by agricultural fields and farm roads included species such as the Redeyed Dove (*Streptopelia semitorquata*), Laughing Dove (*Spilopelia senegalensis*), Cape Turtle Dove (*Streptopelia capicola*), Common Fiscal (*Lanius collaris*), Cape Sparrow (*Passer melanurus*), Neddicky (*Cisticola fulvicapilla*), Swainsons Spurfowl (*Pternistis swainsonii*), Helmeted Guineafowl (*Numida meleagris*), Black Winged Kite (*Elanus axillaris*) and large numbers of Feral Pigeons (*Columba livia domestica*). In the more natural grassland vegetation type of the north eastern section of the study area a breeding pair of Grey Crowned Cranes (*Balearica regulorum*) (EN) were recorded.

Expected but not encountered were the Secretary Bird (VU) (*Sagittarius serpentarius*) possibly occurring in the open grassland. Although not seen on the days of the site visits, a number of birds of prey should be present periodically throughout the year and would in all likelihood include Red Data summer migrant species such as Pallid Harrier (*Circus macrourus*) and Montagu's Harrier (*Circus pygargus*). These species do however prefer the less impacted grassland areas to sustain their preferred prey species.

The grasslands and agricultural fields of the study area harbour several typical highveld endemics. These included several White Storks along with widow, weaver and bishop species (within the wetter areas). Several African Quailfinch's (*Ortygospiza fuscocrissa*) were observed within the grasslands – these species generally feed on the seeds of the wetter

grass species and are renowned wetland indicators. African Pipit (*Anthus cinnamomeus*) and Cape Longclaw (*Macronyx capensis*) were observed throughout the project site – although there is enough nesting habitat for the more endangered lark and pipit species in the general area it must be noted that any explosives, increased traffic loads and earth movement will negatively impact on the breeding of all lark and pipit species, however this is usually not a permanent impact. The grassland area is also ideal habitat for quail and button-quail species although these species are highly nomadic and were not identified during the site investigation.

A number of water birds were identified within the open water of the farm dam in the central section of the study area, these included Red-knobbed Coot (*Fulica cristata*), African Snipe (*Gallinago nigripennis*), Grey Heron (*Ardea cinerea*), Egyptian Goose (*Alopochen aegyptiaca*), Spurwinged Goose (*Plectropterus gambensis*) Yellowbilled Duck (*Anas undulata*), White-faced Duck (*Dendrocygna viduata*), Great white Egret (*Ardea alba*), Cattle Egret (*Bubulcus ibis*), Common Sandpiper (*Actitis hypoleucos*) and Three-banded Plover (*Charadrius tricollaris*). Appendix C includes a complete bird list for the greater area of the properties (including the list in bold that was observed during the site investigation). Although the habitat on the site could not cater for a number of species on this list, it presents an indication of what is and can be found in the vicinity.

9.8.3 Reptiles

Similarly, to the amphibians, the reptiles within the project area will prefer certain habitats over others and they are important ecological indicators. Due to amphibians (frogs and toads) being a major food source for several reptile species, the investigation on the microhabitats can be beneficial in understanding the propensity for both animal groups to occur.

The reptile population in the area is expected to be representative of the vegetation and habitat types present. Through interviews with landowners, it was determined that the Brown House Snake (*Lamprophis capensis*), Rinkhals (*Hemachatus haemachatus*), and the Water Monitor (*Varanus niloticus*) are present.

9.8.4 Amphibians

The presence of suitable habitat within the study area provides refuge to several different species of amphibians however 4 species were identified within the proposed project site during the field survey. This is a limitation that is presented in the dry season, when most frogs hibernate in a variety of areas including under logs and rocks, streambanks and inside termitaria. Four amphibians were encountered during this field survey by (Table 9-4).

Table 9-4: Amphibian Species recorded (Digby Wells(a), 2019)

Scientific Name	English Name	IUCN (2019.2)	NEMBA TOPS List (2015)
<i>Afrana angolensis</i>	Common River Frog	-	-
<i>Bufo gutturalis</i>	Guttural Toad	-	-

Scientific Name	English Name	IUCN (2019.2)	NEMBA TOPS List (2015)
<i>Cacosternum boettgeri</i>	Common Caco	-	-
<i>Strongylopus fasciatus</i>	Striped Stream Frog	-	-

9.8.5 Invertebrates

Seven butterfly species were observed within the proposed project site, these included the, Brown-veined White (*Belenois aurota*), Broad Bordered Grass Yellow (*Eurema brigitta*) (Table 9-5). All the species were located within grassland or the wetland areas. No butterfly species observed were Species of Special Concern. However according to South African National Biodiversity Institute (SANBI), it is possible that the Near Threatened Marsh Sylph (*Metisella meninx*) can be located on site. It is endemic to the wet vleis of highland grassland in northern KwaZulu-Natal, Mpumalanga, Gauteng, the northern part of the Free State and the extreme east of the North West Province, they preferred *Leersia hexandra* dominated grassland. It has become extinct in many areas close to Johannesburg due to building developments.

No invertebrate Species of Special Concern (SSC) were observed on the project site during the site visits in August 2019.

Table 9-5: Recorded List of Butterfly Species on the Weltevreden Project Site (Digby Wells, 2019)

Species Name	Common Name	Status
<i>Belenois aurota</i>	Brown Veined White	LC
<i>Catopsilia florella</i>	African Migrant	LC
<i>Colotis auxo</i>	Sulphar Orange Tip	LC
<i>Junonia hierta</i>	Yellow Pansy	LC
<i>Junonia octavia</i>	Gaudy Commodore	LC
<i>Junonia orithya madagascariensis</i>	Eyed Pansy	LC
<i>Pinacopteryx eriphia</i>	Zebra White	LC

Paracinema tricolor, a locust species was encountered in the grasslands of the project site, *Rhodometra sacraria* (Vestal) was found in the wetland areas. *Spilostethus pandurus* or Seed Bug was found in the grassland areas and the Wolf Spider (*Ctenus* spp.) was encountered at the pans to the north east of the project site.

9.8.6 Ecological Sensitivity

The ecological sensitivity map for the site is represented in Figure 9-11. The remaining grassland, rocky areas, wetland/riparian vegetation units were allocated a high sensitivity since wetlands are regarded as important habitats that should be conserved due to the presence of plant mammal and avifauna SSC as well as habitat diversity that these areas represent.

The sensitive species locations recorded during the field work is represented below in Figure 9-12.

It is very likely that any disturbance to the area will impact the birdlife within all habitats of the property. The wetlands and natural grassland (containing rocky outcrops) areas are the most sensitive and there is a concern that any mining will have a negative impact on the quality of the water and a possible de-watering effect that would impact on the wetland system permanently. It is proposed that should any disturbance occur within the property that the two most sensitive habitats are conserved and managed accordingly.



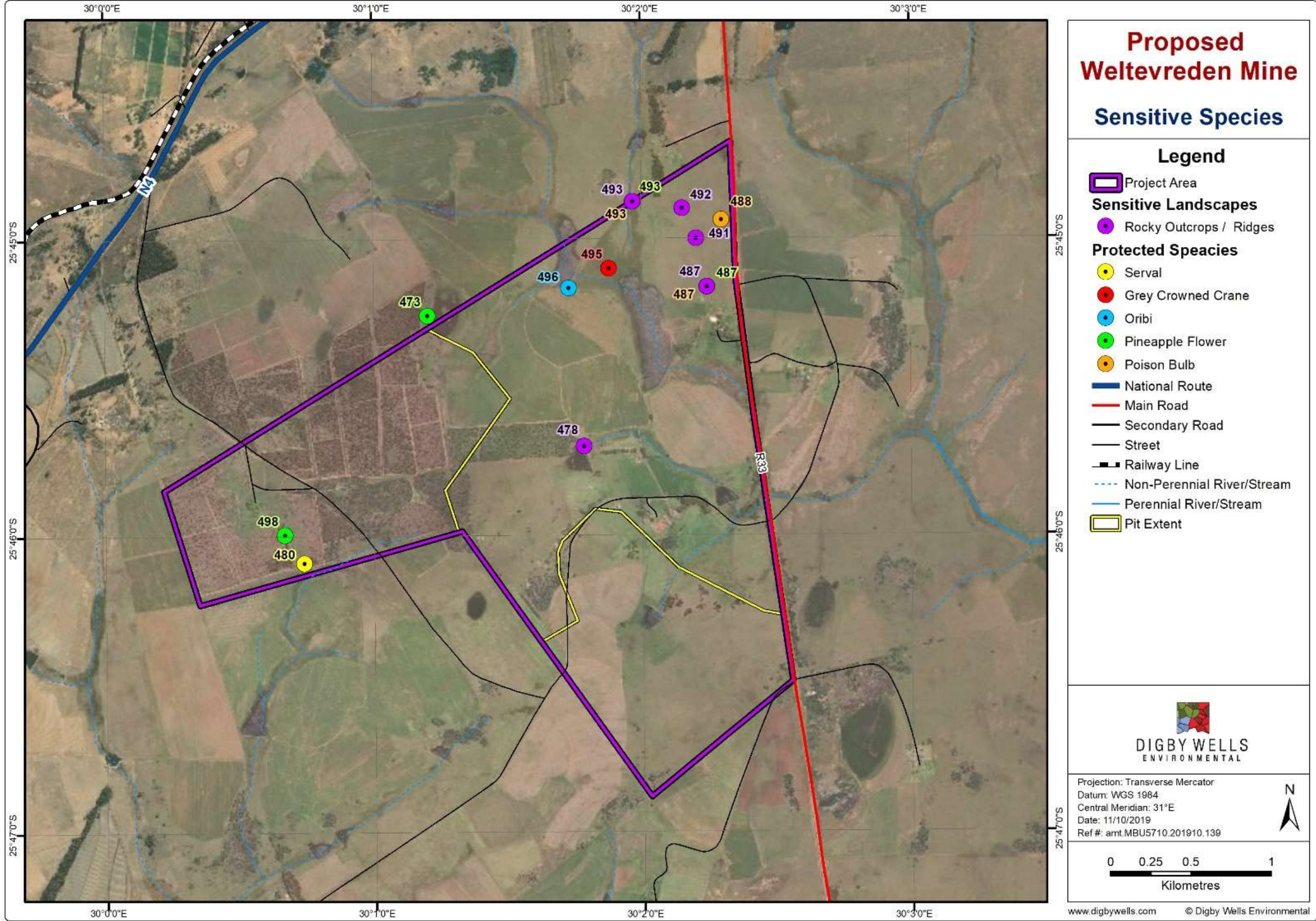


Figure 9-12: Sensitive Species Locations

9.9 Sites of Archaeological and Cultural Importance

Within the project area, Digby Wells identified heritage resources affiliated with the historical period. Table 9-6 presents a description of the identified heritage resources during the survey as well as a description of the Cultural Significance and Field Rating (Digby Wells, 2019c).

