THE PROPOSED MINING PERMIT FOR ALL FORMS OF LIMESTONE, DIMENSION STONE AND MARBLE ON A PORTION OF PORTION 3 OF THE FARM WELVERDIEND NO. 511, VANRHYNSDROP, WESTERN CAPE PROVINCE

DWS SECTION 21 (C) & (I) WATER USE RISK MATRIX

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Prepared for:

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1. DOCUMENT CONTROL

1.1. Quality and revision record

1.1.1. Quality approval

	Capacity	Name	Signature	Date
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This report has been prepared in accordance with Enviroworks Quality Management System.

1.1.2. Revision record

Revision Number	Objective	Change	Date
1	Draft Report	Internal review	19 October 2021
2	Final Report	Client review	21 October 2021

1.2. Disclaimer

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions are to some extent made on reasonable and informed assumptions built on bona fide information sources, as well as deductive reasoning. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage during the impact assessment phase. The author does not accept responsibility for conclusions made in good faith based on own databases or on the information provided. Although the author exercised due care and diligence in rendering services and preparing documents, the author accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the authors and by the use of this document. This report should therefore be viewed and acted upon with these limitations in mind.

2. TABLE OF CONTENTS

3. LIST OF FIGURES

4. LIST OF TABLES

5. INTRODUCTION

Enviroworks (Pty) Ltd has been appointed by B&E International (Pty) Ltd c/o Greenmined Environmental (Pty) Ltd, to conduct the DWS Section (c) & (i) Water Use Risk Assessment Matrix as part of the Water Use Licence Application (WULA) process for the proposed mining permit on a Portion of Portion 3 of the farm Welverdiend No. 511 in the magisterial district of Vanrhynsdorp, Western Cape Province (Figure 1).

The applicant is applying for an environmental authorisation (EA) and a mining permit (MP) for all forms of Limestone, Dimension stone and Marble. The proposed mining footprint is approximately 4.9 ha on the above-mentioned property. The land surface rights are owned by the applicant of this application area.

The purpose of this Risk Matrix is to assess the risk associated with Section 21 (c) & (i) Water Uses- impeding and diverting the flow of water. The proposed mining will possibly take place within the regulated area of watercourses thus triggering the need for a Risk Assessment according to Section 21 (c) & (i) Water Uses.

5.1. Project description

The mining method will entail an open-pit quarry with diamond wire cutting, loading and hauling of the mined material. The quarry will be dug in a pit with face walls of sub-vertical inclination. Benching will not be required due to the shallow nature of the deposit. A system of ramps is to be excavated within the pit to provide access to all face wall sides. The angle of the pit face wall will be carefully determined to prevent and minimize damage and danger from rock falls and/or safety hazards.

Waste and mineralisation on a scale of a few hundred to thousands of tons per day may be drilled and blasted to break off from the pit face in blocks. The material will then be loaded and hauled to various stockpiles and/or waste dumps. Waste rock will be hauled to a waste dump. Waste dumps could be piled at the surface of the active pit, or in previously mined pits. Mineralised material will be stockpiled in a separate location.

Access to the proposed mining area will be via the N7, making use of the existing internal/haul roads to access the mining permit area. Existing water authorisation is in place should water be required for the implementation of the project. Water will be bought and transported to site.

The proposed project will not require any additional electricity connections, as power will be supplied, when needed, by generators.

Site Specific Infrastructure

The prospecting site will contain the following:

- Drill and blast rigs – used to drill small diameter holes into the material

- Excavators – moving heavy stone blocks
- Front End Loaders – ramp/road building and material shifting
- Plant operations (to be confirmed)
- Light Domestic Vehicles (LDVs)
- Flatbed/Low-bed and Ore transport trucks.

5.1.1. Alternatives

A second alternative for the mining permit application area was provided and assessed at a desktop level (Figure 1).

5.2. Objective

Various environmental legislation in South Africa makes provision for the protection of our natural resources and the functionality of ecological systems to ensure sustainability. Such acts include the National Environmental Management: Biodiversity Act (Act 10 of 2004), National Forests Act (Act 84 of 1998), Conservation of Agricultural Resources Act (Act 43 of 1983), National Water Act (Act 36 of 1998) (NWA) and framework legislation such as the National Environmental Management Act (Act 10 of 2004) (NEMA).

The various components of ecological systems are all interrelated, and it is therefore important that specialist studies of all such components be conducted prior to the commencement of any proposed project development. Only once the potential impacts and outcomes of proposed developments on the ecological systems of an area are understood, can informed decisions be made regarding the viability of projects to address and achieve the environmental and socio-economic needs of an area.

5.2.1. Watercourse delineation

The protection of watercourses is of utmost importance to the Department of Water and Sanitation (DWS). This report was compiled to inform the WULA under the NWA and the Water Use Licence Application and Appeals Regulations, 2017 (GN R. 267 of 24 March 2017). The watercourse delineation and assessment were done to delineate the watercourses and determine the Present Ecological State (PES) and Environmental Importance and Sensitivity (EIS) of the watercourses to ensure protection thereof.

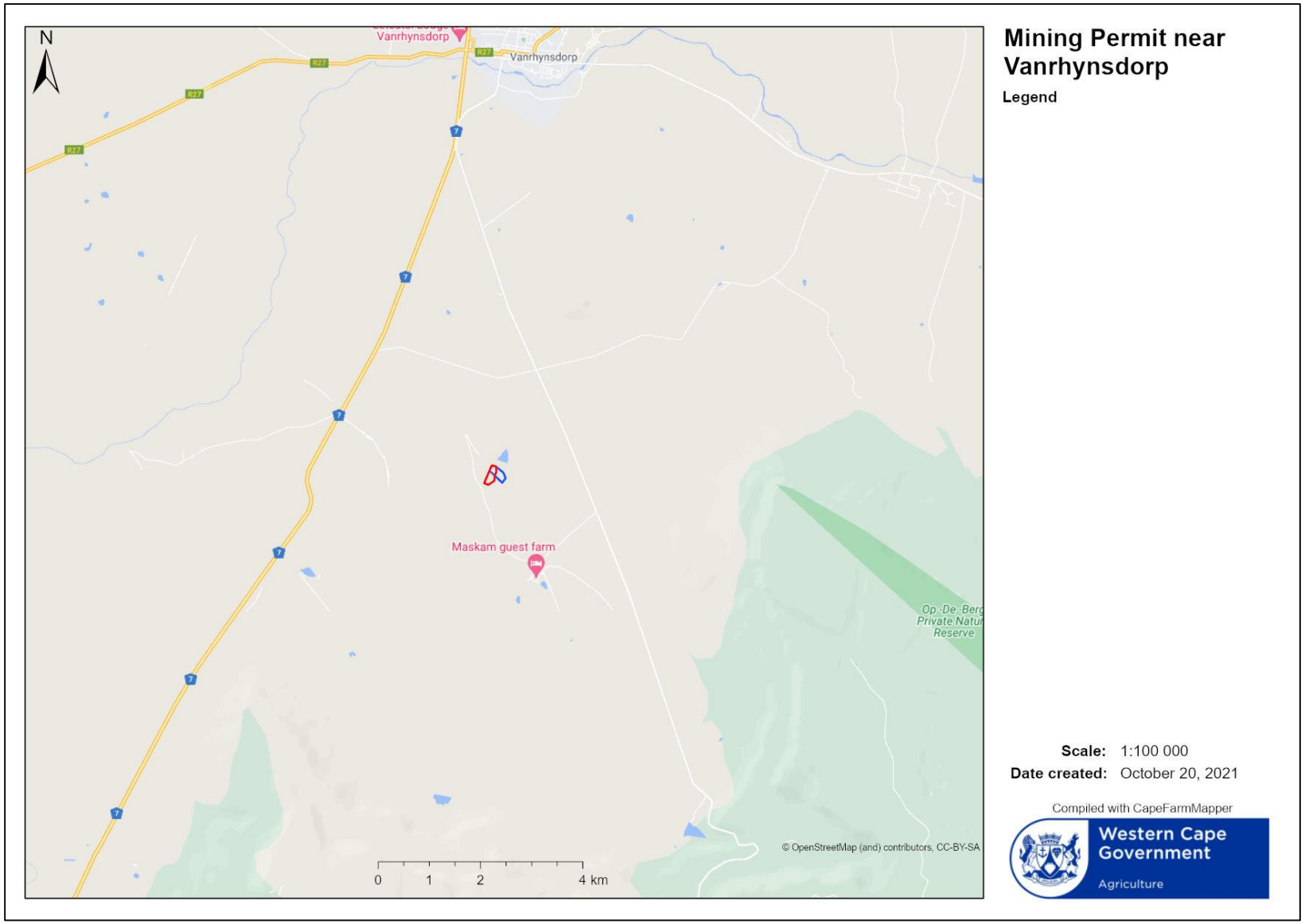

Figure 1 Locality map of the proposed mining permit area, near Vanrhynsdorp. The preferred alternative is outlined in red, while the second alternative is outlined in blue

5.2.2. Water Use Risk matrix

The objective of the Risk Matrix is to assess the risk associated with a Section 21 (c) – Impeding or diverting the flow of water in a watercourse & (i) – Altering the beds, banks, course or characteristics of a watercourse - Water Use. The proponent proposes to mine minerals, potentially within the regulated area of watercourses. The proximity of the development to the watercourses triggers the need for a Risk Assessment Matrix according to Section 21 (c) & (i) of the NWA.

The Constitution of the Republic of South Africa (1996) promotes sustainability; social, ecological and developmental issues are considered to be equally important. The South African National Water Policy (1997) and the NWA were promulgated to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in an equitable, efficient and sustainable manner (Department of Water and Sanitation, 2014).

Watercourses are essential for the maintenance of adequate supply of surface and underground water; provide hydrological stability and flooding- and erosion control; as well as sustaining biota. Due to the potential of the proposed development and associated infrastructure to impact freshwater courses (proximity to watercourses), the proposed project triggers (c) & (i) water uses according to the NWA). As S21 (c) & (i) water use related activities impact watercourses and thus their functions, the objectives of regulating S21 (c) & (i) water uses entail inter alia (taken from Department of Water and Sanitation, 2014):

Protecting watercourses by:

- promoting sustainable utilisation;
- prevention of degradation; and
- ensuring rehabilitation of watercourses.

Preventing pollution of watercourses, i.e. the direct or indirect alteration of the physical, chemical or biological properties of a watercourse so as to make it:

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful-
    - to the welfare, health or safety of human beings;
    - to any aquatic or non-aquatic organisms;
    - to the resource quality; or
    - to property.

According to Government Notice 509 of 2016 - GENERAL AUTHORISATION IN TERMS OF SECTION 39 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) FOR WATER USES AS DEFINED IN SECTION 21(C) OR SECTION 21(I), IMPEDING OR DIVERTING THE FLOW OF WATER IN A WATERCOURSE (SECTION 21(C)), OR ALTERING THE BED, BANKS, COURSE OR CHARACTERISTICS OF A WATERCOURSE (SECTION 21(I)) OF THE NATIONAL WATER ACT (ACT NO. 36 OF 1998) a project can be excluded from a General Authorisation according to Section 3 – unless it triggers any of the activities from (a) to (e) of Section 3, and Section 6 that's states –

(2) All State Owned Companies (SOC's), and other institutions specified in Appendix D2 having lawful access to that property or land may on that property use water in terms of section 21(c) or (i) of the Act as specified under each of the relevant SOC's and other institution (Appendix D2).

According to Appendix D2 (Figure 2) below:

APPENDIX D2: **Activities that are generally authorized for SOC's and institutions subject only to compliance to the conditions of this Notice.**

SOC's, INSTITUTION or Individual	ACTIVITIES
ESKOM and other institutions	**Construction of new** transmission and distribution power lines, and **minor maintenance** of roads, river crossings, towers and substations where footprint will remain the same.
SANPARKS and provincial conservation agencies	All bridges, low water bridge crossings and pipe lines below 500 mm in diameter.
SANRAL and other provincial Departments of Transport or municipalities.	All maintenance of bridges over rivers, streams and wetlands and new construction of bridges done according to SANRAL Drainage Manual or similar norms and standards.
TRANSNET and other institutions	All 1.5 meter diameter and smaller pipe lines (*except pipelines excluded in terms of this Notice - paragraph 3 (e)*) and maintenance of railway line crossings of rivers and wetlands outside the boundary of a wetland.
Gautrain Management Agency	Maintenance of existing infrastructure and expansion to crossings of rivers within the existing servitude.
TELKOM and other communication companies	All cables crossing rivers and wetland outside delineated wetland boundary.
RAND WATER and other water boards	All raw water 1.5 meter diameter and smaller pipe lines crossings river and wetlands outside delineated wetland boundary.
Municipalities and other institutions.	Mini-scale hydropower developments with a maximum capacity of 10kW – 300kW. (*Read together with General notice 665 of 6 Sept 2013 General Authorisation section 21 (e) or as amended*) These hydropower plants will provide basic, non-grid electricity to rural communities and agricultural land and must in no way affect the flow regime, flow volume and/or water quality including temperature.

Figure 2 Appendix D2 as taken from GN 506 of 2016

General Authorisations (GA) for Section 21(c) & (i) water uses *does not apply:*

(a) To the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009;

(b) To the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the **Risk Matrix** (Appendix A of the GA Regulations);

(c) In instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;

(d) Where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse; and,

(e) To any water use in terms of section 21 (c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous material.

5.3. Receiving environment

5.3.1. Geology and soil

The property and surrounds are classified as having a geology of alluvium, sand and limestone of Quaternary origin (ENPAT, n.d.). The lithology can be described as alluvium, colluvium, eluvium, boulder gravel, gravel, scree, sand, soil, debris (Figure 3) (Council for Geoscience, n.d.).

The soil type is classified as red-yellow freely drained soils with limited pedological development, usually shallow on hard or weathering rock, with or without intermittent diverse soils; lime is generally present in part or most

of the landscape (Department of Agriculture, Forestry and Fisheries, n.d.; ENPAT, n.d.). The depth is usually >= 450 mm with less than 15% clay content. It does have a relatively high erosion factor of 0.6 (out of a score of 0.7) (Schulze, 2009; CapeFarmMapper ver 2.6.2).

5.3.2. Climate

Vanrhynsdorp has an arid climate and receives most of its rainfall during the winter (Figure 4) (https://www.worldweatheronline.com/vanrhynsdorp-weather-averages/western-cape/za.aspx), but there is a smaller peak of rainfall in summer between December and February. The dry season is between September and November, and then March. September has the lowest average precipitation of 9.5 mm. Rainfall is the highest in April to August, with June having the highest average precipitation of 37.2 mm. January is usually the warmest with an average high temperature of 30 ^{o}C (Figure 5). June and July is usually the coldest, with an average low temperature of 15 ^{o}C (https://www.worldweatheronline.com/vanrhynsdorp-weather-averages/western-cape/za.aspx).

5.3.3. Vegetation type

The proposed mining permit area and surrounds are situated within the Vanrhynsdorp Gannabosveld (SKk5) vegetation type (Figure 6), that is part of the Succulent Karoo Biome and Knersvlakte Bioregion (Mucina and Rutherford, 2006, CapeFarmMapper ver. 2.6.2).

Vanrhynsdorp Gannabosveld vegetation is distributed in the Western Cape Province in Namaqualand, southern Knersvlakte between Vredendal and Vanrhynsdorp at the foot of the Matsikamma and Gifberg Mountains as well as northeast of Vanrhynsdorp (Mucina and Rutherford, 2006). About half of the area lies at an elevation between 100–200 m and most of the rest at 200–300 m (Mucina and Rutherford, 2006).

The landscape in which this vegetation type occurs is mainly flat or only slightly undulating, supporting succulent shrubland dominated by *Salsola* (over large stretches), *Drosanthemum, Ruschia* and some disturbance indicators such as (mainly) short-lived Aizoaceae, including representatives of the genera *Galenia, Psilocaulon, Caulipsolon* and *Mesembryanthemum* (Mucina and Rutherford, 2006). In the south, the shale plains can acquire a grassland appearance through seasonal dominance of *Bromus pectinatus* and *Stipa capensis*. Spectacular annual and geophyte flora can appear in spring after good winter rains (Mucina and Rutherford, 2006).

It is estimated that between 14.9 – 20% of this vegetation type has been transformed (Mucina and Rutherford, 2006; Skowno et al., 2019), mostly into cultivated land and open-cast gypsum mining (Mucina and Rutherford, 2006). Rehabilitation after open-cast mining remains minimal due to lack of little viable topsoil to cover the rehabilitated fields. Aliens (*Atriplex* and *Bromus*) have invaded large patches of vegetation. Increased cover of *Stipa capensis* (despite the name, still unclear whether of indigenous or alien origin) diminishes grazing potential for sheep (due to damage to wool by caryopses) (Mucina and Rutherford, 2006).

None of the vegetation type is conserved in statutory conservation areas (Mucina and Rutherford, 2006; Skowno et al., 2019) but the ecosystem is classified as Least Concern (Figure 7) and there are very little remaining extent

of indigenous vegetation on the property or direct surrounds due to past mining and stockpiling (Figure 8) (South African National Biodiversity Institute, 2018).

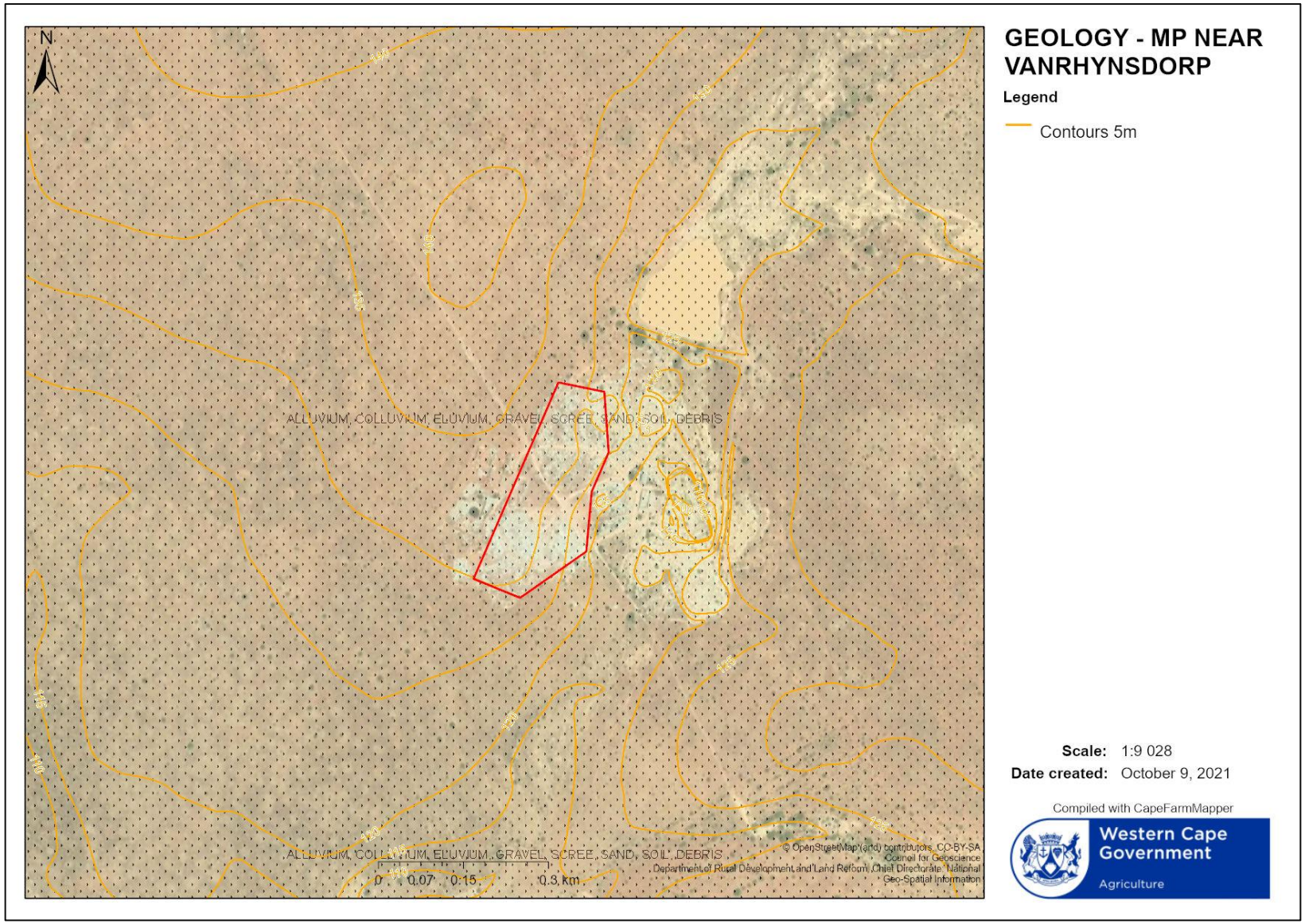

Figure 3 Geology map of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp

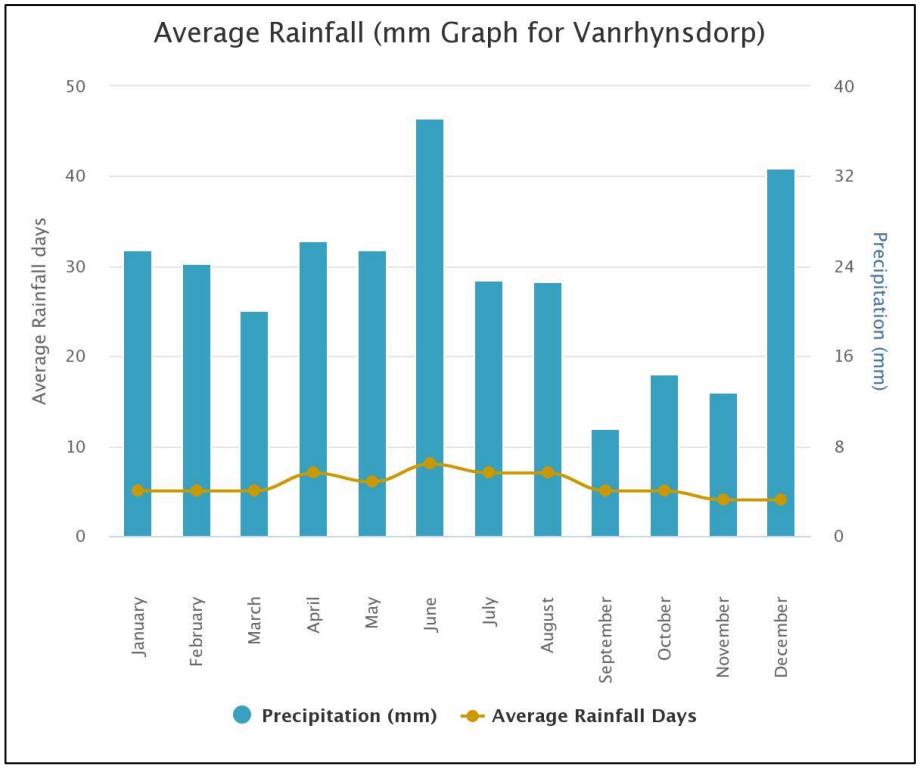

Figure 4 Average monthly rainfall in mm for Vanrhynsdorp (from Worldweatheronline, 2021)

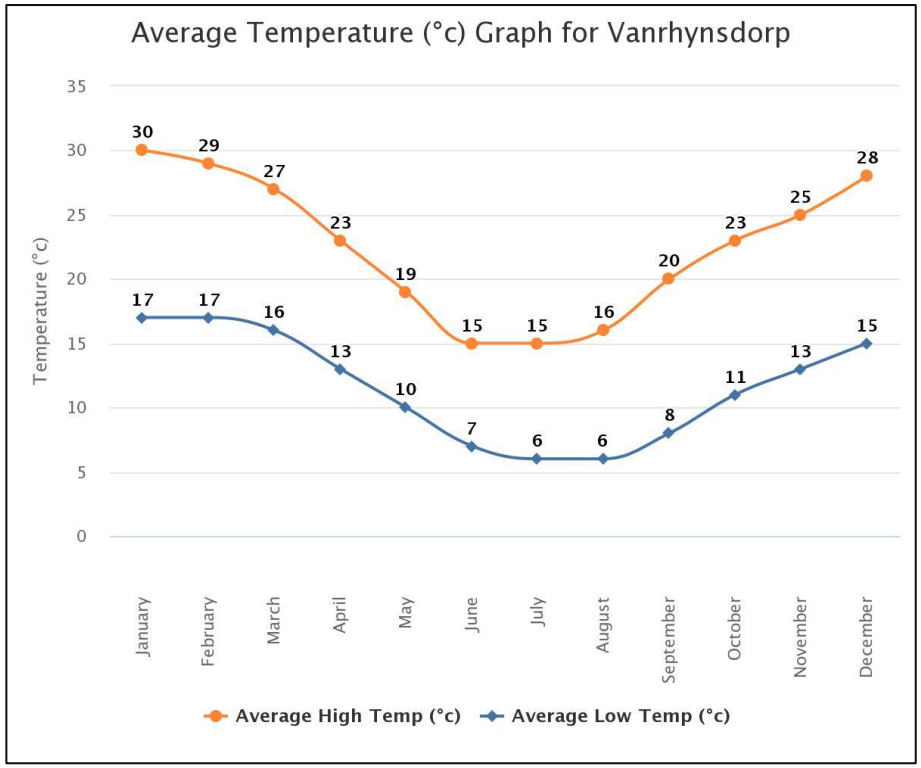

Figure 5 Average monthly temperature in degrees Celsius for Vanrhynsdorp (from Worldweatheronline, 2021)