Table 9-6: Heritage Resources Identified

Site Name	Description	CS and Field Rating
BGG-001	<p>Burial ground demarcated by fencing – this fencing appears to have been erected in two phases, as there are two different styles and one type of fence has deteriorated. The burial ground includes ten visible graves, one of which is outside the fence perimeter. This appears to be a child grave.</p> <p>Of all the graves, seven were marked with stone and soil piles. One of these graves is marked with a white cross and marker and two are indicated by small metal markers. One had no headstone. No names or dates were visible on these markers. One grave was marked by brick fittings with a brick headstone (this may also be a child grave). Another grave was marked by brick fittings with no headstone. One grave had granite fittings, slab and headstone with a legible name and date. This grave belongs to the Mthimunye family and dates to 1990.</p>	Very High Grade I
Wf-001	<p>An extensive werf with a mix of historical and modern structures. The werf includes a farmhouse, animal pens, barns and several other structures, some of which appear to be housing. Some of these structures have thatched roofs, while others have tin. The barn appears in the historical imagery. Some of the modern structures appear in an area which appears to have been a dense treeline or windbreak in the historical imagery. These structures are presently in use.</p> <p>There is one ruined structure and one stone animal pen in proximity to the werf. These do not appear on the historical imagery, but this may be because of their size. The age of these structures has therefore not been verified.</p>	Low General Protection IV B
Wf-002	<p>A werf with a mix of historical and modern structures. One of the structures is visible on the historical layering – this is most likely the Zoekop farmhouse or barn. These structures are currently in use.</p>	Low General Protection IV B

10 Social Context

The social context is summarised below as extracted from the Socio-economic Impact Assessment (Digby Wells, 2019b)

The proposed Project will be located within the Nkangala District Municipality (NDM), one of 3 district municipalities in the Mpumalanga province. The project site is specifically in Ward 1

of the Emakhazeni Local Municipality (ELM) in this district. The nearest large settlements to the site are the town of Belfast (11 km north east of the site) and its township of Siyathuthuka (15 km north of the site).

Ward 3 had the largest population and the greatest population density (4 676 people per km²) when compared with Wards 1 and 3 (17.4 people per km² and 14.1 people per km² respectively). Development needs for these wards will therefore vary. It will be important to consult with the community and local government structures to ascertain priority needs for the SLP in these wards.

The predominant population group in Belfast in 2011 was White and in Siyathuthuka it was Black African. The population in Wards 1 and 3 were 99% Black African whereas in Ward 8 it was 43% White and 51% Black African. If the mine's social investment project selection criteria prioritise benefits to Historically Disadvantaged Individuals (HDIs), Wards 1 and 3 will be ranked higher than Ward 8 when selecting a geographical location for projects.

Ward 3 had the highest proportion of people of working age (61%); this was slightly higher than in Ward 8 (59%) and Ward 1 (57%). Ward 1 has a slightly higher proportion of children and the elderly (43%) when compared with Wards 3 and 8 and local and district populations (where it is approximately 40%). Almost half of the population 15 years and older in both Wards 1 and 8 were employed, compared with less than a third of the population in Ward 3. Dependency rates in all three wards but especially in Ward 3 were therefore high. Unemployment amongst the economically active population 15 years and older was the highest in Ward 1 (20%), followed by Ward 3 (12%) and Ward 8 (11%). If these individuals secure employment at the mine, it will improve livelihoods and reduce the levels of dependency in their households.

The mine has the potential to provide much needed formal jobs to qualifying individuals living close to the mine. Amongst the 3 wards, Ward 1 had the greatest proportion of people 20 years and older who had completed some secondary education (36%). Ward 8 also had the greatest proportion of people 20 years and older that had completed matric (36%), followed by Ward 3 (33%) and Ward 1 (30%). At least 30% of the population 20 years and older in the local and district municipal and the provincial levels had completed matric. Amongst the 3 wards, Ward 8 had the highest proportions of undergraduates and postgraduates, which were 5% and 2% respectively. These were higher percentages than those found in the Emakhazeni local and Nkangala district municipalities and in Mpumalanga province.

Of the 3 wards, Ward 3 had the largest proportion of households headed by women (47%) and Ward 8 had the lowest (30%). Female-headed households could be economically impoverished where women are primarily employed in low paying positions such as domestic work or in the informal sector. As indicated above, Ward 1 had the highest proportions of employed individuals with no income (10%), earning up to R20 000 (34%) and earning from R20 001 to R40 000 (29%). The total for these categories in Ward 1 is 73%, which is higher than the corresponding totals for Ward 3 (55%) and Ward 8 (46%). Income at household level presented a different picture. Ward 3 therefore had the greatest proportion of households with annual incomes of R0 to R20 000 (42%). In contrast, the comparative proportion in Ward 1 is

14.8% and in Ward 8 it is 26%. When comparing the Siyathuthuka township with the town of Belfast, it was found that the former had twice the number of households with no annual income. Siyathuthuka also had almost twice the proportion of households (17%) with annual income up to R4 800 and twice the number of households (22%) with annual incomes up to R9 600 per annum. This means these households live in absolute poverty (i.e. a family of 4 earning less than R 1 600 per month will struggle to meet their daily basic needs). Where possible, the mine should consider initiating and supporting community and economic development projects that will benefit impoverished households and respond to the needs of children, the elderly and women for inclusion in their SLP.

With respect to service delivery, it was found that almost all households (99%) in Ward 3 were receiving water from a regional or local service provider, compared to Wards 1 and 8 where approximately 20% of households depended on alternative sources such as boreholes. More households were accessing water from a borehole in Wards 1 (11%) 8 (9%) and the local municipality (10%) when compared with Ward 3. Most households (98%) in Ward 3 also had access to flush or chemical toilets whereas the corresponding proportions of households in Wards 1 and 8 with flush or chemical toilets were 91% and 75% respectively. Alternative sanitation facilities in these two wards included pit latrines without ventilation (3% and 11% in Wards 1 and 8 respectively). Ward 3 was also the best serviced when one considered refuse removal services, with 100% of households receiving regular refuse removal services from the local authority or private company. The corresponding proportions in Wards 1 and 8 were 81% and 67% respectively. Of the 3 wards in the primary study area, Ward 3 was the most formal and contemporary as it had the highest proportion of formal houses and the lowest proportions of traditional houses or shacks.

Economic development that the mine can deliver will have the potential to stimulate the economy in the Emakhazeni Local Municipality, the smallest local municipal contributor to the district and provincial GDP. Mining contributed the most (25.8%) towards the GDP of the ELM in 2016. Priority needs determined for Emakhazeni Local Municipality during NDM's community outreach meetings in October 2017 constituted of RDP houses, land use management for advancement of human settlements, building and maintenance of infrastructure, and provision of basic services at farm wards. Priorities for Wards 1, 3 and 8 are detailed in the IDP of the ELM (Emakhazeni Local Municipality, 2019) and will be considered further in the mine's SLP.

11 Land Use

The post-mining land use is essentially the end land use to which Xivono would like to return the land affected by mining activities. The closure objectives set as part of the mine closure planning process aim to ensure that the final land use is achieved, and that the area is sustainable in the long term, both from an environmental and social point of view.

The final land uses as described in this report are based on the current perceptions and may alter in time due to further feasibility studies, economic developments and extensions.

11.1 Current and Surrounding Land Use

Available satellite imagery indicates that the project area consists mostly of old cultivated land (Oldlands), cultivated lands, afforested land, and grasslands, as well as water bodies in the form of marshes, wetlands, and dams. Sparse dispersed settlements (Urban and Homesteads) also make up a small percentage of the project area (Digby Wells, 2019a).

11.1 Post-Mining Land Use

The post-mining land use will aim for the following:

The land on which the mining operations occur must be rehabilitated, as far as is practical, to its natural state or where the land use conforms to the concept of sustainable development.

Considering the pre-mining development land capability described in Section 9.4.2, the post-closure land use should be conducive to livestock grazing and areas not impacted by mining should continue to be utilised as per pre-mining development land use.

12 Potential Post-Closure Impacts

The following section describes the main environmental risks during the post-closure phase of the proposed Project.

The recommendations proposed in the various specialist assessments should be consulted for the best measures to be put in place to mitigate the potential impacts during the operational phase as well as the decommissioning and closure phase.

12.1 Groundwater

At LoM, pumping of groundwater from the open pits will cease, the final voids will be backfilled, and groundwater levels will recover. Groundwater levels in the surrounding area which were drawn down due to the dewatering will subsequently return to close to the natural, pre-mining state. However, due to the low recharge influx and increased porosity of the backfill materials it will take a long time before groundwater levels will return to pre-mining conditions. The numerical model was used to simulate groundwater rebound and indicated the rebound will indeed be slow. Groundwater levels in the vicinity of the site are expected to take approximately 80 years to recover. However, due to the limited scale of the drawdown cone it is expected that the long-term recovery will have a minor impact (Digby Wells, 2019d).

12.1.1 Groundwater Contamination

Once mining has ceased, Acid Mine Drainage (AMD) is still likely to form given the partially unsaturated conditions and the consequent contact of water and oxygen in the backfilled pits and hards stockpiles. Groundwater contaminants could migrate from these areas once groundwater levels in the open pits start to recover.

The migration of contaminated water from the open pits and the hards stockpiles was simulated for 50- and 100-years post-closure (Figure 12-1). The maximum extent of the contaminant plume (sulphate >50 mg/l) was calculated to be ~850 m from the backfilled opencast pits at 100 years Post-Closure. The migration of pollutants will mainly be in a north-easterly direction from OC1 and in a south-westerly and easterly direction from OC2.

Based on the contaminant transport simulations for the open pits, borehole DRIBH1 is projected to be within the zone of contamination and may experience increased sulphate concentrations 40 years Post-Closure. It is recommended to install a monitoring borehole close to DRIBH1 and to continuously monitor the groundwater quality during the Operational Phase and into the Post-Closure Phase. If proven this borehole will be affected by the mining activities an alternative water supply should be provided (Digby Wells, 2019d).

It is unlikely that any other privately-owned boreholes or the spring located in the vicinity of the proposed development will be impacted upon. The contaminant migration indicates that the plumes will flow towards and following local drainage lines located between and to the west and the east of the open pits.

According to the simulations the plumes will only reach the drainage lines west and east of the pits after 50 years, and after 100 years the anticipated sulphate concentrations are still below the SANS drinking water standards aesthetic limit of 250 mg/l and are therefore only expected to slightly increase salt load to the drainage lines. This impact is therefore considered to be low. Frequent water quality monitoring should be carried out for the Operational Phase and continue into the Post-Closure Phase to be able to discern trends in surface water quality (Digby Wells, 2019d).

The drainage line between the two pits is expected to receive an increased salt load from the contaminant plumes and expected sulphate concentrations of the groundwater close to the streams may go up to 1 000 mg/l. This is expected to have a moderate impact on the drainage line and associated unchanneled valley bottom wetland. To mitigate the contaminant plume migration the open pits should be properly rehabilitated, including reduction of recharge to these areas by properly top-soiling and vegetating the areas. This will reduce infiltration of water into the groundwater and reduce plume extents (Digby Wells, 2019d).

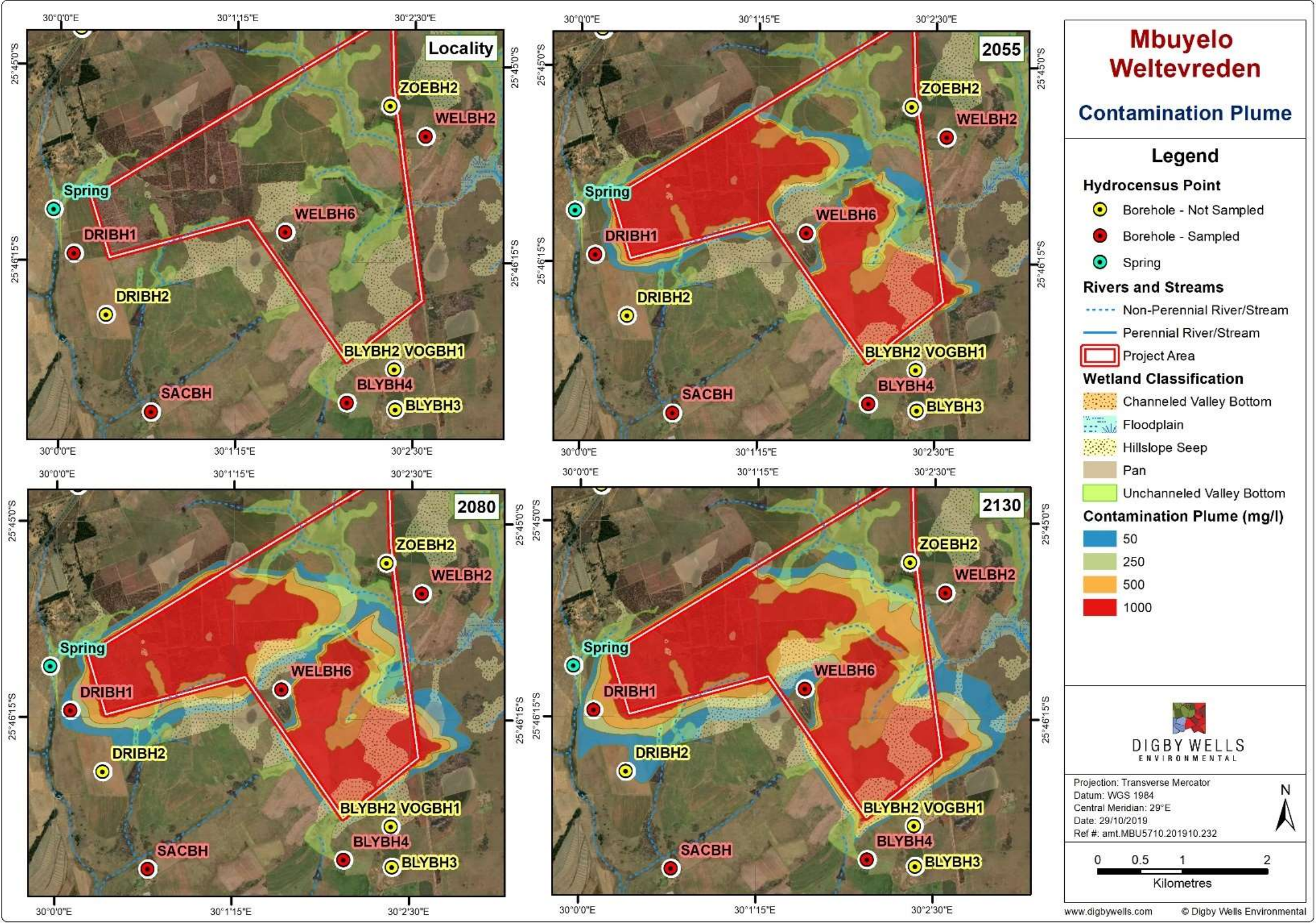


Figure 12-1: Groundwater Contaminant Plumes Post-Closure (Digby Wells, 2019d)

12.1.2 Mine Decant

For open pit mining the decant point can be established as the lowest topographical point of the pit outline at the end of life of mine. When the active dewatering of the open pits has ceased groundwater levels will rebound. As the backfilled open pits flood, decant will occur when the groundwater level recovers to above the lowest surface elevation of the pit. This can occur long after the end of life of mine and is referred to as the time-to-decant. Based on the proposed mine plans and site topography Digby Wells determined the potential decant points for each pit (Figure 12-2).

The volume of the open pits at was based on the depth and extent of the pit shells. It is assumed the pits will be backfilled as the rollover mining method is being used. Decant calculations were carried out for OC1 and OC2 (Digby Wells, 2019d). The porosity of the backfill material was taken to be between 15% and 25% of the total mined volume (Table 12-1). A recharge rate of between 6.5% and 20% was used for the time-to-decant and decant volume calculations.

Due to the relative shallow depth of the open pits, decant could potentially occur soon after dewatering has ceased, and the estimated time-to-decant may be less than 10 years based on the pit volumes below the respective decant elevations for OC1 and OC2. Decant volume calculations show expected discharge rates of between approximately 220 and 820 m³/d (Table 12-2).

Table 12-1: Open Pit Mine Volume Calculations (Digby Wells, 2019d)

Open Pit	Total mined volume m ³ (below decant position)	Void volume (15% effective porosity)	Void volume (25% effective porosity)
OC1	2,720,551	408,082.62	680,137.7
OC2	1,306,042	195,906.33	326,510.55

Table 12-2: Decant Volumes (m³/d) (Digby Wells, 2019d)

Open Pit	Pit surface area (m ²)	Recharge 6.5%	Recharge 20%
OC1	2,015,000	266	819
OC2	1,645,000	217	669

Decant from OC1 will flow towards the tributary east of the pit; the decant from OC2 will flow towards the tributary west of the pit. Based on the calculated decant volumes and expected quality of the potential decant indicates a moderate impact if decant would occur and is not mitigated against. To reduce the impact on surface water quality a water treatment plant will be needed to improve the water quality emanating from the mining areas. Any potential decant flows from the open pits should be captured, for instance by an abstraction borehole placed

inside the rehabilitated pit area at the decant points. This would locally reduce the groundwater level and prevent decant flow.

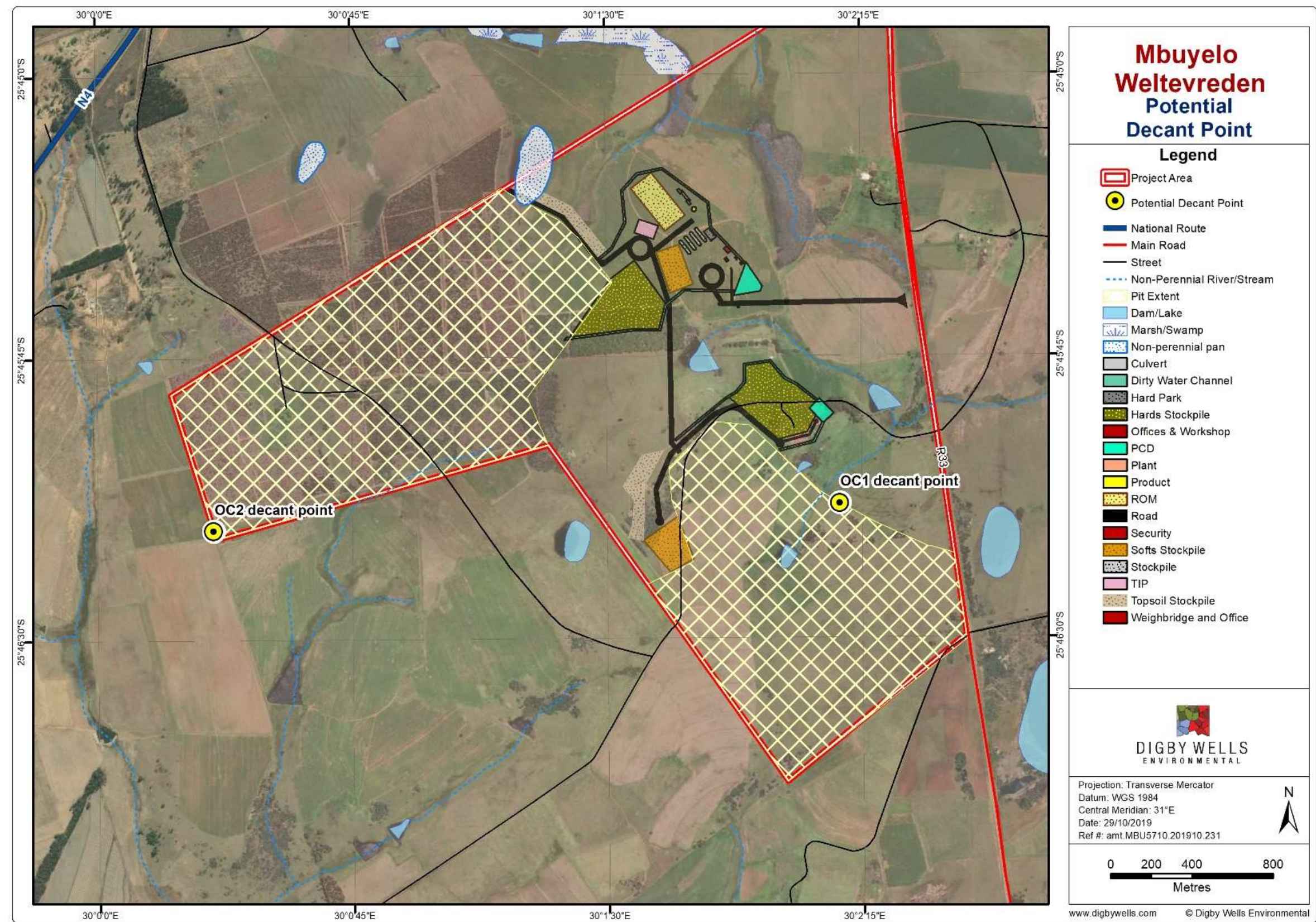


Figure 12-2: Potential Decant Points

12.2 Surface Water and Wetlands

The decommissioning and rehabilitation activities pose significant potential negative impacts to functioning wetlands and catchments. Furthermore, disturbed surface areas undergoing rehabilitation could cause major negative impacts due to spread of alien invasive vegetation, increased soil compaction, erosion and subsequent sedimentation into the wetland and river ecosystems.