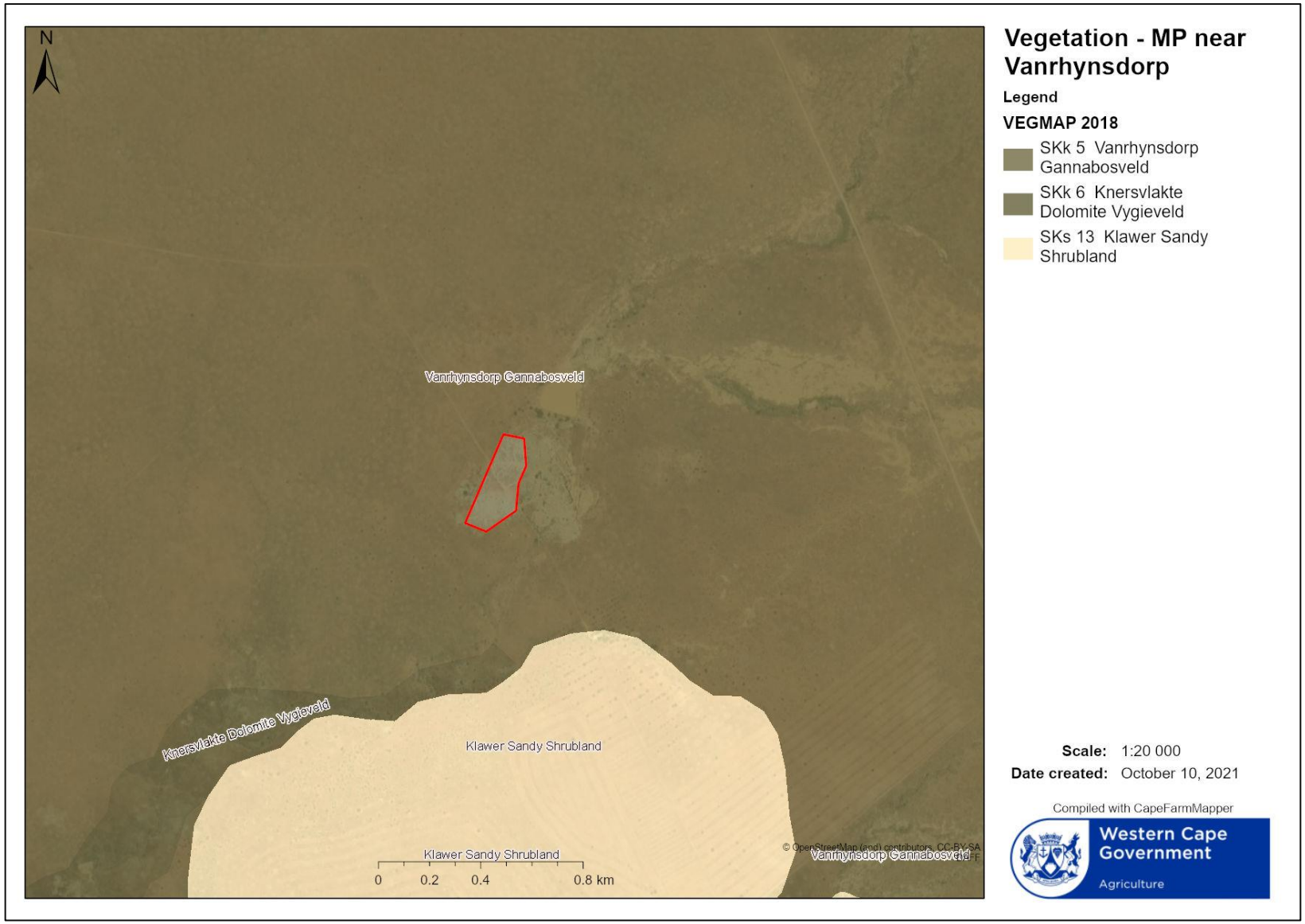

Figure 6 Vegetation type map of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp

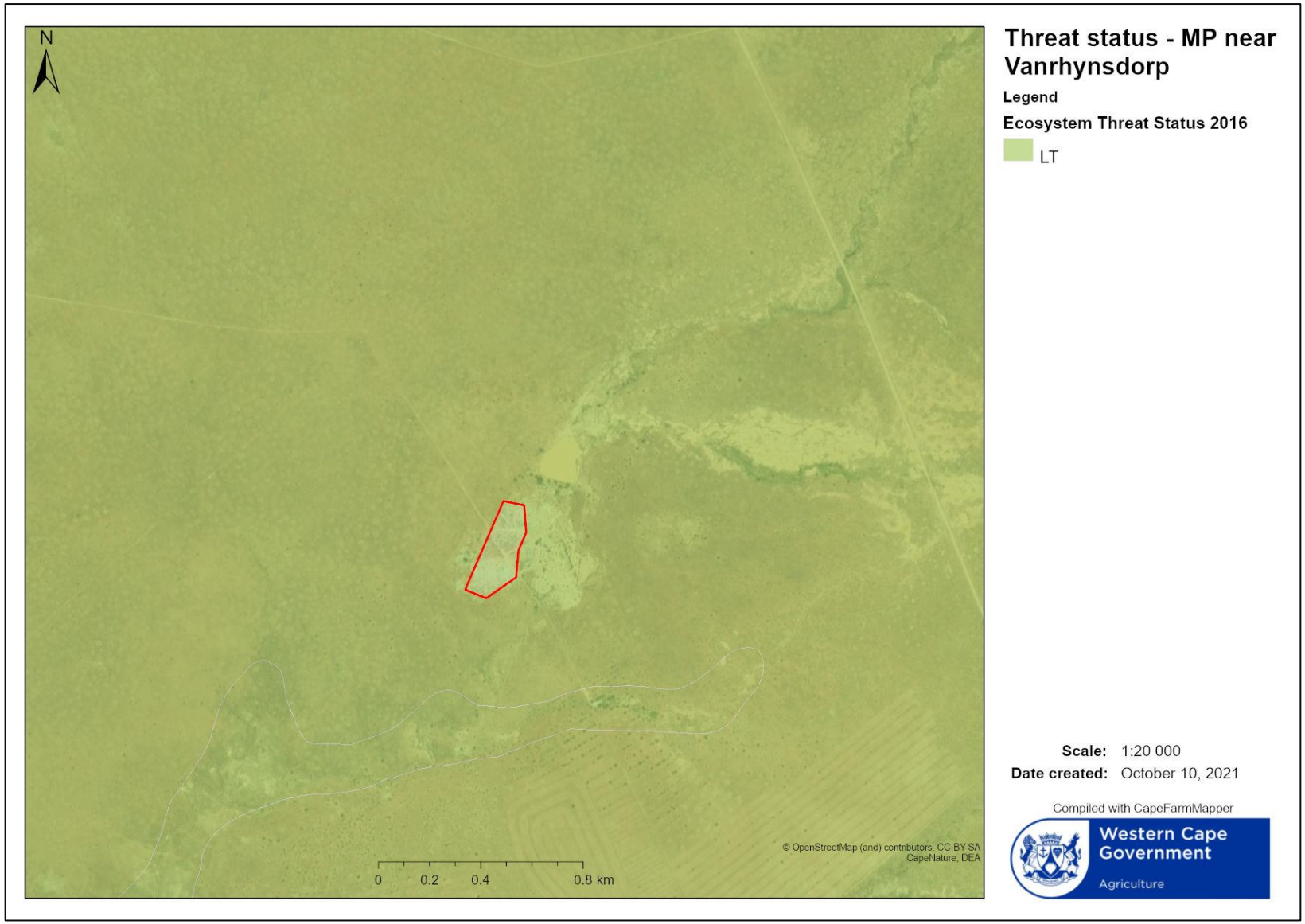

Figure 7 Ecosystem threat status map of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp

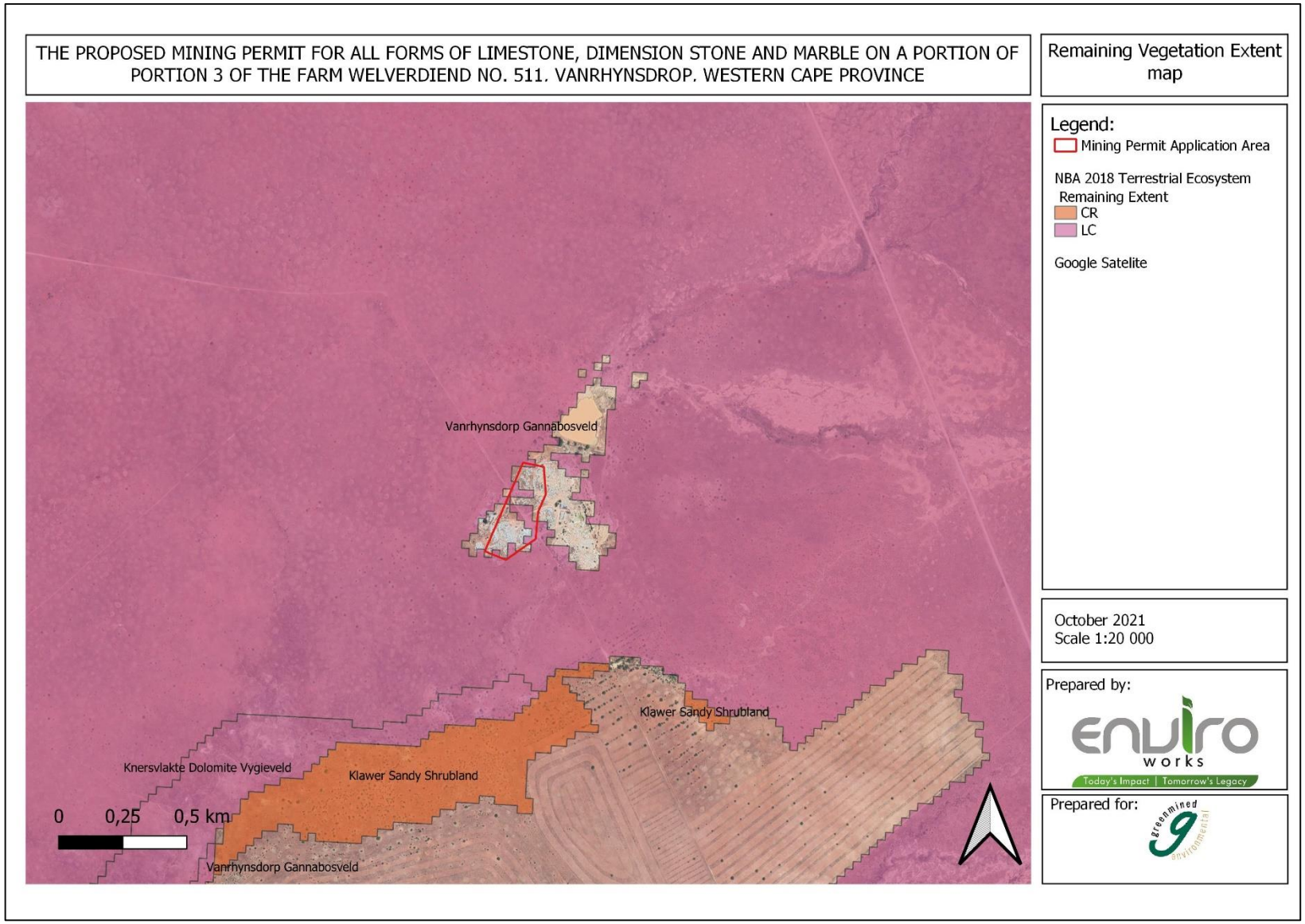

Figure 8 Remaining extent of terrestrial ecosystems of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp

6. BACKGROUND

6.1. Study area

The proposed mining footprint is situated in the Olifants/Doorn Water Management Area (WMA) (Department of Water Affairs, n.d.), in quaternary catchment E33G (Water Research Commission, n.d.).

The major river in the WMA is the Olifants River, of which the Doring River (draining the Koue Bokkeveld and Doring areas) and the Sout River (draining the Knersvlakte) are the main tributaries (from DEAP, 2011).

The Olifants River rises in the mountains in the south-east of the WMA and flows in a north-westerly direction (from DEAP, 2011). Its deep narrow valley widens and flattens downstream of Clanwilliam until the river flows through a wide floodplain downstream of Klawer. The Doring River is a fan shaped catchment and rises in the south, flowing in a northerly direction. It is first joined by the Groot River and then by the Tra-Tra River flowing from the west and the Tankwa River from the east, before flowing in a westerly direction to its confluence with the Olifants River just upstream of Klawer (from DEAP, 2011).

Important conservation areas in the WMA include the Tankwa-Karoo National Park, the Verlorenvlei wetland in the Sandveld (which enjoys Ramsar status), the Cederberg Wilderness Area, and the northern section of the Groot Winterhoek Wilderness Area (from DEAP, 2011).

The Olifants River and its tributary, the Doring River are important from a conservation perspective because they contain a number of species of indigenous and endemic fish that occur in no other river systems, and that are endangered (from DEAP, 2011). The Olifants estuary is one of only three permanently open estuaries on the west coast of South Africa. It therefore represents a critical habitat to many estuarine-associated fish species.

The mean annual precipitation over much of the WMA is less than 200 mm, with the result that, except in the wetter south-west, the climate is not suitable for dryland farming on a large scale. Consequently, more than 90% of the land in the Olifants-Doorn WMA is used as grazing for livestock, predominantly for sheep and goats (from DEAP, 2011).

The agricultural sector, followed by manufacturing, represent the key economic sectors in the WMA both in terms of contribution to Gross Regional Domestic Product (GDPR) and employment (from DEAP, 2011). Together they account or ~ 68% of the GDPR and 50% of the employment. The agricultural sector is also the single largest consumer of water (95%). Urban and industrial (including manufacturing) (2%), rural use, including livestock (2%) and mining (1%) make up the remaining 5%. In terms of population, the majority of the population (~70%) lives in urban settlements, while the remaining 30% lives in the rural areas. Approximately 500 km^2 of the WMA is under irrigation, of which almost 50% lies within the Olifants river catchment and includes citrus, deciduous fruits, grapes and potatoes, providing the mainstay of this WMA's economy. In addition to the intensive irrigation practised along the Olifants River, significant irrigation also takes place in the Koue Bokkeveld, along the rivers and from groundwater in the Sandveld sub-area (from DEAP, 2011).

The surface water quality of the Olifants-Doorn WMA is quite variable (from DEAP, 2011): the physical and chemical characteristics of the WMA geology have a strong influence on the water quality and agricultural activities influence the water quality significantly throughout the WMA, especially during the summer months.

One of the concerns regarding surface water quality is the impact that mining activities within non-perennial rivers could have, since it results in an increase in turbidity and suspended sediment concentrations, increased salinity, which causes silting of rivers and streams and smothering of habitat of aquatic organisms (from DEAP, 2011).

According to the Reserve Determination of Water Resources for the Olifants-Doorn Catchments (No. 189 of Government Gazette No. 41473 of 02 March 2018), classifies the river (Olifants) of quaternary catchment E33G as having a Present Ecological State (PES) of D (i.e. Largely modified), and an Ecological Importance and Sensitivity of Moderate.

The Classes and Resource Quality Objectives of Water Resources for the Olifants-Doorn Catchments (No. 467 Government Gazette No. 39943 of 22 April 2016) classifies the site as falling within the Lower Olifants Irrigation Integrated Unit of Analysis, having a class of III – this indicates sustainable minimal protection and high utilization (Lower Olifants Irrigation). The Mainstream Cumulative Ecological Category refers to flows and impacts generated in the quaternary catchment plus all the upstream flows and impacts. For this quaternary catchment, a class of D has been assigned. Average Tributary Incremental Ecological Category refers to only the proportion of flow that comes from the runoff in the segment of the river or tributary; and a category of C has been assigned to the quaternary catchment.

The site falls within the Western Coastal Belt classification of the Level 1 River Ecoregions (Kleynhans et al., 2005). The landscape typically consists of plains with low and moderate relief. Altitude varies from sea level to 700 metres above mean sea level (m.a.m.s.l.). Vegetation types consist of Succulent Karoo types. The Olifants, Doring, Sout, Groen and Buffalo rivers traverse this region while the Orange River flows through the northern part. Mean annual precipitation is very low/arid and drainage density is low, with low/medium stream frequency (Kleynhans et al., 2005).

7. METHODOLOGY

7.1. Defining and delineating watercourses

Rivers: have a general morphology distinguishing the active river channel or bed, the riverbanks, and in the lower systems, the floodplains associated with the river banks. The river ecosystem is formed by the interaction between river biota and their hydro-geochemical environment.

Riparian Habitat: includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent

and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

For this report, the definition and motivation for a watercourse and a regulated area for the protection of the freshwater resources can be summarised as follows:

The extent of a watercourse as per the Water Use Authorisation (WUA) in terms of the NWA defines a watercourse as:

"*(a) a river or spring;*
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and,
(d) reference to a watercourse includes, where relevant, its bed and banks".

Further to this, GN 509 of 2016 defines a regulated area of a watercourse for Section 21 (c) or (i) of the Act water uses as:

"*(a) the outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;*
(b) in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or,
(c) a 500 m radius from the delineated boundary (extent) of any wetland or pan"

Any of the above will trigger a WUA in terms of Section 21 (c) and (i) of the NWA.

Instream habitat: includes the physical structure of a watercourse and the associated vegetation in relation to the bed of the watercourse.

Section 21 (c) and (i) Water Use: Defined as activities taking place within a watercourse and regulated area that potentially or actually obstruct or redirect flow of water and/or change the characteristics (i.e. resource quality) of the watercourse are regarded as Section 21(c) and/or (i) water use.

Section 21 (c) & (i) water uses are non-consumptive and their impacts are often more difficult to detect and manage. Undetected impacts can significantly change various attributes and characteristics of a watercourse, especially if left unmanaged and uncontrolled. Thus, the risks posed by Section 21 (c) & (i) water uses on watercourses are an important consideration.

In terms of determining the impact and risks of proposed activities on resource quality, the following definition was used-

Resource quality: The quality of all the aspects of a water resource including -
(a) the quantity, pattern, timing, water level and assurance of instream flow;
(b) the water quality, including the physical, chemical and biological characteristics of the water;
(c) the character and condition of the instream and riparian habitat; and,

(d) the characteristics, condition and distribution of the aquatic biota.

Impacts were identified and assessed based on the following understanding: Impacts arising from project inputs and outputs (e.g. water use, changes in surface drainage or water quality, emissions, effluent, chemicals, solid waste, introduction of invasive species and disturbances).

Watercourses were delineated following the standard national methods developed for the delineation of wetlands and riparian areas (Rountree et al., 2008). Terrestrial vegetation surrounding drainage lines usually have a distinctive, more robust growth form that can be utilized for delineation of watercourses. Satellite imagery was thus used for the delineation of riparian watercourses using growth form and structure of vegetation associated with watercourses, as done by other studies (Dabrowski, 2019).

In arid regions such as the Succulent Karoo Biome, vegetation is the best indicator for delineation of riparian zones along drainage lines as there is a very distinct change in vegetation structure characterized by robust growth forms compared to adjacent terrestrial areas. For pans (wetlands) in arid areas the conventional methods of wetland delineation are not appropriate. The soils of temporary wetlands in very arid areas are often too shallow, too saline, or too temporarily inundated to exhibit typical wetland features such as gleying and mottling (Dabrowski, 2019; Day et al., 2010). Hydrophytic vegetation indicators are also not reliable indicators of wetlands in arid environments. The centre of arid pans in the area of inundation may be bare of vegetation or have vegetation growing on sediments (Dabrowski, 2019; Day et al., 2010).

7.2. Site biodiversity

Data sources from literature were consulted and used where necessary in the study and include the following:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford, 2006) and the National List of Ecosystems that are Threatened and in Need of Protection (GN 1002 of 9 December 2012).
- A brief discussion of the area in which the site occurs, using available literature, to place the study area in context.
- A broad-scale map was generated of the terrestrial- and aquatic ecosystems of the site using available GIS data (Collins, 2017; Pool-Stanvliet et al., 2017; Van Deventer et al., 2020, 2019).

7.3. Date and season of site visit

A site visit took place on 07 October 2021. A walkthrough was done, assessing environmental conditions and pictures were taken of the environment. The site visit took place in the spring of 2021, during the start of the dry season. The weather conditions were accommodating, where clear visibility facilitated the inspection of the proposed footprint and surrounding area.

7.4. Desktop study

Watercourses were firstly identified from a desktop study and use was made of topographic maps, geo-referenced Google Earth images, local and national data sets of watercourses (Collins, 2017; Council for Scientific and Industrial Research, 2018a, 2018b; Driver et al., 2011). A desktop delineation of suspected watercourses was undertaken by identifying rivers and wetness signatures from the digital base maps. Areas suspected to be wetlands and watercourses were then further investigated in the field. Data was extracted from online National GIS databases with specific reference to the status of ecosystems and biodiversity within the area (CapeFarm Mapper ver 2.6.1; BGIS, 2021).

7.5. Site assessment

A site visit/assessment of the proposed project footprint and surrounding area was conducted on 07 October 2021 to verify the desktop study's results of watercourses and to make observations about the general conditions and state of the watercourses, including the surrounding environment. The watercourses within the 500 m buffer of the development, and within the zone of influence of the proposed development were assessed.

The SANBI Biodiversity GIS and CapeFarmMapper websites were consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping (Driver et al., 2011; Pool-Stanvliet et al., 2017). This information was used to inform the resource protection related recommendations.

Input into this report was thus informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features at the site.

Therefore, a combination of satellite imagery and site observations were employed to map watercourse features across the site. Significant reliance on visual eco-morphological observations was made to derive an understanding of the state of the habitat within the subject site. This state may change under a different meteorological regime. Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments.

7.5.1. Determining the State of a Watercourse

The state of a watercourse is expressed in terms of its bio-physical components (characteristics):

- Drivers (physico-chemical, geomorphology, hydrology) which provide a particular habitat template; and,
- Biological responses (fish, riparian vegetation and aquatic invertebrates).

The **Present Ecological State** (PES) refers to the current state or condition of a watercourse in terms of all its characteristics and reflects the change to the watercourse from its reference condition.

The method used to determine the PES for watercourses was the Index of Habitat Integrity (IHI) which measures the impact of human disturbance on riparian and instream habitats (Kleynhans, 1996). The IHI is a rapid assessment of the severity of impacts affecting habitat integrity within a river reach. It can be applied to both perennial and non-perennial watercourses (Dabrowski, 2019; Kleynhans, 1996). Each impact on the riparian and instream habitat is given a score between 0 – 20 based on the degree of modification (Table 1). An IHI class (i.e. Ecological category) is then determined based on the resulting score (Table 2).

The **Ecological Importance and Sensitivity (EIS)** of a watercourse is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales, and both abiotic and biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

For watercourses, the EIS is based on a rapid instream and riparian habitat ecological importance and sensitivity assessment, using a modified version of DWAF EIS tool for rivers, from Nkurenkuru Ecology and Biodiversity (2020). This method is based on assigning a score between 0-4 to simple criteria (Table 3). The level of confidence in the score is given. The average scoring of these criteria places the watercourse in an EIS Category according to Table 4

Table 1 Scoring of criteria to determine the PES of rivers and drainage lines according to Kleynhans (1996).

Criteria	Score	Comments
Instream Habitat		
Water abstraction		
Flow modification		
Bed modification		
Channel modification		
Physico-chemsitry		
Inundation		
Alien macrophages		
Introduced aquatic fauna		
Rubbish dumping		
Riparian habitat		
Vegetation removal		
Exotic vegetation		
Bank erosion		
Channel modification		
Water abstraction		
Inundation		
Flow modification		
Physico-chemsitry		

Table 2 Criteria for PES calculations for watercourses.

Ecological Category	Score	Description
A	> 90-100%	**Unmodified**, natural.
B	80-90%	**Largely natural** with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-79%	**Moderately modified**. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-59%	**Largely modified**. A large loss of natural habitat, biota and basic ecosystem functions has occurred.

Ecological Category	Score	Description
E	20-39%	**Seriously modified**. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-19%	**Critically/Extremely modified**. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

Table 3 Outcome of a rapid instream and riparian habitat ecological importance and sensitivity assessment, using a modified version of DWAF EIS tool for rivers, from Nkurenkuru Ecology and Biodiversity (2020)

Determinant	Score	Confidence	Comments
1. Rare & Endangered Species			
2. Populations of Unique Species			
3. Species/taxon Richness			
4. Diversity of Habitat Types or Features			
5 Migration route/breeding and feeding site for wetland species			
6. Sensitivity to Changes in the Natural Hydrological Regime			
7. Sensitivity to Water Quality Changes			
8. Flood Storage, Energy Dissipation & Particulate/Element Removal			
9. Protected Status			
10. Ecological Integrity			
Total			
Median			
Overall ecological sensitivity & importance			

Table 4 Criteria for EIS calculations for watercourses.

EIS Categories	Score	Description
Low/Marginal	**D**	Not ecologically important and sensitive at any scale. Biodiversity ubiquitous and not sensitive to flow and habitat modifications.
Moderate	**C**	Ecologically important and sensitive on provincial/local scale. Biodiversity not usually sensitive to flow and habitat modifications.
High	**B**	Ecologically important and sensitive. Biodiversity may be sensitive to flow and habitat modifications.
Very High	**A**	Ecologically important and sensitive. On national even international level. Biodiversity usually very sensitive to flow and habitat modifications.

7.6. Impacts And Risk Assessment

Impacts were assessed using a common, defensible method that is based on DWS 2015 publication: Section 21 (c) and (i) Water Use Risk Assessment Protocol, of assessing significance that will enable comparisons to be made between risks of potential impacts and will enable transparency of the process upon which risks of impacts have been assessed. The first part of the assessment is the identification of environmental activities, aspects and impacts. The impacts are rated according to criteria set out in Appendix B. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary. The assessment of significance is undertaken twice. Initial, significance is based on only

natural and existing mitigation measures. The subsequent assessment takes into account the recommended management measures required to mitigate the impacts.

8. ASSUMPTIONS AND LIMITIATIONS

- A desktop delineation of the wetland and riparian area was done before the site visit. This is thought to be an acceptable method.
- The watercourse assessment is confined to the proposed project property and does not include the neighbouring and adjacent properties, which were only considered as part of the desktop assessment.
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles.
- The risk assessment was applied on the basis that the stipulated mitigation measures and all specialist recommendations will be implemented, and therefore the results presented demonstrate the impact significance of perceived impacts on the receiving freshwater environment post-mitigation.
- All information provided by the EAP, applicant and engineering design team to the environmental specialist was correct and valid at the time that it was provided.
- The proposed project footprint as provided by the engineering design team is correct and will not be significantly deviated from.
- Significant reliance on visual eco-morphological observations was made to derive an understanding of the state of the habitat within the subject site. This state may change under a different meteorological regime.
- Freshwater resources that fall outside of the affected catchment (but still within the 500 m DWS regulated area) and are not at risk of being impacted (such as upslope water resources) by the specific activity were not delineated nor assessed. Such features were flagged during a baseline desktop assessment prior to the site visit.
- This assessment deals primarily with inland wetlands (i.e. no existing connection to the ocean and these ecosystems are characterised by the complete absence of marine exchange and/or tidal influence) (Ollis et al., 2013).
- Selection of assessment techniques and tools were based on the assessment practitioner's knowledge and experience of these tools and their attributes and shortcomings.
- The assessment techniques and tools are currently the most appropriate available tools and techniques to undertake assessments of freshwater resources; they are rapid assessment tools that rely on qualitative information and expert judgment. While these tools have been subjected to peer review processes, the methodology for these tools are ever evolving and will likely be further refined in the future. For the purposes of this assessment, the assessments were undertaken at rapid levels with somewhat limited field verification: it therefore provides an indication of the PES of the portions of the affected systems rather than providing a definitive measure.

- PES and EIS were only determined for the affected/regulated areas even though upstream and downstream as well as catchment impacts were considered (based on available desktop information).
- The PES and EIS assessments undertaken are largely qualitative assessment tools and thus the results are open to professional opinion and interpretation.
- The EIS assessment did not specifically address the finer-scale biological aspects of the watercourses such as faunal species.
- The initial study was undertaken as a desktop assessment and as such, the information gathered must be considered with caution, as inaccuracies and data capturing errors are often present within these databases.
- The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the wetland and riparian areas.

9. RESULTS

The proposed mining footprint is situated adjacent to and old marble mine. The surface area of the proposed mining permit is currently used as a stockpile for the marble (Figures 9 - 16). The mining footprint thus has been affected by the marble mine's activities across the surface area (Figure 17) (CapeFarmMapper ver. 2.6.2).