Proposed OC2 pit will result in the direct destruction of HGM units 4, 5, 6, 13, and portions of HGM units 15, 16 and 17. Proposed OC1 pit will result in the direct destruction of a portion of HGM unit 19, and HGM units 20, and 25. OC1 and OC2 pits as well as the associated surface infrastructure will result in a direct loss of approximately 94.86 ha. The potential indirect losses have not been quantified but are expected to be significant (Digby Wells, 2019f).

Furthermore, decant is likely to occur downgradient of the OC1 and OC2 pits, which may be regarded as major impact to the downstream wetland and aquatic integrity. HGM units 5, 6, 16, 17, 19, 20 and 25 are important hillslope seepage and valley bottom wetland systems supplying water to the downstream wetland and aquatic ecology, which forms part of a Freshwater Ecosystem Priority Areas (FEPA) river catchment and may be considered sensitive.

13 Risk Assessment

A risk assessment is the overall process of risk identification, risk analysis and risk mitigation evaluation. A baseline Hazard Identification and Risk Assessment (HIRA) was completed as part of the project.

13.1 Methodology

The baseline HIRA is based on a qualitative method to determine the risks. The following process steps were taken:

- A general discussion on hazards and “driving forces” was used to determine things that could “go wrong” during the mine closure;
- The boundaries of the project were defined;
- Areas within the mining area were defined;
- For each of the areas in the process:
 - Potential unwanted events were identified;
 - The most likely severity of the event, should the event occur, and likelihood of that severity occurring were then estimated;
 - Based on this, the level of risk was estimated using the risk matrix:
 - Inherent Risks (i.e. without any safeguards) ranked;
 - Residual Risks (i.e. considers safeguards are in place and effective) ranked; and

- Additional “controls or safeguards” were recommended to possibly further reduce the level of residual risk.

The three levels of risks are classified and indicated in Table 13-1 below:

Table 13-1: Risk Levels

Risk Rating	Risk Level	Guidelines for Risk Matrix
9 - 25	High	Escalate to a higher level and implement specific action plans
5 - 8	Medium	Proactively manage via appropriate management system
1 - 4	Low	Monitor & manage as appropriate via management system

The four risk categories are outlined and included in the risk matrix. These are in no order of priority:

- Health and Safety – Injury or harm to people;
- Environmental Impact;
- Damage or loss business interruption; and
- Reputational risk – Community / Government / Media.

A qualitative Severity and Likelihood Matrix was used during the risk estimation as shown below in Table 13-2.

Once the severity and likelihood of the unwanted events had been rated, the risk rank was determined using the risk matrix. This matrix is not a simple multiplication tool; risk rank is skewed so that emphasis is placed on high severity events, rather than on high likelihood events.

Table 13-2: Risk Assessment Matrix

ENVIRONMENTAL RISK MATRIX											
RISK RATING								(H&S) Injury or harm to people	(E) Environmental impact	(D) Damage / Loss - business interruption	(R) Reputation - Community / Government / Media
CONSEQUENCE / SEVERITY	Catastrophe	5	MEDIUM RISK	HIGH RISK	HIGH RISK	HIGH RISK	HIGH RISK	Multiple fatalities / Impact on health ultimately fatal	Extreme environmental harm – L3 incident irreversible	Substantial or total loss of operation / R200m or more	International impact – international public attention
	Major	4	LOW RISK	MEDIUM RISK	HIGH RISK	HIGH RISK	HIGH RISK	Single fatality or loss of quality of life / Irreversible impact on health	Major environmental harm – L2 incident remediable post LOM	Partial loss of operation / R100m – R199m	National impact – national public concern
	Moderate	3	LOW RISK	MEDIUM RISK	HIGH RISK	HIGH RISK	HIGH RISK	Serious / Reportable injury. Potential irreversible impact on health	Serious environmental harm - L2 incident remedial within LOM	Partial Shutdown / R50m – R99m	Considerable impact – regional public concern
	Minor	2	LOW RISK	LOW RISK	MEDIUM RISK	MEDIUM RISK	HIGH RISK	Lost time injury or health effects / Reversible impact on health	Material environmental harm – L2 incident remediable short term	Brief disruption to operation / R10m – R49m	Limited impact – local public concern
	Insignificant	1	LOW RISK	LOW RISK	LOW RISK	LOW RISK	MEDIUM RISK	First aid case / exposure to minor health risk	Minimal environmental harm – L1 incident	No disruption to Operation / < R10m	Slight impact – public awareness may exist but no public concern
			LIKELIHOOD / FREQUENCY/ PROBABILITY					Note: Consider Severity first. Scenarios: - Worst case scenario - Most probable case scenario - Consider historical events, data or information Inherent Risk: Start with identifying the Severity of the Hazard/Event, then the Likelihood of that Severity actually occurring (not the likelihood of the hazard/event occurring) without any controls to mitigate . Residual Risk: Start with identifying the Severity of the Hazard/Event, then the Likelihood of that Severity actually occurring (not the likelihood of the hazard/event occurring) with controls in place to mitigate . Remember: Precautionary Principle			
			1	2	3	4	5				
			Rare	Unlikely	Possible	Likely	Almost Certain				
		Percentage (%)	<0.1%	0.1 - 0.4%	5 - 14%	15 - 49%	75 - 100%				
		Descriptor	The unwanted event has never been known to occur in the business, or is highly unlikely that it could ever occur beyond 20 years	The unwanted event has happened in the business at some time, or could happen within 20 years	The unwanted event could well have occurred in the business at some point within 10 years	The unwanted event has occurred infrequently, occurs in order of less than once per year & is likely to reoccur within 5 years	The unwanted event has occurred frequently, occurs in order of one or more times per year & is likely to reoccur within 1 year				
							Risk rating	Risk Level	Action		Sign-off
							9 to 25	(H) High	Escalate to a higher level and implement specific action plans		CEO
							5 to 8	(M) Medium	Proactively manage via appropriate management system		Senior Management
							1 to 4	(L) Low	Monitor & manage as appropriate via management system		Section Manager

13.2 Risk Analysis

Potential residual risks for and during mine closure were identified and discussed in Table 13-3.

Digby Wells ranked the unwanted events for risk based on the maximum reasonable severity should they occur and the likelihood of that specific severity / consequence occurring.

The analysis assumed no safeguards are in place (i.e. inherent risk) and afterwards considered safeguards in place and effective (i.e. residual risk).

For the highest ranked events, additional “controls” must be put in place to reduce the level of risk. The residual risks ranked assumed the safeguards are in place and effective.

Table 13-3: Risks Identified

Mine:		Proposed Weltevreden Project	DMR Reference:		MP30/5/1/2/2/10250MP		Evaluation Year:		2019	
Location:		Belfast, Mpumalanga					Last Modified:		2019/11/18	
Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Inherent Risk			Safeguards	Residual Risks			Additional Controls
			Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating	
Destruction of wetland habitat.	Loss of wetland ecology, as well as negative impacts on downstream ecology of the Klein Komati River.	Environmental Impact	5	5	High		5	5	High	Consider Wetland off-set Project
Potential contaminated groundwater plume.	Borehole DRIBH1 is projected to be within the zone of contamination and may experience increased sulphate concentrations 40 years Post-Closure.	Environmental Impact	4	4	High	Rehabilitation of the pits and hard stockpiles to reduce infiltration of rainwater into the dump to reduce seepage generation. Clean water and runoff should be diverted where possible towards the rehabilitated pits as fast as possible after mining has stopped. Groundwater quality should be frequently sampled to establish if a contaminant plume will migrate.	3	4	High	Install a monitoring borehole close to DRIBH1 and to continuously monitor the groundwater quality during the Operational Phase and into the Post-Closure Phase. If proven this borehole will be affected by the mining activities an alternative water supply should be provided
Potential AMD impacting on wetlands and surface water resources.	Deterioration of water quality affecting aquatic biodiversity and surface water users.	Environmental Impact	4	4	High	Treat mine affected decant water to acceptable water quality levels prior to discharge into the natural environment. Neutralise mine affected decant water with calcium carbonate or lime at identified decant points to obtain water with acceptable quality.	2	4	Medium	Passive and active water treatment options should be considered as a priority if decant is proven.
Loss of wetland habitat integrity and ecosystem services.	Toxicant removal and water for human use.	Environmental Impact	4	3	High	Concurrently rehabilitate mined areas and areas that become available during the LoM. Treat mine affected decant water to	4	2	Medium	

Mine:		Proposed Weltevreden Project	DMR Reference:	MP30/5/1/2/2/10250MP			Evaluation Year:	2019		
Location:		Belfast, Mpumalanga					Last Modified:	2019/11/18		
Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Inherent Risk			Safeguards	Residual Risks			Additional Controls
			Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating	
						acceptable water quality levels prior to discharge into the natural environment. Neutralise mine affected decant water with calcium carbonate or lime at identified decant points to obtain water with acceptable quality.				
Possibility of not implementing the final Land Use Plan for the disturbed areas.	Land not having a functional use. Could potentially impact wetlands, water resources, biodiversity and health and safety.	Environmental Impact	4	3	High	Roll-over mining. Concurrent rehabilitation.	4	2	Medium	Investigate post-closure land use options. Conduct feasibility assessments for the various options to determine the most appropriate post-closure land use(s). Detailed landform modelling to optimise material handling activities.
Potential mine water decant causing contamination of groundwater.	If groundwater levels within the open pits recover to elevations higher than decant elevations, this water may then flow from the pit areas and cause groundwater contamination down gradient of the mine.	Environmental Impact	3	4	High	Groundwater level recovery in the rehabilitated open pits should be frequently monitored to create stage curves and predict the final water recovery level. Rehabilitation of the pits and hards stockpiles to reduce infiltration of rainwater into the dumps and rehabilitated areas to reduce seepage generation.	2	3	Medium	Installation of groundwater abstraction boreholes at decant points to reduce water level and prevent decant flow, and treatment of the abstracted water.
Closure Plan potentially not approved by DMR.	Closure certificate not issued by the DMR.	Damage / Loss - Business Interruption	2	4	Medium	On-going engagement with DMR.	2	3	Medium	
Potential drawdown of groundwater levels in surrounding boreholes as a result of dewatering the open pits.	Negative impact on surrounding groundwater users.	Environmental Impact	2	4	Medium	Dewatering of the opencast pits should cease as soon as possible after mining activities are	2	3	Medium	

Mine:		Proposed Weltevreden Project	DMR Reference:		MP30/5/1/2/2/10250MP			Evaluation Year:		2019	
Location:		Belfast, Mpumalanga						Last Modified:		2019/11/18	
Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Inherent Risk			Safeguards	Residual Risks			Additional Controls	
			Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating		
						completed to allow for groundwater level recovery. Groundwater level recovery should be frequently monitored to identify deviations from the predicted recovery rate Groundwater quality should be frequently sampled to establish if a contaminant plume will migrate. Clean water and runoff should be diverted where possible towards the opencast pits voids to flood areas as fast as possible after mining has stopped.					
Potential contaminated groundwater plume.	The drainage line between the two pits is expected to receive an increased salt load from the contaminant plumes and expected sulphate concentrations of the groundwater close to the streams may go up to 1 000 mg/l. This will have an impact on the drainage line and associated unchanneled valley bottom wetland.	Environmental Impact	2	4	Medium	Rehabilitation of the pits and hards stockpiles to reduce infiltration of rainwater into the dump to reduce seepage generation. Clean water and runoff should be diverted where possible towards the rehabilitated pits as fast as possible after mining has stopped. Groundwater quality should be frequently sampled to establish if a contaminant plume will migrate.	2	3	Medium		
Potential sedimentation and siltation of nearby watercourses.	Deterioration of water quality affecting aquatic biodiversity.	Environmental Impact	2	4	Medium	Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas. Movement of	1	3	Low		

Mine:		Proposed Weltevreden Project	DMR Reference:		MP30/5/1/2/2/10250MP			Evaluation Year:		2019	
Location:		Belfast, Mpumalanga						Last Modified:		2019/11/18	
Hazard (Unwanted Event)	Consequence(s)	Primary Risk Category	Inherent Risk			Safeguards	Residual Risks			Additional Controls	
			Severity	Likelihood	Risk Rating		Severity	Likelihood	Risk Rating		
						demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance.					
Potential improper infilling, profiling and revegetation of rehabilitated areas.	Creation of preferential flow paths, increasing the potential for erosion, compacted soils resulting in poor vegetation cover, increased potential for the spread and establishment of alien and invasive species.	Environmental Impact	2	3	Medium	Concurrently rehabilitate mined areas and areas that become available during the LoM. Rehabilitate disturbed areas according to a final landform design. Actively re-vegetate disturbed areas as well as decommissioned footprint areas. No material should be dumped within any wetlands or watercourses.	2	2	Low	Wetland monitoring must be carried out during the decommissioning phase to ensure no unnecessary impact to wetlands takes place. Implement and maintain an alien vegetation management programme for the duration of the decommissioning phase and into closure. Detailed landform modelling to optimise material handling activities	
Potential contaminated groundwater plume.	Simulations indicate that the plumes will reach the drainage lines west and east of the pits, after 50 years, and after 100 years, The anticipated sulphate concentrations will be below the SANS drinking water standards aesthetic limit of 250 mg/l and are therefore only expected to slightly increase salt load to the drainage lines.	Environmental Impact	1	4	Low	Frequent water quality monitoring should be carried out for the Operational Phase and continue into the Post-Closure Phase to be able to discern trends in surface water quality.	1	4	Low	Optimise closure water monitoring network.	

14 Threats, Opportunities and Uncertainties

The following has been identified, with respect to threats, opportunities and uncertainties to the compilation of this plan and to define any additional work that is needed to reduce the level of uncertainty:

14.1 Threats

- All risks identified within the risk assessment;
- Based on the mineralogy and AMD results all coal and waste rock materials are classed as potentially acid generating (PAG), potentially leading to AMD development and pollution of groundwater and surface water resources if not mitigated and managed;
- Groundwater levels in the vicinity of the site are expected to take approximately 80 years to recover Post-Closure. However, due to the limited scale of the drawdown cone it is expected that the long-term recovery will have a minor impact;
- The drainage line between the two pits is expected to receive an increased salt load from the contaminant plumes. This is expected to have a moderate impact on the drainage line and associated unchanneled valley bottom wetland;
- Decant from OC1 will flow towards the tributary east of the pit; the decant from OC2 will flow towards the tributary west of the pit. Based on the calculated decant volumes and expected quality of the potential decant indicates a moderate impact if decant would occur and is not mitigated against. Any potential decant flows from the open pits should be captured and treated before it enters streams and wetlands;
- The access road that has been constructed in the vicinity of HGM unit 20 and the proposed OC1 pit must be rehabilitated to prevent any further disturbance and degradation of the hillslope seepage wetland system, which may be regarded as ecologically significant on a catchment scale as well as important for the provision of multiple ecological services; and
- The quantified destruction of 94.86 ha of wetland habitat due to open pit mining activities, and the unquantified destruction and degradation of the remaining wetland ecology, as well as the downstream ecology of the Klein Komati River, as a result of desiccation and decant are regarded as a fatal flaw to the proposed project in terms of the wetland and aquatic ecology of the greater area.

14.2 Uncertainties

- Whether enough backfill material will be available for rehabilitation of the open pit areas;
- Water treatment options, like constructed wetlands;

- Impact mining might have on the water bottling business adjacent to the mining right area;
- Whether any third-party borehole water qualities will be affected by the mining activities, such as DRIBH1; and
- Suitable wetland buffers. It is recommended that a hydro-pedological assessment be carried out for the determination of suitable wetland buffers.

14.3 Opportunities

- Integrated planning to develop a suitable and sustainable post-closure land use across the project site;
- A closure water management plan should be developed. This should assess the management of a critical water level to minimise contamination of the shallow weathered aquifer. This should all be analysed in a financial model to further inform the most effective closure water management options. The groundwater model should be used as a management tool to inform this process; and
- Benefit to the local community if they are involved in alien invasive plant (AIP) removal programmes.

15 Rehabilitation and Closure Actions

The main aim in developing the RCP is to minimise and mitigate the impacts caused by mining and industrial activities and to restore land back to a satisfactory standard or to a predetermined state. It is best practice to develop the RCP as early as possible to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a mine's RCP is defined and understood from before mining progresses and is complimentary to the objectives and goals set.

Table 15-1 below sets out the rehabilitation and closure actions required at the various areas related to the mine.

Table 15-1: Summary of Rehabilitation and Closure Actions

Area	Detail	Main Actions
Offices and Workshops	General Infrastructure - Workshops, Stores and Offices	<ul style="list-style-type: none"> ■ All mobile infrastructure such as containers and diesel tanks should be removed from the mine as they can be re-used elsewhere. ■ If complete infrastructure removal is chosen, demolish all fixed infrastructure to 1m below surface. Inert demolition rubble could be used as backfill material into the open pit. Any contaminated material should be disposed of off-site at an appropriate licenced facility. ■ Analyse soil on the disturbed footprint areas for possible soil contamination. If contamination is discovered, this soil must be treated or disposed of in the appropriate manner ■ Shape the footprint be free-draining and to emulate the surrounding surface topography. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Remove AIPs. ■ Implement robust monitoring and maintenance of the rehabilitation.
Plant	Crusher and Screening Plant	<ul style="list-style-type: none"> ■ If complete infrastructure removal is chosen, demolish all fixed infrastructure to 1m below surface. Inert demolition rubble could be used as backfill material into the open pit. Any contaminated material should be disposed of off-site at an appropriate licenced facility. ■ Analyse soil on the disturbed footprint areas for possible soil contamination. If contamination is discovered, this soil must be treated or disposed of in the appropriate manner. ■ Shape the footprint be free-draining and to emulate the surrounding surface topography. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Remove AIPs. ■ Implement robust monitoring and maintenance of the rehabilitation.
Open Pits	OC1 and OC2	<ul style="list-style-type: none"> ■ Concurrently backfill and rehabilitate available sections of the mined-out open pits (implement roll-over mining). ■ Shape the footprint be free-draining and to emulate the surrounding surface topography. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Remove AIPs. ■ Implement robust monitoring and maintenance of the rehabilitation. ■ Consider treatment of mine decant water if required.

Area	Detail	Main Actions
Waste and Product Stockpiles	Softs, Hards, Product Stockpiles and ROM	<ul style="list-style-type: none"> ■ Use as much of the overburden material as part of concurrent rehabilitation activities. ■ All product stockpiles must be removed prior to decommissioning and closure. ■ Analyse soil on the disturbed footprint areas for possible soil contamination. If contamination is discovered, this soil must be treated or disposed of in the appropriate manner. ■ Shape the footprint be free-draining and to emulate the surrounding surface topography. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Remove AIPs. ■ Implement robust monitoring and maintenance of the rehabilitation.
Pollution Control Dams	PCD1 and PCD2	<ul style="list-style-type: none"> ■ Desilt all dams. ■ Remove contaminated material from all dams, if present. ■ Flatten dam walls. ■ Remove and dispose of HDPE lining, if present. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Implement robust monitoring and maintenance of the rehabilitation
Linear Infrastructure	Dirty Water Channels	<ul style="list-style-type: none"> ■ Demolish and rehabilitate water channels if these will not be required as part of post-closure water management measures. ■ Remove and dispose of HDPE lining, if present. ■ Infill channels to create a free-draining topography. ■ Rip the footprint to reduce compaction. ■ Ameliorate soil through addition of fertiliser and lime, if required. ■ Establish vegetation. ■ Remove AIPs. ■ Implement robust monitoring and maintenance of the rehabilitation.

Area	Detail	Main Actions
	Roads	<ul style="list-style-type: none">■ Rip mine constructed roads to reduce compaction.■ Ameliorate soil through addition of fertiliser and lime, if required.■ Establish vegetation.■ Remove AIPs.■ Implement robust monitoring and maintenance of the rehabilitation.
	Pipelines	<ul style="list-style-type: none">■ Remove all pipelines and associated support infrastructure constructed by the mine which will not be required post-closure.
	Power Lines	<ul style="list-style-type: none">■ Remove any powerlines and associated support infrastructure constructed by the mine which will not be required post-closure.

16 Financial Provision

The financial provision is done in terms of regulation 53 and 54 of the MPRDA regulations (2004) and in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended which provides that the holder of a mining right must make full financial provision for rehabilitation of negative environmental impacts.

16.1 Methodology

The regulations for the determination of financial provision for mine rehabilitation and closure were promulgated on 20 November 2015 (GN R1147 in GG 39425 of 20 November 2015) under the NEMA, as amended. The financial provision calculation did not, however, address any of the requirements of these regulations as it is still accepted to calculate the financial provision using the DMR cost model.

The financial provision has been determined for Year 1 and LoM. Once the project is approved by the DMR, the financial provision will need to be updated annually throughout the LoM with the latest information available.

The goals to be achieved for the various items requiring rehabilitation were taken from the DMR Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provisions Provided by a Mine (2005).