Due to the arid nature of the area, there were no surface water visible in the natural watercourses that were encountered. Surface flow through the drainage features and watercourses are considered to be limited to flood or precipitation events. No natural perennial watercourses occur in the study area and watercourses within 500m from the proposed footprint are all classified as ephemeral that flow during heavy rainfall and run-off events. There is an artificial dam upstream from the mine footprint (Figures 18 & 19) which had water in at the time of the site visit, but from historical satellite imagery from Google Earth, the dam has been empty at times, and is thus not perennial.

Figure 9 View of the access road to the proposed mining footprint

Figure 10 Some of the old mine's infrastructure are present on the proposed mining footprint

Figure 11 Marble being stored/stockpiled across the proposed mining footprint

Figure 12 Marble being stored/stockpiled across the proposed mining footprint

Figure 13 Marble being stored/stockpiled across the proposed mining footprint

Figure 14 Marble being stored/stockpiled across the proposed mining permit area

Figure 15 Marble being stored/stockpiled across the proposed mining footprint, as viewed from the dam wall

Figure 16 Old marble mine and area disturbed by it, as viewed from the dam wall

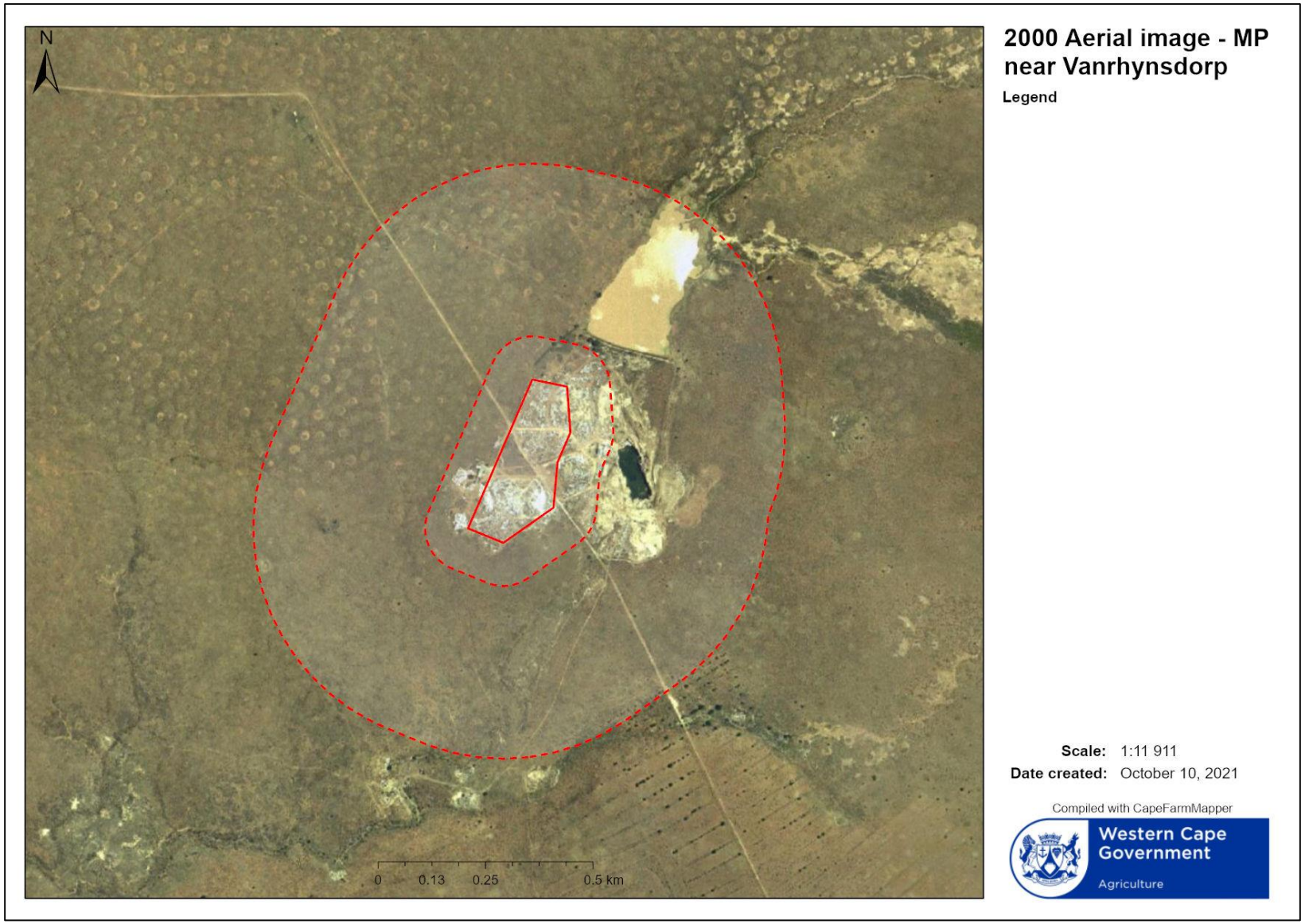

Figure 17 NGI Aerial imagery of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp, with a 100m and 500m drawn around the mining permit footprint

Figure 18 The artificial dam upstream from the proposed mining footprint

Figure 19 Dam wall, upstream from the proposed mining footprint

Figure 20 Gentle slopes leading to the old- and proposed mining footprint in the background, with the valley bottom in the foreground

The proposed mining permit footprint is situated on the crest of a relatively gentle slope. East of the mining permit footprint, the slope ends in a valley (Figure 20). Upslope from the western boundary is thus at a higher elevation (i.e. higher point on the landscape) than the proposed mining footprint (Figure 21); and considered to be outside the area of influence from the proposed project. Water flow in the landscape will be generally south-east upstream and within the mining footprint. The land cover to the west, north and south of the proposed mining footprint, and to the east of the old mine is covered by natural vegetation (Figure 22 & 25).

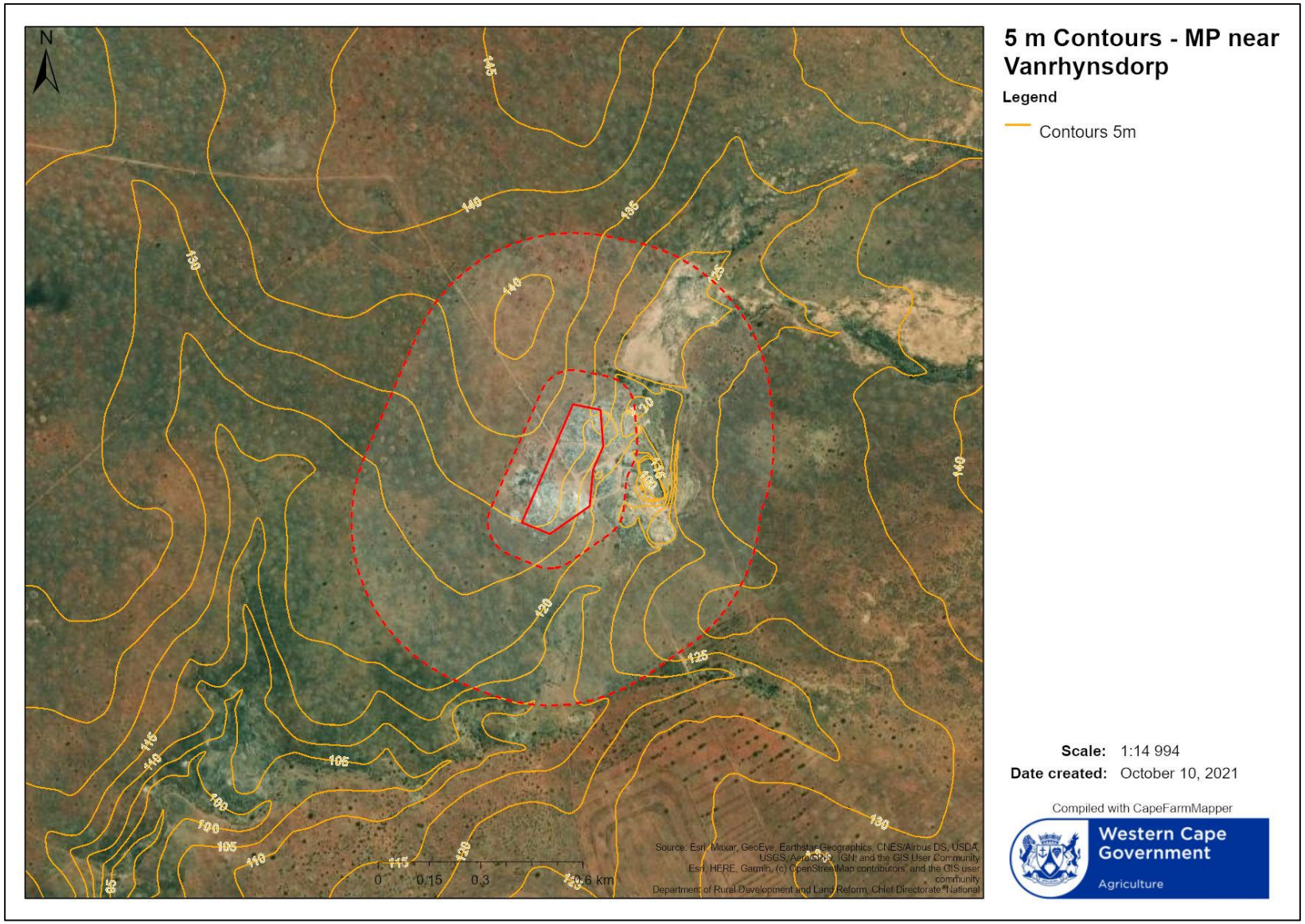

Figure 21 Contour map (5 m) of the proposed mining permit (MP) area and surrounds, near Vanrhynsdorp

Figure 22 Natural vegetation landcover to the west of the proposed mining footprint

Figure 23 Natural vegetation landcover to the east of the old mine

Figure 24 Natural vegetation landcover to the south-west of the proposed mining footprint

Figure 25 Natural vegetation landcover on the slope south and the south-east of the proposed mining footprint

The watercourse map indicate that a non-perennial watercourse flows through the old marble mine (Figure 26). This watercourse has been largely transformed by the previous mining activities, and the dam essentially impounds any surface water flow from upstream (Figures 27 - 29).

A berm, adjoining the dam wall, has been constructed around the eastern boundary of the old mine, and it effectively divert surface water that would have flown through the non-perennial watercourse (Figure 30).

For this reason, choosing the preferred alternative will not differ significantly from the second alternative in terms of impacts on watercourses. Using the preferred alternative could however provide opportunity in the future to restore the transformed watercourses and could re-establish the more natural and meandering flow path, as opposed to the more rigid and straightened path created by the berm's diversion. The second alternative was thus excluded from further assessment during the study.

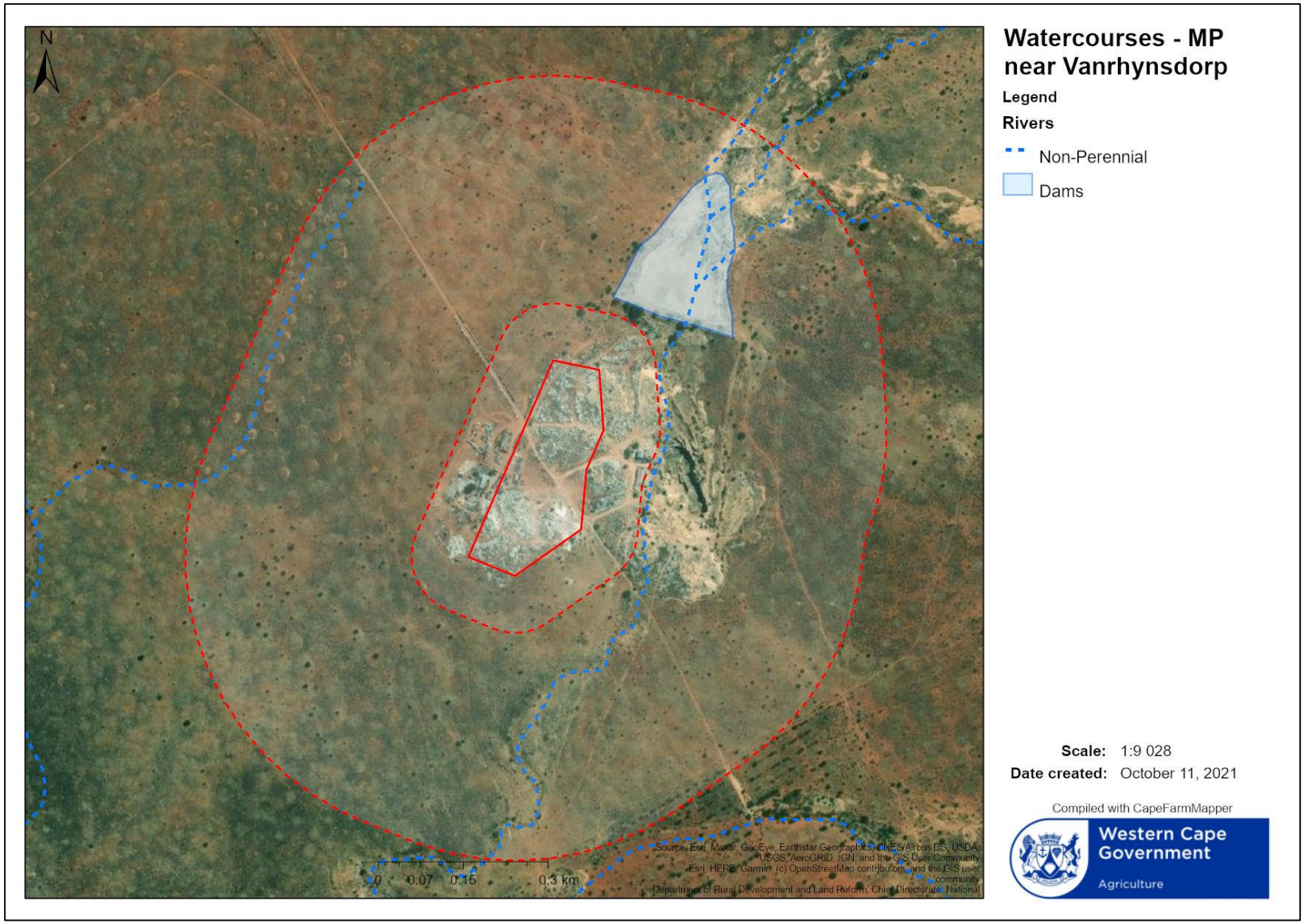

Figure 26 Watercourse map, with a 100m and 500m buffer around the proposed mining permit (MP) area