Table 16-1 below indicates what is included for each financial provision scenario (i.e. Year-1 and LoM).

Table 16-1: Components included in Year-1 and LoM Financial Provision

Component	Description	Year 1	LoM
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	Yes	Yes
2 (A)	Demolition of steel buildings & Structures	Yes	Yes
2 (B)	Demolition of reinforced concrete buildings & structures	Yes	Yes
3	Rehabilitation of access roads (Including water channels)	Yes (50% of LoM roads and channels)	Yes
4(A)	Demolition & rehabilitation of electrified railway lines	No	No

Component	Description	Year 1	LoM
4(B)	Demolition & rehabilitation of non-electrified railway lines	No	No
5	Demolition of housing &/or administration facilities	Yes	Yes
6	Opencast rehabilitation including final voids & ramps	Yes (Year 2020 mining area)	Yes (Year 2029 mining area)
7	Sealing of shafts, adits & inclines	No	No
8(A)	Rehabilitation of overburden & spoils	Yes (10% of total area)	Yes
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	Yes (10% of total area)	Yes
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	Yes	Yes
9	Rehabilitation of subsided areas	No	No
10	General surface rehabilitation	Yes	Yes
11	River diversions	No	No
12	Fencing	No	No
13	Water management	Yes	Yes
14	2 to 3 years of maintenance & aftercare	Yes	Yes

16.2 Rates

The 2005 DMR Master Rates published by the DMR are no longer accurate. The 2005 rates have therefore been escalated using an average annual CPIX obtained from Statistics South Africa (refer Table 16-2). The latest CPIX released by Statistics South Africa was for September 2019, hence the average used reflects 2018 CPIX average, up to November of that year.

Table 16-2: Annual Escalation Rates

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Sep 2019
CPIX (%)	4.7%	7.1%	11.5%	7.1%	4.3%	5%	5.6%	5.7%	6.1%	4.6%	6.4%	5.3%	4.7%	4.3%

16.3 DMR Classification

The DMR Guideline Document classifies a mine according to a number of factors which allows one to determine the appropriate weighting factors to be used during the quantum calculation. The following factors are considered:

- The mineral mined;
- The risk class of the mine;
- Environmental sensitivity of the mining area;
- Type of mining operation; and
- Geographic location.

Once the risk class (Class A, B or C) and the sensitivity of the area where the mine is located (Low, Medium or High) had been determined using the appropriate tables (Table 16-3, Table 16-4, Table 16-5 and Table 16-6) the unit rates for the applicable closure components were identified.

Table 16-3: Primary Risk Class for Type of Mineral Mined (Weltevreden Risk Class Highlighted in Red)

Mineral	Ore	Size: large if > than (tpm)	Primary Risk Class			
			Large Mine		Small Mine	
			Mine & Mine Waste	Mine, Mine Waste, Plant & Plant Waste	Mine & Mine Waste	Mine, Mine Waste, Plant & Plant Waste
Antimony		1000	A	A	C	C
Asbestos		0	A	A	A	A
Base metals (Copper, Cadmium, Cobalt, Iron ore, Molybdenum, Nickel, Tin, Vanadium)	Sulphide	10 000	A	A	C	A
	Oxide	10 000	C	A	C	A

Mineral	Ore	Size: large if > than (tpm)	Primary Risk Class			
			Large Mine		Small Mine	
			Mine & Mine Waste	Mine, Mine Waste, Plant & Plant Waste	Mine & Mine Waste	Mine, Mine Waste, Plant & Plant Waste
Coal		0	A	A	A	A
Chrome		10 000	C	A	C	C
Diamonds and precious stones		10 000	C	B	C	C
Gold, silver, uranium		10 000	B	A	B	A
Phosphate		10 000	C	B	C	C
Platinum		10 000	C	B	C	B
Mineral sands (Ilmenite, Titanium, Rutile, Zircon)		10 000	C	B	C	C
Zinc and Lead		10 000	C	A	C	A
Industrial Minerals (Andalusite, Barite, Bauxite, Cryolite, Fluorspar)		10 000	C	C	C	C

Table 16-4: Criteria Used to Determine the Area Sensitivity

Sensitivity	Sensitivity Criteria		
	Biophysical	Social	Economic
Low	<ul style="list-style-type: none"> Largely disturbed from natural state, Limited natural fauna and flora remains, 	<ul style="list-style-type: none"> The local communities are not within sighting distance of the mining operation, 	<ul style="list-style-type: none"> The area is insensitive to development, The area is not a major source of

Sensitivity	Sensitivity Criteria		
	Biophysical	Social	Economic
	<ul style="list-style-type: none"> Exotic plant species evident, Unplanned development, Water resources disturbed and impaired. 	<ul style="list-style-type: none"> Lightly inhabited area (rural). 	<p>income to the local communities.</p>
Medium	<ul style="list-style-type: none"> Mix of natural and exotic fauna and flora, Development is a mix of disturbed and undisturbed areas, within an overall planned framework, Water resources are well controlled. 	<ul style="list-style-type: none"> The local communities are in the proximity of the mining operation (within sighting distance), Peri-urban area with density aligned with a development framework, Area developed with an established infrastructure. 	<ul style="list-style-type: none"> The area has a balanced economic development where a degree of income for the local communities is derived from the area, The economic activity could be influenced by indiscriminate development.
High	<ul style="list-style-type: none"> Largely in natural state, Vibrant fauna and flora, with species diversity and abundance matching the nature of the area, Well planned development, Area forms part of an overall ecological regime of conservation value, Water resources emulate their original state. 	<ul style="list-style-type: none"> The local communities are in close proximity of the mining operation (on the boundary of the mine), Densely inhabited area (urban/dense settlements), Developed and well-established communities. 	<ul style="list-style-type: none"> The local communities derive the bulk of their income directly from the area, The area is sensitive to development that could compromise the existing economic activity

Table 16-5: Weighting Factor 1 – Nature of Terrain

	Flat	Undulating	Rugged
Weighting factor 1: Nature of the terrain/ accessibility	1.00	1.10	1.20

Note:

- a) Flat - Generally flat over the mine area;
- b) Undulating - A mix of sloped and undulating areas within the mine area; and
- c) Rugged - Steep natural ground slopes (greater than 1:6) over the majority of the mine area.

Table 16-6: Weighting Factor 2 – Proximity to Urban Area

	Urban	Peri-urban	Remote
Weighting factor 2: Proximity to urban area where goods and services are to be supplied	1.00	1.05	1.10

Note:

- d) Flat - Generally flat over the mine area;
- e) Undulating - A mix of sloped and undulating areas within the mine area; and
- Rugged - Steep natural ground slopes (greater than 1:6) over the majority of the mine area.

The classification of the proposed Weltevreden Mine has been summarised in Table 16-7.

It must be noted, however, that of the 18 closure components that exist only 3 are influenced by the risk class and sensitivity, the remaining 15 have a standard multiplication factor, irrespective of the class or sensitivity.

Table 16-7: Mine Classification

Mine	Risk Class	Sensitivity	Terrain	Proximity to Urban Area
Weltevreden	A	Medium	Flat	Peri-Urban

16.4 Assumptions

The following assumptions have been developed:

- The financial provision was calculated based on the DMR Guideline Document;

- The calculations do not account for any value recovered from the sale of plant, steel or other material;
- Concurrent rehabilitation of the open pits will continue during the mine life. At LoM, only the final mining cut will require rehabilitation;
- Concurrent annual environmental costs will be included into the operating budget of the mine. The operation has not been initiated and a Zero (R 0.00) rand concurrent annual environmental cost is reported;
- The calculation is nominal and does not include the time-value of money (i.e. undiscounted);
- All roads within the mining area are the responsibility of the mine, except where they are proclaimed national or provincial roads;
- Survey data (footprints, volumes, etc.) provided by the mine's surveyor is correct;
- This study did not include a detailed assessment of issues concerning shallow or deep aquifer groundwater pollution and long-term decant from workings;
- A 12% allowance has been included for preliminary and general fees. These fees account for the costs required to manage the closure and rehabilitation process as well as provide personnel to monitor and maintain the rehabilitated areas after closure;
- A contingency of 10% is included to allow for unforeseen costs associated with contractors or rate increases;
- The closure cost estimate includes VAT as required by the DMR Guideline Document.

16.5 Summary

Closure costs were calculated by means of the DMR method of calculation. A summary of the calculated closure costs for Year 1 and LoM is presented in Table 16-8 and Table 16-9 respectively.

Table 16-8: Year 1 - Summary of Financial Provision



<div></div> <div>DIGBY WELLS</div> <div>ENVIRONMENTAL</div>		Digby Wells Environmental					
		Xivono Mining (Pty) Ltd, Weltevreden Mine, MBU5710					
		DMR Closure Cost Assessment, 2019, Rev 0					
		Calculation of the Quantum, 2019					
Class A (Medium Risk)		Unit:	A	B	C	D	E=A*B*C*D
Component	Description:		Quantity	Master rate	Multiplication factor	Weighting factor 1	Amount (Rands)
			Step 4.5	Step 4.3	Step 4.3	Step 4.4	
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	m³	19,915.26	R 15.15	1.00	1.00	R 301,794
2 (A)	Demolition of steel buildings & Structures	m²	1,019.71	R 211.09	1.00	1.00	R 215,249
2 (B)	Demolition of reinforced concrete buildings & structures	m²	360.29	R 311.08	1.00	1.00	R 112,078
3	Rehabilitation of access roads (Including water channels) (50% after Year 1)	m²	76,028.86	R 37.77	1.00	1.00	R 2,871,889
4(A)	Demolition & rehabilitation of electrified railway lines	m		R 366.63	1.00	1.00	R 0
4(B)	Demolition & rehabilitation of non-electrified railway lines	m		R 199.98	1.00	1.00	R 0
5	Demolition of housing &/or administration facilities	m²	60.49	R 422.18	1.00	1.00	R 25,536
6	Opencast rehabilitation including final voids & ramps (First Year - as per LoM Plan)	ha	31.62	R 214,865.53	0.52	1.00	R 3,532,825
7	Sealing of shafts, adits & inclines	m³		R 113.32	1.00	1.00	R 0
8(A)	Rehabilitation of overburden & spoils (10% after Year 1)	ha	1.35	R 147,539.51	1.00	1.00	R 199,552
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste) (10% after Year 1)	ha	1.89	R 183,757.80	1.00	1.00	R 347,009
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	5.26	R 533,719.74	0.80	1.00	R 2,247,892
9	Rehabilitation of subsided areas	ha		R 123,542.12	1.00	1.00	0
10	General surface rehabilitation	ha	8.78	R 116,876.18	1.00	1.00	R 1,026,458
11	River diversions	ha		R 116,876.18	1.00	1.00	R 0
12	Fencing	m		R 133.32	1.00	1.00	R 0
13	Water management	ha	31.62	R 44,439.61	0.67	1.00	R 941,450
14	2 to 3 years of maintenance & aftercare	ha	48.00	R 15,553.86	1.00	1.00	R 746,657
							R 12,568,388
Weighting Factor 2 (step 4.4)			1.05		Sub Total 1		R 13,196,808
Preliminary and General					12% of Sub Total 1		R1,583,616.91
Contingency					10% of Sub Total 1		R1,319,680.76
Sub Total 2							R 16,100,105
VAT (15%)							R 2,415,016
GRAND TOTAL							R 18,515,121

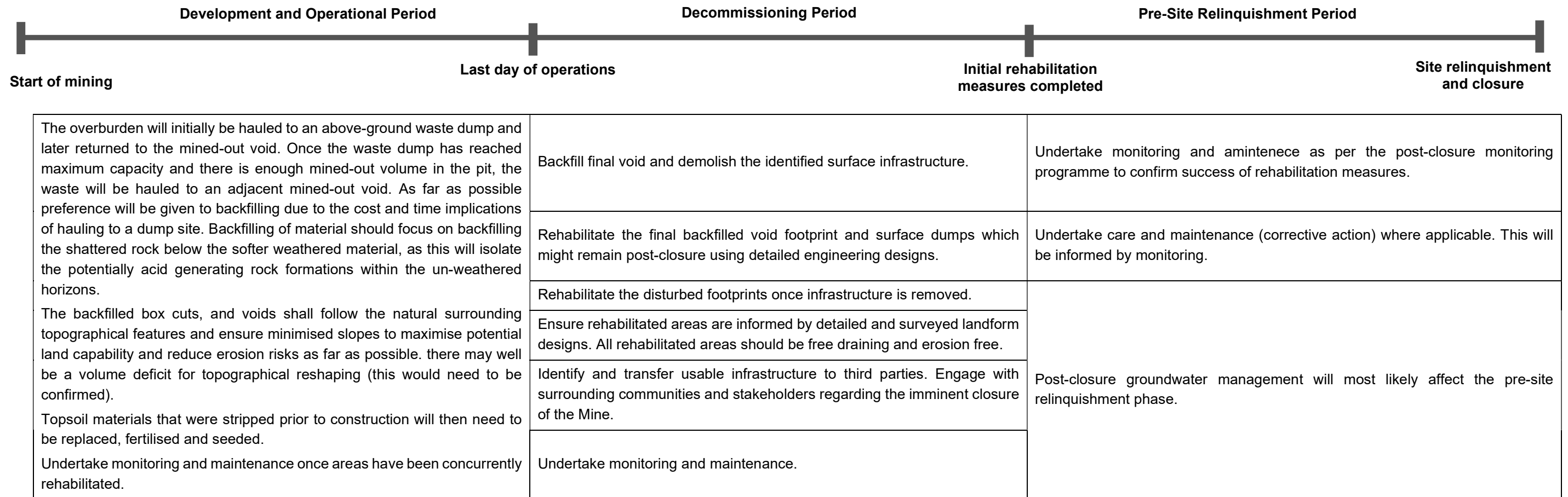
Table 16-9: LoM – Summary of Financial Provision

<div></div> <div>DIGBY WELLS</div> <div>ENVIRONMENTAL</div>		Digby Wells Environmental					
		Xivono Mining (Pty) Ltd, Weltevreden Mine, MBU5710					
		DMR Closure Cost Assessment, 2019, Rev 0					
		Calculation of the Quantum, 2019					
Class A (Medium Risk)		Unit:	A	B	C	D	E=A*B*C*D
Component	Description:		Quantity	Master rate	Multiplication factor	Weighting factor 1	Amount (Rands)
			Step 4.5	Step 4.3	Step 4.3	Step 4.4	
1	Dismantling of processing plant & related structures (incl. overland conveyors & Power lines)	m³	19,915.26	R 15.15	1.00	1.00	R 301,794
2 (A)	Demolition of steel buildings & Structures	m²	1,019.71	R 211.09	1.00	1.00	R 215,249
2 (B)	Demolition of reinforced concrete buildings & structures	m²	360.29	R 311.08	1.00	1.00	R 112,078
3	Rehabilitation of access roads (Including water channels)	m²	152,057.71	R 37.77	1.00	1.00	R 5,743,778
4(A)	Demolition & rehabilitation of electrified railway lines	m		R 366.63	1.00	1.00	R 0
4(B)	Demolition & rehabilitation of non-electrified railway lines	m		R 199.98	1.00	1.00	R 0
5	Demolition of housing &/or administration facilities	m²	60.49	R 422.18	1.00	1.00	R 25,536
6	Opencast rehabilitation including final voids & ramps (Final Year - as per LoM Plan)	ha	41.32	R 214,865.53	0.52	1.00	R 4,617,160
7	Sealing of shafts, adits & inclines	m³		R 113.32	1.00	1.00	R 0
8(A)	Rehabilitation of overburden & spoils	ha	13.53	R 147,539.51	1.00	1.00	R 1,995,523
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	ha	18.88	R 183,757.80	1.00	1.00	R 3,470,090
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	ha	5.26	R 533,719.74	0.80	1.00	R 2,247,892
9	Rehabilitation of subsided areas	ha		R 123,542.12	1.00	1.00	0
10	General surface rehabilitation	ha	37.95	R 116,876.18	1.00	1.00	R 4,435,555
11	River diversions	ha		R 116,876.18	1.00	1.00	R 0
12	Fencing	m		R 133.32	1.00	1.00	R 0
13	Water management	ha	41.32	R 44,439.61	0.67	1.00	R 1,230,410
14	2 to 3 years of maintenance & aftercare	ha	94.48	R 15,553.86	1.00	1.00	R 1,469,543
							R 25,864,608
Weighting Factor 2 (step 4.4)			1.05		Sub Total 1		R 27,157,839
Preliminary and General					12% of Sub Total 1		R3,258,940.65
Contingency					10% of Sub Total 1		R2,715,783.87
Sub Total 2							R 33,132,563
VAT (15%)							R 4,969,884
GRAND TOTAL							R 38,102,448

17 Preliminary Mine Closure Schedule

The mine closure schedule addresses the timing of rehabilitation and closure activities performed during the decommissioning and post-closure phases of the Mine. A preliminary mine closure schedule has been developed in line with the closure objectives defined in Section 8.2, namely the remaining operational period, decommissioning period and pre-site relinquishment period.

Vegetation monitoring and maintenance should ideally continue for 3 years and water monitoring for 10 years after the decommissioning period. Although Xivono will aim to reduce the pre-site relinquishment period, monitoring and maintenance would have to continue until the site relinquishment criteria are met and a closure certificate issued by the DMR.



18 Audits, Reporting Requirements and Monitoring Plan

Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps are shown in Table 18-1. The audit schedule differentiates between internal and external audits, defines the frequency and the responsible person.

All audit findings are captured in the Environmental Management System (EMS). Resources and timeframes are assigned to all audit findings, and progress is tracked on the EMS platform.

Table 18-1: Internal, External and Legislated Audits

Internal/External	Type	Frequency	Responsible person
Internal	Water Use License audit	Annual	Environmental Manager
	Environmental Legal Compliance audits	Annual	Environmental Manager
	Addressing knowledge gaps for the closure plan	Annual	Environmental Manager
External	EMS ISO 14001:2015 audit	Annual	EMS specialist
	Water Use License audit	Annual	Water specialist
	GN704 audit	Annual	Water specialist
	Environmental audit (EA/EMP)	Annual	Environmental specialist
	Closure cost audit	Annual	Closure specialist

19 Monitoring Plan and Site Relinquishment Criteria

The management measures for the pre-site relinquishment period at specific areas are provided in Table 19-1 and primarily consist of environmental monitoring. Monitoring provides information on whether rehabilitation methods employed are functioning correctly or not. Monitoring should provide an early indication of problems arising so that corrective management actions can be taken.

The duration of post closure monitoring will be determined based on environmental performance and until it can be demonstrated that the rehabilitation work has achieved the agreed endpoints; however, at present, it has been assumed that post closure monitoring will continue for 10 years for groundwater and surface water. It is important that the data obtained during monitoring is used to gauge the success of rehabilitation. Negative monitoring findings should be clearly linked to specific corrective actions.

The following aspects should be monitored during the post-closure phase:

- Soil fertility;
- Erosion control;
- Dust control;
- Vegetation establishment on rehabilitated areas;
- Alien invasive plant species;
- Aquatic health; and
- Surface water; and
- Groundwater quality and quantity.

Table 19-1: Monitoring and Success Criteria

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
Soil Management				
Erosion	<ul style="list-style-type: none">Conduct a visual assessment to determine areas of potential erosionUndertake field investigations, fixed point photography to document the significance of the erosion occurring on site	<ul style="list-style-type: none">Bi-annually for at least 3 years after decommissioning or as deemed necessary	<ul style="list-style-type: none">No evidence of significant erosionErosion control measures are in place and effective	As required: <ul style="list-style-type: none">Re-shape areas to ensure that they are free drainingEstablish vegetation on bare patches if practicalRepair and stabilisation of erosion gullies and sheet erosion
Soil fertility	<ul style="list-style-type: none">Undertake a visual assessment and delineate areas where poor vegetation growth has occurredSubmit soil samples to an accredit soil laboratory to conduct soil fertility analysis	<ul style="list-style-type: none">Annually until soil fertility supports the final land use or for at least 3 years after decommissioning or as deemed necessary	<ul style="list-style-type: none">Self-sustaining vegetation establishment	As required: <ul style="list-style-type: none">Apply amelioration as informed by sampling undertaken
General site status	<ul style="list-style-type: none">Conduct a visual assessment with respect to compliance of the afore-mentioned closure measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site	<ul style="list-style-type: none">Once-off following implementation of rehabilitation measures	<ul style="list-style-type: none">Waste/rubble free sites	As required: <ul style="list-style-type: none">Clear remnant rubble and dispose of accordingly
Topography	<ul style="list-style-type: none">Conduct a visual assessment to determine areas of potential erosionUndertake regular digital surveys of rehabilitated areas to confirm that final topography is aligned with landform designs	<ul style="list-style-type: none">During decommissioning period	<ul style="list-style-type: none">No evidence of significant erosionNo evidence of water ponding on rehabilitated areasThe final profile achieved must be acceptable in terms of surface water drainage requirements and the end land use objectives	As required: <ul style="list-style-type: none">Re-shape areas to ensure that they are free drainingRefer to end land use approach and refine measures to be implemented in achieving the desired final land use
Terrestrial- and Aquatic Ecosystem Health Management				
Vegetation re-growth	<ul style="list-style-type: none">Determine whether re-growth of vegetation communities are on a trajectory of achieving a stable self-sustaining community dominated by species typical of the climax-species present in the adjacent areasInspect rehabilitated areas to assess vegetation re-growth and provide for early detection of erosionUndertake fixed point photography at specific points at the rehabilitated sites to obtain a long term directly comparable method of determining changes in the landscapeConduct evaluation of rehabilitated areas by means of field inspections. During these	<ul style="list-style-type: none">Yearly for at least 3 years after decommissioning or as deemed necessary	<ul style="list-style-type: none">Limited to no erosionSelf-sustaining vegetation ecosystem	As required: <ul style="list-style-type: none">Rip and prepare areas to promote re-growth of vegetationRe-vegetate poorly established rehabilitated areas where practicalApply additional fertiliser and/or organic matter, depending on the condition of the vegetation and the initial organic material application