Figure 27 View from the dam wall where the non-perennial watercourse is expected - now transformed by previous mining activities; dam also impound upstream flow

Figure 28 View from the dam wall where the non-perennial watercourse is expected - now transformed by previous mining activities; dam also impound upstream flow

Figure 29 View from the dam wall where the non-perennial watercourse is expected - now transformed by previous mining activities; dam also impound upstream flow

Figure 30 Berm, adjoining the dam wall, along the eastern boundary of the old mine

As mentioned previously, from the contour map (Figure 20) the proposed mining footprint is situated on a relatively gentle slope and crest (Figure 31), ending on a foot slope before a valley floor. The portion of the valley floor that contained the non-perennial watercourse, has been heavily impacted by the past mining activities (physical alterations) and also hydrologically by the upstream dam to the north-east. Surface water flowing south (upstream from the mining footprint) will mostly be impeded by the dam (Figure 32). Surface water flowing to the south-east and east will likely be diverted by the berm from entering the old mine area, into the valley and

watercourses downstream. Surface water flow will be diverted around the existing old mining infrastructure and stockpiled material. Some surface water flow will also be generated within the proposed mining footprint and old mine itself. Surface water within the old mine could accumulate locally due to depressions created by the past mining activities. Surface water could also leave the proposed- and old mining footprint and enter the watercourses downstream.

Surface water flowing from upslope of the proposed mining footprint in a south-western and western direction will likely flow through the proposed mining footprint, before flowing into the valley and watercourses downstream. It will be important to develop and implement a proper stormwater management plan, so that clean surface water be diverted around the proposed mine, 'dirty' water from the proposed mine footprint should be contained if contaminated with waste or hazardous matter and should be allowed to settle out sediments. Stormwater management will also prevent the proposed mine from impeding surface water flow to reach the downstream watercourse.

Even though the watercourses upstream from the dam are outside the zone of influence of the proposed mining permit footprint, it was used as a baseline to compare the watercourses downstream from the proposed- and old mining footprint. There was a definite active channel with riparian vegetation upstream from the dam (Figure 33).

Figure 31 Crest and slope on which the mining footprint is proposed, as viewed from the berm opposite the proposed mine

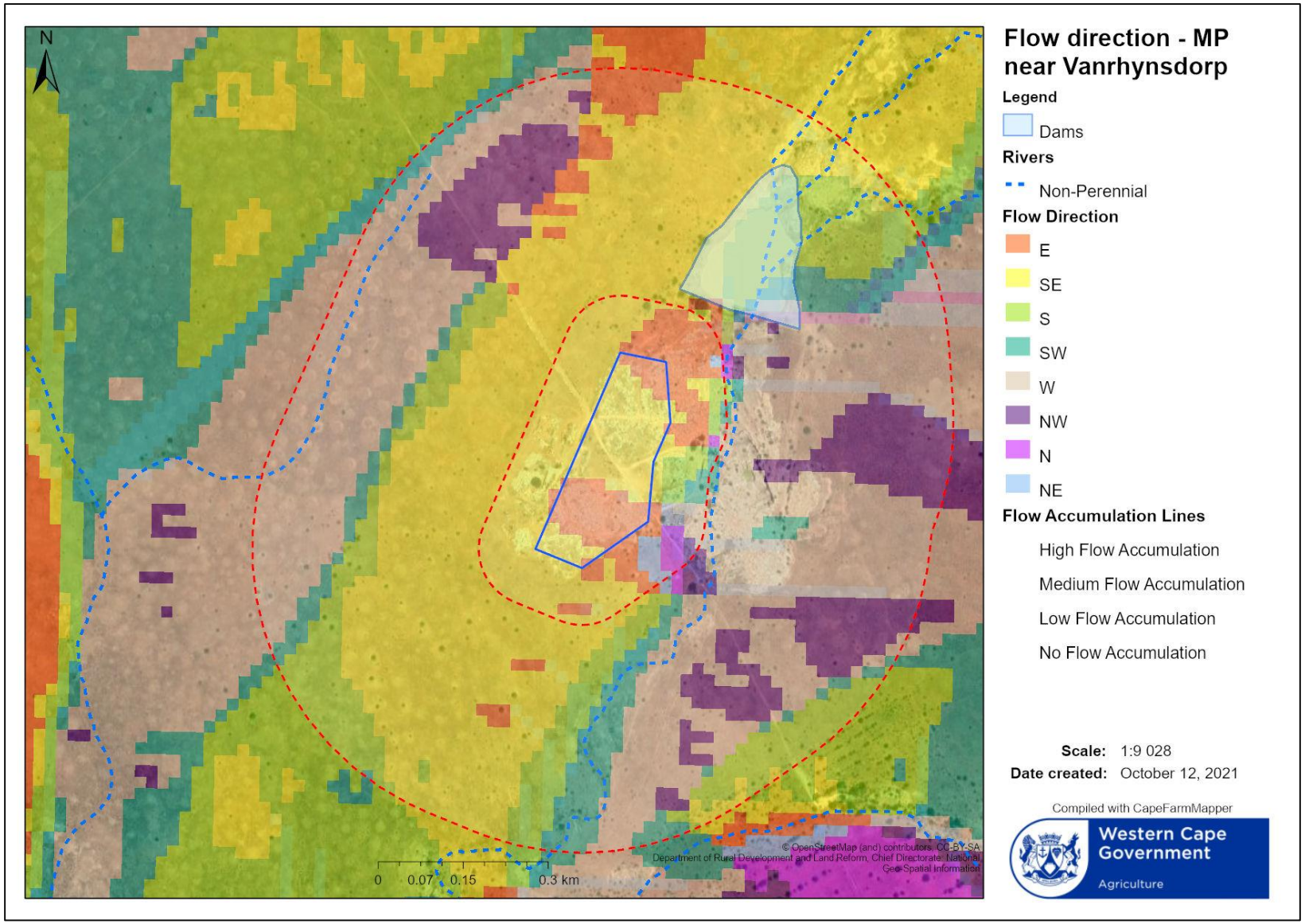

Figure 32 Surface water flow direction on the proposed mining permit (MP) footprint and surrounds, near Vanrhynsdorp

Figure 33 Riparian vegetation and active channel upstream from the dam

Figure 34 Wide area with low vegetation cover adjacent to the riparian area

Some areas with low vegetation cover are adjacent to the riparian area (Figure 34). There is a hard sealed soil surface layer in these areas. There are parts within the bare areas where silt have been deposited and are water affected, i.e. from evidence of cracking (Figure 35).

Soil sealing or capping is where the bare soil surface is sealed, rainfall cannot penetrate and runs off laterally, even on very gentle slopes (Agriculture Organization of the United Nations. Soil Resources et al., 1993). This soil sealing prevents rainfall infiltration, decreases soil moisture, increases surface run-off and erosion. Soil sealing

can be promoted by the following factors (Agriculture Organization of the United Nations. Soil Resources et al., 1993):

- The generally low organic matter contents of the soils, commonly found in areas with high temperatures;
- The heavy raindrop impact that commonly occurs during intensive rainstorms;
- Weak topsoil structure; and,
- Reduced vegetation cover that physically protect the soil.

Figure 35 Bare (low vegetation cover) area upstream from the dam where silt deposits show cracking from being water affected

The berm and soil stockpiles around the old mine show similar surface sealing than the bare soil upstream of the dam. Soil erosion features were observed on the berm and soil stockpiles (Figures 36 & 37). The inherent soil properties on the site make them prone to erosion, and this is confirmed by the features of soil capping and erosion observed on the old mine. This means vegetation clearing, soil disturbance and stored soil will require specific management measures to manage and mitigate the impacts of the proposed mine.

Figure 36 Soil capping and erosion on the berm around the old mine

Figure 37 Soil capping and erosion on the berm around the old mine

Downslope from the proposed – and old mining footprint, the valley has a gently slope with a meandering channel. The area does show signs of past disturbance from stockpiled soil and scattered marble blocks (Figure 38 & 39).

Figure 38 View of valley downslope from the proposed mining- and old mining footprint

Figure 39 View of valley downslope from the proposed mining- and old mining footprint

After being diverted around the old mine by the berm, the water flow has created a relatively narrow distinctive channel with a prominent channel and bank (Figure 40 - 43). High surface water flow is expected from the straight diversion created by the berm. Additional surface flow and sediment input is also created by the bare sealed soil with low vegetation cover which the diverted water flow pass through, closer to the south of the old mine (Figure 44). This area is likely a stockpile of the old mine.

Figure 40 Water diverted around the old mine by the berm, before it joins the valley downstream from the old mine

Figure 41 Water diverted around the old mine by the berm, before it joins the valley downstream from the old mine

Figure 42 Water diverted around the old mine by the berm, before it joins the valley downstream from the old mine

Figure 43 Water diverted around the old mine by the berm, before it joins the valley downstream from the old mine

Figure 44 Old stockpile next to the old mine. Low vegetation cover and sealed soil will likely generate additional surface water run-off and sediments

Sediment from the old mine's footprint and stockpiles are deposited in the old roads (preferential flow pathways for water and soil is also compacted and damaged by vehicles) (Figure 45) and where the slope becomes gentler the channel becomes broader with less distinct banks (Figure 46).

Figure 45 Access road below the old mine footprint

Figure 46 High sediment load deposited in the watercourse, after it has been diverted around the mine by the berm, downstream from the old mine, and just before it joins the valley's watercourse

The ephemeral watercourse below the proposed- and old mining footprint has a distinct channel and banks (Figure 47). Since the upstream dam is impounding a large part of the upstream surface water flow, the watercourse downstream from the old- and proposed mining footprint has experienced significant hydrological changes and will most likely be ephemeral in nature, only flowing in times of extreme rainfall and surface water run-off. Vegetation cover is high within the downstream ephemeral watercourse below the access road south of the old- and proposed mining footprint. Aerial imagery from 1942 indicate a more distinct active channel that is visible (Figure 48) (Department of Agriculture, Land Reform and Rural Development's National Geo-Spatial Information Department, 2021), supporting the statement that the watercourse has experienced hydrological changes from the upstream impoundment.

Watercourses in this sub-catchment has experienced significant impacts over time form the following:

- Surface water flow is impounded upstream by the artificial dam; thus changing the hydrology to reducing the water flowing downstream;
- A portion of the non-perennial watercourse is transformed by the old mine;
- Drainage is diverted around the old mine by a berm; this has also straightened the watercourse, potentially increasing the surface run-off speed and erosion potential: this is evident in eroded channel just downstream from the berm at the mine;
- Sediment deposits are increased in the channels and regulated area of the watercourse downstream of the old mine;
- Vegetated stockpiles indicate some past disturbance (topsoil disturbance or from stockpiling marble and soil within watercourses and their regulated areas) (Figure 49 & 50));

- Further physical disturbance form footpaths, dirt access roads that traverse the ephemeral watercourse (Figure 51);
- There is also another old mine downstream from the proposed- and old mine, more than 500m away from both (Figure 52);
- The stockpiling of marble on the proposed mining permit area, could have also had some local impact in surface drainage and surface texture.

Figure 47 High vegetation cover in distinct bed and banks of the valley bottom's watercourse

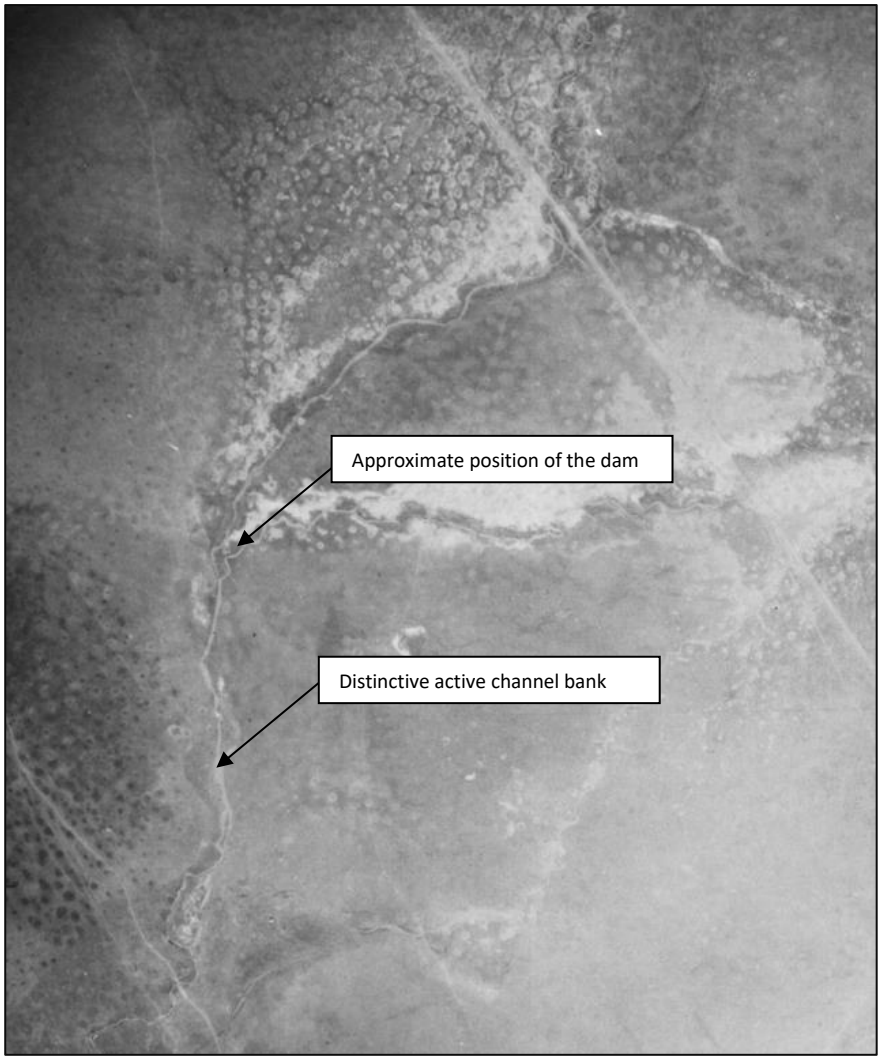

Figure 48 Aerial imagery from 1942 indicting the catchment in which the proposed mine is situated. This is before the dam was built upstream from the proposed mine.

Figure 49 High vegetation cover in distinct bed and banks of the valley bottom's watercourse, signs of past disturbance

Figure 50 Gentle slopes leading to the old- and proposed mining footprint in the background, with the valley bottom in the foreground. Soil heaps from past disturbance is also visible

Figure 51 Narrow access roads/paths traverses the watercourses and valley bottom

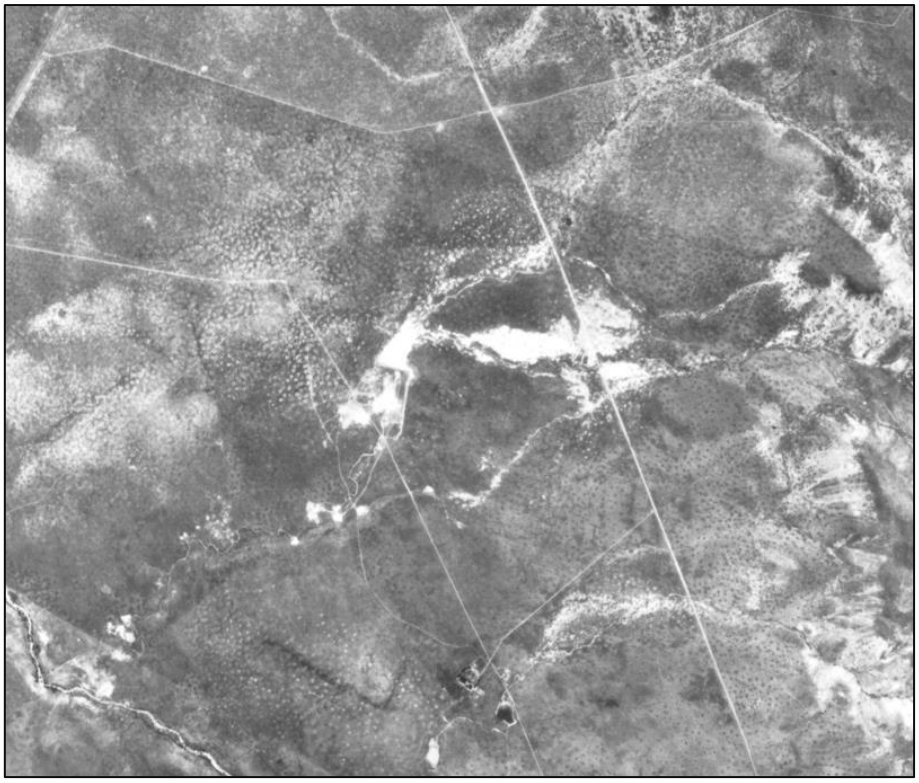

Figure 52 Aerial imagery of the proposed mining permit area and surrounds from 1976, indicating the old mine; disturbance in the watercourse and its regulated area is visible downstream from the old- and proposed mining footprint

The ephemeral watercourse channel is relatively well defined and covered in relatively high cover of vegetation. The channel varies from a narrow channel (Figure 53) to considerably wider at other sections (Figure 54). The banks show signs of disturbance or erosion (Figure 55 & 56) to more clear signs of past disturbance (Figure 57).

The ephemeral watercourse had distinctive morphology of channel beds and banks that was used for the delineation, supported by some alluvial deposits in places, as might be expected from a riparian area. Very few other riparian indicators are present according to the standard indicators i.e. distinctive riparian vegetation. The area is invaded by *Prosopis sp.* (Mesquite, classified as a category 1b alien invasive species in the Western Cape), where a concentration of Mesquite along watercourses forms the most distinguishable riparian vegetation.

Figure 53 Channel form at the foot of the slope on which the proposed mining footprint is situated

Figure 54 Wide channel with relatively high vegetation cover

Figure 55 Some slopes have collapsed or are physically disturbed along the ephemeral watercourse banks/slopes of valley downslope from the proposed mining footprint

Figure 56 Some banks indicate water flow (i.e.. erosion) or it could be due to physical disturbance

Figure 57 Relatively steep sites and narrow channel, signs that some parts of this area previously disturbed, most likely by mining

9.1. PES and EIS of watercourses

No guideline document or other local documentation exist that specifically addresses the identification and delineation of these semi-arid and often unchanneled drainage lines as riparian habitat (Grobler, 2016). International literature do described these arid or semi-arid drainage lines as sensitive landscape features as arid-region drainage line channels, especially those with sandy banks, are often very responsive to large flows and recover slowly from them because of the limited vegetation growth and the large inter-annual variability in peak discharges thus arid drainage lines display a high sensitivity to change and rarely reach a state of equilibrium (Grobler, 2016; Lichvar and Wakeley, 2004).

Riparian vegetation provides cover for terrestrial fauna for feeding, breeding and dispersal in the landscape. Drainage lines act as conduits for flood waters, delivering them to main stem rivers. As such, they should be retained in good condition to ensure water quality is not negatively affected downstream habitats (Dabrowski, 2019).

The ephemeral watercourse can be classified as having a PES of C, thus it is moderately modified. A loss and change of natural habitat, hydrology and biota have occurred, but the basic ecosystem functions are still predominantly unchanged, despite the significant impact in changes in hydrology and disturbance within the regulated area and part of the ephemeral watercourse. The scoring and motivation for PES scoring is given in the Table 5 below. The aspects affecting the PES are:

- Upstream dam;
- Paths and access roads that traverse the watercourse and its regulated area;

- Portions of the watercourse (as indicated on watercourse databases) has been heavily impacted and transformed by the old mine;
- High sediment load just downstream of the old mine; and,
- Bank erosion and past disturbance.

Table 5 PES for the ephemeral watercourse downstream from the proposed mining area.

Criteria	Score	Comments
Instream Habitat		
Water abstraction	18	Dam upstream
Flow modification	16	Presence of dirt roads and paths, flow modifications from berm & disturbances
Bed modification	7	Portion transformed by old mine, water directed around old mine; some erosion from water diversion, sedimentation from stockpiles & disturbance
Channel modification	9	Portion transformed by old mine, water directed around old mine; some erosion from water diversion, sedimentation from stockpiles & disturbance
Physico-chemsitry	5	Increased sediment load from the old mine (bare soil, stockpiles and access roads)
Inundation	0	None observed
Alien macrophages	0	None observed
Introduced aquatic fauna	0	None observed
Rubbish dumping	8	Stockpiles & marble
	72,00	
Riparian habitat		
Vegetation removal	8	Some removed by old mine & roads
Exotic vegetation	10	Some observed
Bank erosion	5	Some observed
Channel modification	9	Portion transformed by old mine, water directed around old mine; some erosion from water diversion, sedimentation from stockpiles & disturbance
Water abstraction	18	Upstream dam
Inundation	0	None observed
Flow modification	16	Presence of dirt roads and paths, flow modifications from the berm & disturbances
Physico-chemsitry	5	Increased sediment load from the old mine (bare soil, stockpiles and access roads)
	64,50	
Average:	68.25	Thus PES: C

The EIS for the ephemeral drainage line is C, thus ecologically important and sensitive on a local scale only. Biodiversity not usually sensitive to flow and habitat modifications (Table 6).

Table 6 Outcome of the rapid instream and riparian habitat ecological importance and sensitivity assessment, using a modified version of DWAF EIS tool for rivers, from Nkurenkuru Ecology and Biodiversity (2020)

Determinant	Score	Confidence	Comments
1. Rare & Endangered Species	0	2	Not specifically surveys, but unlikely from pat disturbance
2. Populations of Unique Species	0	2	Not specifically surveys, but unlikely from pat disturbance
3. Species/taxon Richness	2	3	Moderate in terms of riparian vegetation
4. Diversity of Habitat Types or Features	1	3	Low instream and riparian habitat diversity
5 Migration route/breeding and feeding site for wetland species	3	3	Potential habitat for avifauna in riparian vegetation, as well as for species dependent on riparian and ephemeral watercourse habitats
6. Sensitivity to Changes in the Natural Hydrological Regime	1	3	Ephemeral system that has been impacted by changes in hydrological regime
7. Sensitivity to Water Quality Changes	2	3	Impacted currently by sediments
8. Flood Storage, Energy Dissipation & Particulate/Element Removal	2	3	Relatively natural vegetation with potential for energy dissipation

Determinant	Score	Confidence	Comments
9. Protected Status			
10. Ecological Integrity	2	4	ESA
Total	3	4	Based on PES
Median	16		
Overall ecological sensitivity & importance	**C**		

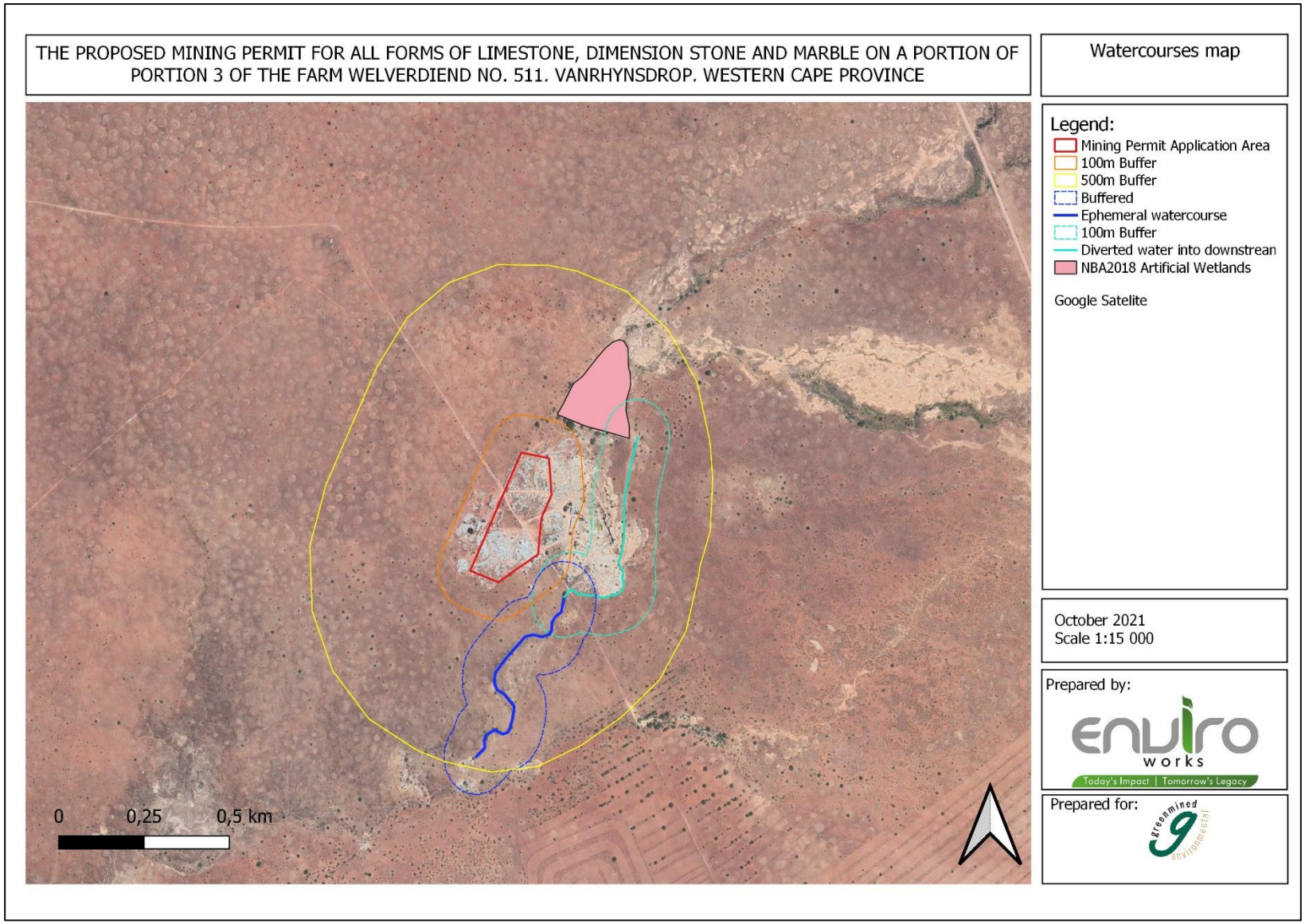

Figure 58 Watercourses delineated within 500m downstream of the proposed mining footprint

10. IMPACTS AND RISK ASSESSMENT

The following section identifies the potential impacts (both positive and negative) which the project will have on the watercourses.