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
	<p>assessments, measurement of growth performance and species abundance will be carried out to determine:</p> <ul style="list-style-type: none"> Plant basal cover and species abundance in the grassed areas. Estimates of vegetation canopy and ground cover as well as height; Distribution, growth and survival of woody species; Dominant plant species (woody and herbaceous); Presence of exotic invasive species, and degree of encroachment; Browsing or grazing intensity; Notes regarding erosion, such as, type, severity, degree of sediment build-up; Species composition and richness. 			
Alien invasive species	<ul style="list-style-type: none"> Visually inspect areas where invasive species have been previously eradicated and areas prone to invasive species (e.g. eroded/degraded areas, along drainage lines, etc.) Undertake surveys on relevant sites where bush encroachment has previously been identified to determine the status quo of invasive vegetation 	<ul style="list-style-type: none"> Yearly for at least 3 years after decommissioning or as deemed necessary 	<ul style="list-style-type: none"> Limit and/or prevent declared Category 1, 2 and 3 invader species establishing Minimise extended threat to ecosystems, habitats or other species Increase the potential for natural systems to deliver goods and services Minimise economic or environmental harm or harm to human health 	<ul style="list-style-type: none"> Foliar application technique Cut-stump technique Revisit mitigation measures Continue control and management
Aquatic biomonitoring	<ul style="list-style-type: none"> Aquatic bio-monitoring programme 	<ul style="list-style-type: none"> Twice yearly for at least 3 years after decommissioning or as deemed necessary 	<ul style="list-style-type: none"> In situ water quality IHAS SASS5 MIRAI FRAI Diatoms 	

Component / Aspect	Monitoring		Performance / success criteria	Corrective action
	Methodology	Frequency / duration		
Surface Water and Groundwater Management				
Surface water quality	<ul style="list-style-type: none">Monitor surface water quality in terms of the monitoring network that is aligned to the closure monitoring network	<ul style="list-style-type: none">Bi-annually for at least a 10-year period after decommissioning or as deemed necessary	<ul style="list-style-type: none">Acceptable threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land use and downstream usersNo possible surface contaminant sources remaining on the rehabilitated mine site that could compromise the planned land use and/or pose health and safety threats	As required: <ul style="list-style-type: none">Undertake a source-pathway investigationDevise measures to clean-up sources of contamination
Groundwater quality and quantity	<ul style="list-style-type: none">Monitor groundwater quality and levels in terms of the monitoring network that is aligned to the closure monitoring network	<ul style="list-style-type: none">Bi-annually for at least a 10-year period after decommissioning or as deemed necessary	<ul style="list-style-type: none">Acceptable threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land useThe applicable thresholds do not pose a threat to surrounding land uses or land users	As required: <ul style="list-style-type: none">Investigate the drilling and operation of scavenger boreholesInvestigate the potential of water treatment as a long-term remediation measure.
Dust Management				
Dust	<ul style="list-style-type: none">Continuous PM10 monitoring buy designated air quality officer at a sensitive receptor location	<ul style="list-style-type: none">Quarterly for at least a 3-year period after decommissioning or as deemed necessary	<ul style="list-style-type: none">Acceptable threshold levels that meet the South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) Dust Control Regulations (2013)	As required: <ul style="list-style-type: none">Undertake an investigation to the source of the dustDevise measures to reduce dust to acceptable levels

20 Vegetation Management

Plant species to be selected for rehabilitation should be hardy, tolerant of drought, acidity, fire and harsh conditions. *Cynodon dactylon* (Couch Grass) are suitable for this. The vegetation established will also need to align with the proposed end land use. Table 20-1 provides a list of species to consider as part of the revegetation programme.

Cynodon dactylon is a dominant graminoid species in the vegetation types in the mining right and therefore should form a large part of the seed mix. *Digitaria eriantha* and *Eragrostis curvula* are also found within the vegetation type and should be used to a lesser extent. *Chloris gayana* is a good stabilising grass and it also very palatable.

Table 20-1: Species Characteristics

Species name	Common name	Properties	Grazing potential	Sowing/ planting rate
Grasses				
<i>Cynodon dactylon</i>	Couch Grass	Mat-forming, stabiliser	High	9 kg/ha
<i>Digitaria eriantha</i>	Finger Grass	Perennial	High	8 kg/ha
<i>Eragrostis curvula</i>	Weeping Love Grass	Perennial, robust, spreads quickly	Moderate	8 kg/ha
<i>Chloris gayana</i>	Rhodes Grass	Perennial, stabiliser	High	4 kg/ha
TOTAL				29kg/ha

21 Alien Invasive Species Management

Alien invasive species tend to out-compete the indigenous vegetation; this is because they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 2010). They are tough, can withstand unfavourable conditions and are easily spread which is detrimental to rehabilitation of vegetation. Alien Invasive Plants (AIPs) directly compete with rehabilitating vegetation and could result in increasing costs of revegetation in the long term. In addition, various invasive species are required by law to be removed.

Originally the Conservation of Agriculture Resources Act, 1983 (Act No. 43 of 1983) (CARA) regulated the control of weeds however this was superseded by the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) which considers the management of alien and invasive species. The most recent Alien and Invasive Species Lists (GN R.864 in GG 40166 of 29 July 2016) categorises species into the following:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

Control methods should be used that are appropriate for the species concerned, as well as to the ecosystem in which they occur. When performing the controlling methodology for weeds and invaders, damage to the environment must be limited to a minimum. One of the most cost-effective and sustainable options is to utilise biocontrol. Biocontrol makes use of a natural enemy of the AIP in its native country to help reduce the population in the country it invades (see the Agricultural Research Council website for more information on Biocontrol). If mechanical and chemical means need to be used, AIPs must be continually removed after rehabilitation has occurred for at least three growing seasons to ensure the seed bank is depleted. Continual monitoring will be needed for seeds that are likely to be blown in from adjacent areas.

The following should be considered during the rehabilitation process:

- There must be no planting of alien plants anywhere within the project area;
- The transportation of soils or other substrates infested with alien species should be strictly controlled;
- Benefits to local communities as a result of the alien plant control programme should be maximised by not only ensuring that local labour is employed, but by also ensuring that cleared alien trees are treated as a valuable wood resource that can be utilised; and
- It is considered essential that appropriate veld management (particularly appropriate grazing levels and burning frequencies) should be applied to areas of secondary indigenous vegetation (e.g. secondary grassland of historically cultivated areas), and especially the grassland and wetland vegetation of untransformed habitats. Appropriate grazing levels and burning frequencies will not only ensure that good vegetation condition and biodiversity levels are maintained but will also serve to control the spread and increase in cover of palatable alien species.

22 Organisational Capacity

The following closure organisational considerations have emerged as good practice and is suggested for consideration by Xivono. Once the relevant persons have been selected then the training and capacity building needed for closure can be determined.

The establishment of a closure committee, which has emerged as international best standard, is key to ensure that closure planning is carried out in terms of the relevant legal requirements and company policies. Although closure planning forms part of the EMF, the establishment of a multi-disciplinary committee can help ensure that closure planning is an integrated activity which is incorporated into mine planning. Figure 22-1 below shows typical key roles that may be identified for a closure committee as defined by ICMM (2019).

The role of the closure champion in a committee is critical, as the champion will be responsible for liaising with other key leaders within the organisation. The community liaison and development officer engage with the relevant stakeholders, which can be actioned through a stakeholder forum. Human resources consider the transition into closure and develops plans to minimise job losses. The technical specialists focus on addressing the knowledge gaps and guides rehabilitation implementation. The finance officer ensures that sufficient funds are available for closure.

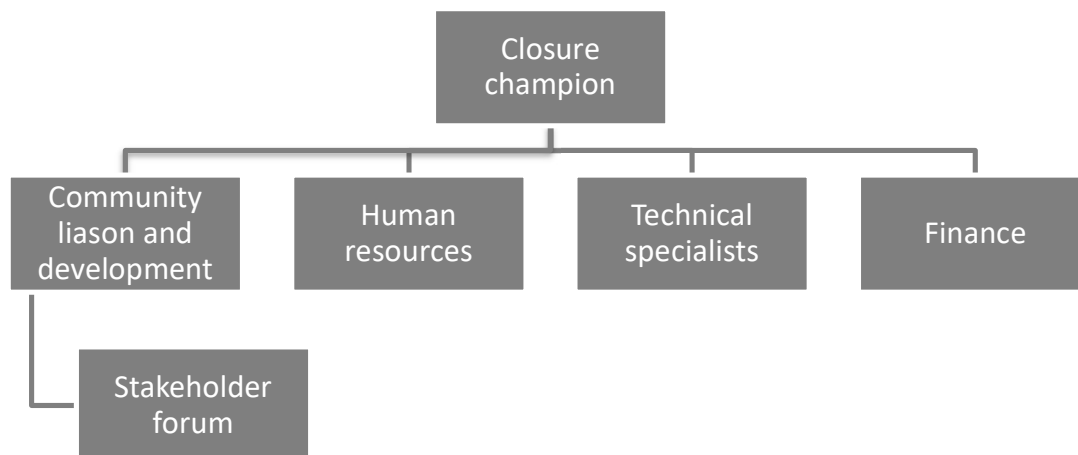


Figure 22-1: Typical Closure Committee Roles

22.1 Motivation for Amendments

No amendments are made at this stage of reporting.

23 Stakeholder Participation

No stakeholder issues or comments have informed this RCP as it has not been presented for comments at this stage of the project.

24 Closing Statement

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction; and end with achievement of long-term physical and chemical stability of the site. Not only will the implementation of this concept result in a more satisfactory environmental outcome, but it will also reduce the financial burden of closure and rehabilitation. In this RCP, Digby Wells outlines the various rehabilitation measures to be implemented to close the mine safely and sustainably and according to its closure objectives.

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