Once the potential watercourse impacts are identified, they are assessed by rating their Risk after which the final Significance is calculated and rated for each identified impact.

The objective of this section is therefore firstly to identify all the potential impacts on watercourses of the project and secondly to determine the significance of the impacts and how effective the recommended mitigation measures will be able to reduce their significance.

The inherent soil properties on the site make them prone to erosion, and this is confirmed by the features of soil sealing and erosion observed on the old mine. This means vegetation clearing, soil disturbance and stored soil will require specific management measures to manage and mitigate the impacts of the proposed mine. Clearing of vegetation, disturbance of soil and creating stockpiles leaves bare soil vulnerable to soil sealing and erosion. Sealed soil will generate increased run-off with higher erosion potential downstream. This in turn can erode watercourses and increase sedimentation in the system downstream. Exposed or bare soil (and stockpiles) will also be vulnerable to erosion, this will also increase the impact of sedimentation downstream. Given the infrequency of rainfall in the area, these impacts may fortunately happen at a relatively slow rate.

The mining activities in the mining permit application areas do not fall within the regulated area according to the definition in the NWA (in the absence of a 1:100 year flood line delineation) (within 100m of a watercourse) (Figure 58) but the proposed mining will impact upon the regulated areas, which is in turn connected to the ephemeral watercourse; thus even though the proposed mining permit footprint is not directly in the regulated area of the watercourse it can impact the regulated area and consequently the watercourse. This assessment assumed that no new access roads will be created. The existing access roads on site pass though the ephemeral watercourse and its regulated area, thus if the access roads have not yet been registered for c & I water uses, it should be done now. For this reason, it is recommended that the proposed mine and associated infrastructure be registered for a c & i water use. If any activities will take place within the regulated area of the ephemeral watercourse, it should be properly assessed and licenced/registered of a c & i water use.

The potential impact of changes in water quality and quantity are also a risk of the proposed development. Since the ephemeral watercourse has a relatively high vegetation cover, water quality and sedimentation impacts are expected to be filtered by the vegetation. Significant downstream impacts on the ephemeral watercourse and Wiedou River (> 2.5 km south) are thus expected to be buffered, especially considering the arid nature of the environment.

Surface water flowing from upslope of the proposed mining footprint in a south-western and western direction will likely flow through the proposed mining footprint, before flowing into the valley and ephemeral watercourse downstream. It will be important to develop and implement a proper stormwater management plan, so that

clean surface run-off be diverted around the proposed mine, 'dirty' water from the proposed mine footprint should be contained if contaminated with waste or hazardous matter and should be allowed to settle out sediments if sediment is picked up in the disturbed mining footprint, before entering into the natural environment or the regulated area of the ephemeral watercourse. Stormwater management should also prevent the proposed mine from impeding surface water flow to reach the downstream watercourse, thus the stormwater management should aim to maintain the natural hydrological flow (quantity, timing and speed of surface water run-off) in the landscape as best as possible.

With suitable mitigation measures the impacts can be decreased, and construction- and operation activities should not have any significant impact upon the regulated area and downstream watercourses.

The following potential impacts have been identified and the aspects and activities associated with the construction and operational phase.

Potential impacts:

1. Loss of watercourses and watercourse habitat and ecological structure

Should stockpiles be situated outside the regulated area of the ephemeral watercourses (100m buffer of the ephemeral stream), this impact will not be applicable.

Table 7 Aspect and activity register for the impact: Loss of watercourses and watercourse habitat and ecological structure.

No.	Construction	Operation
1.1	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat

2. Loss of hydrological functioning and impacting water quality and sediment balance

The impacts on sediment balance, hydrological functioning and water quality are assessed together. The following aspects can lead to increased surface run-off, erosions, sediment balance and water quality and quantity.

Table 8 Aspect and activity register for the impact: Loss of hydrological functioning and impacting water quality and sediment balance.

No.	Construction	Operation
2.1	Increased run-off and erosion potential, erosion and sedimentation from: • Site clearing, removal of vegetation and earthworks in the vicinity of the watercourses and stormwater system	Increased run-off and erosion potential, erosion and sedimentation from: • Poor rehabilitation of watercourses, regulated areas or stormwater management infrastructure • Site clearing, removal of vegetation and earthworks in the vicinity of the watercourses and stormwater system
2.2	Poor stormwater management can lead to increased volume of contaminated water that needs to be manged in the footprint	Poor stormwater management can lead to increased volume of contaminated water that needs to be manged in the footprint
2.3	Poor stormwater management can lead to impact on water quality and availability as a result in ineffective dirty water	Poor stormwater management can lead to impact on water quality and availability as a result in ineffective dirty water

No.	Construction	Operation
	separation, and dirty water entering into the natural environment and watercourses	separation, and dirty water entering into the natural environment and watercourses

3. Changes to ecological and socio-cultural service provisioning

Due to the access roads to the east of the proposed mining footprint, impacts can arise from using the road, as it passes through the ephemeral watercourse and its regulated area.

Should stockpiles be situated outside the regulated area of watercourses (100m buffer of the ephemeral stream), impact no. 3.2. will not be applicable.

Table 9 Aspect and activity register for the impact: Changes to ecological and socio-cultural service provisioning.

No.	Construction	Operation
3.1	Reduced water and habitat quality due to oil and chemical leaks, waste rubble dumping, increased littering, increased sedimentation and alteration of natural hydrological regimes from using access road to the east of the proposed mining footprint	Reduced water and habitat quality due to oil and chemical leaks, waste rubble dumping, increased littering, increased sedimentation and alteration of natural hydrological regimes from using access road to the east of the proposed mining footprint
3.2	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas

Specific mitigation measures:

- Similar to the western berm around the old mine, stormwater management should be implemented at the proposed mining footprint.
- Surface run-off should be diverted around the proposed new mine and 'dirty'/contaminated water must be recycled back into the mining system
- Flow continuity and connectivity of the watercourses must be reinstated post-construction activities and operational phase.
- Regular monitoring of water quality must be implemented in order to ensure the impacts of runoff and decant of water into watercourse is prevented or minimised.
- Adequate storm water management must be incorporated into the design of the proposed development throughout all phases. In this regard, special mention is made of: Sheet runoff from cleared areas, paved surfaces, bare, disturbed- and compacted soil and access roads needs to be curtailed.
- Runoff from paved and compacted bare soil surfaces, including channelled stormwater or water should be slowed down by the strategic placement of berms or increasing surface roughness to slow down the flow of water.
- Topsoil and waste stockpiles must have berms and catchment paddocks at their toe to contain runoff of the facilities.

- Construction, development and mining activities should be excluded from the regulated area of the watercourse as much as possible.
- Compacted areas are to be ripped, re-profiled and revegetation as soon as areas becomes available.
- Any areas where active erosion are observed must be immediately rehabilitated in such a way as to ensure that the hydrology of the area is re-instated to conditions which are as natural as possible.
- Cutting/ clearing of the herbaceous layer within the watercourse along the linear development should be avoided so as to retain soil stability provided by the grass root structures.
- watercourse crossings and diversions must be inspected quarterly.
- Establish vegetation around disturbed areas to prevent any erosion.
- Stormwater runoff should be handled on surface and directed towards natural watercourses.
- Access roads for support vehicles, and vehicles used in the construction of the crossings, should not encroach into the freshwater features (this excludes existing access roads)
- Install retardation structures where water leaves the site or exits stormwater channels/bermed/diverted areas flow and into the natural watercourse/environment.
- Construct diversion drains around the site timeously prior to operation.
- Ensure adherence to GNR 704 of the NWA.
- Where the diversion re-enters the natural system, it must enter the system at the same elevation as the receiving aquatic environment as well as consist of an energy dissipation structure thereby preventing erosion and incision of the natural watercourse.
- The point where the diversion re-enters the natural watercourse must enter the system where possible at an acute angle to prevent the creation of turbulent flow, erosion and incision.
- Ensure erosion protection measures are adequately implemented and monitored.
- No construction of infrastructure may take place within watercourses and associated buffer zones unless authorisation is granted by the DWS.
- As far as possible all mining activity and infrastructure should be excluded from the watercourses and associated 100 m buffer zone.

From the impact ratings in Appendix B it can be seen that should mitigation be applied, all potential impact risks will be low but could have moderate risk should no mitigation be applied.

11. RECOMMENDATIONS

The following sections are taken from Government Notice 509 of 2016 - GENERAL AUTHORISATION IN TERMS OF SECTION 39 OF THE NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998) FOR WATER USES AS DEFINED IN SECTION 21(C) OR SECTION 21(I), IMPEDING OR DIVERTING THE FLOW OF WATER IN A WATERCOURSE (SECTION 21(C)), OR ALTERING THE BED, BANKS, COURSE OR CHARACTERISTICS OF A WATERCOURSE (SECTION 21(I)) OF

THE NATIONAL WATER ACT (ACT NO. 36 OF 1998) and are the conditions and requirements of the notice and General Authorisations for c & i water uses. Items in italic are additions by the specialist. The applicability of conditions should be confirmed with the Competent Authority.

11.1. Conditions

(1) The water user must ensure that:

(a) impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse do not detrimentally affect other water users, property, health and safety of the general public, or the resource quality;

(b) the existing hydraulic, hydrologic, geomorphic and ecological functions of the watercourse in the vicinity of the structure is maintained or improved upon;

(c) a full financial provision for the implementation of the management measures prescribed as per the General Authorisation (GN 506 of 2016), including an annual financial provision for any future maintenance, monitoring, rehabilitation, or restoration works, as may be applicable; and

(d) upon written request of the responsible authority, they implement any additional management measures or monitoring programmes that may be reasonably necessary to determine potential impacts on the water resource or management measures to address such impacts.

(2) Prior to the carrying out of any works, the water user must ensure that all persons entering on -site, including contractors and casual labourers, are made fully aware of the conditions and related management measures specified as per the General Authorisation (GN 506 of 2016).

(3) The water user must ensure that –

(a) any construction camp, storage, washing and maintenance of equipment, storage of construction materials, or chemicals, as well as any sanitation and waste management facilities –

(i) is located outside the 1 in 100 year flood line or riparian habitat of a river, spring, lake, dam or outside any drainage feeding any wetland or pan, and

(ii) is removed within 30 days after the completion of any works.

(b) The water user must ensure that the selection of a site for establishing any impeding or diverting the flow or altering the bed, banks, course or characteristics of a watercourse works:

(i) is not located on a bend in the watercourse;

(ii) avoid high gradient areas, unstable slopes, actively eroding banks, interflow zones, springs, and seeps;

(iii) avoid or minimise realignment of the course of the watercourse;

(iv) minimise the footprint of the alteration, as well as the construction footprint so as to minimise the effect on the watercourse.

(c) The water user must ensure that a maximum impact footprint around the works is established, clearly demarcated, that no vegetation is cleared or damaged beyond this demarcation, and that equipment and machinery is only operated within the delineated impact footprint.

(d) The water user must ensure that measures are implemented to minimise the duration of disturbance and the footprint of the disturbance of the beds and banks of the watercourse.

(e) The water user must ensure that measures are implemented to prevent the transfer of biota to a site, which biota is not indigenous to the environment at that site.

(f) The water user must ensure that all works, including emergency alterations or the rectification of incidents, start upstream and proceed in a downstream direction, to ensure minimal impact on the water resource.

(g) The water user must ensure that all material excavated from the bed or banks of the watercourse are stored at a clearly demarcated location until the works have been completed, upon which the excavated material must be backfilled to the locations from where it was taken (i.e. material taken from the bed must be returned to the bed, and material taken from the banks must be returned to the banks).

(h) The water user must ensure that adequate erosion control measures are implemented at and near all alterations, including at existing structures or activities with particular attention to erosion control at steep slopes and drainage lines.

(i) The water user must ensure that alterations or hardened surfaces associated with such structures or works -

(i) are structurally stable;

(ii) do not induce sedimentation, erosion or flooding;

(iii) do not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse;

(iv) do not cause a detrimental change in the quality of water in the watercourse;

(v) do not cause a detrimental change in the stability or geomorphological structure of the watercourse; and,

(vi) does not create nuisance condition, or health or safety hazards.

(j) The water user must ensure that measures are implemented at alterations, including at existing structures or activities, to –

(i) prevent detrimental changes to the breeding, nesting or feeding patterns of aquatic biota, including migratory species;

(ii) allow for the free up and downstream movement of aquatic biota, including migratory species; and

(iii) prevent a decline in the composition and diversity of the indigenous and endemic aquatic biota.

(k) The water user must ensure that no substance or material that can potentially cause pollution of the water resource is being used in works, including for emergency alterations or the rectification of reportable incidents.

(I) The water user must ensure that measures are taken to prevent increased turbidity, sedimentation and detrimental chemical changes to the composition of the water resource as a result of carrying out the works, including for emergency alterations or the rectification of reportable incidents.

(m) The water user must ensure that in- stream water quality is measured on a weekly basis during construction, including for emergency alterations or the rectification of reportable incidents, which measurement must be by taking samples, and by analysing the samples for pH, EC/TDS, TSS/Turbidity, and /or Dissolved Oxygen ("DO ") both upstream and downstream from the works – *this measure will only apply if there is sufficient flow in*

watercourses, and this is unlikely as watercourses are ephemeral. Frequency of water sampling should be confirmed with the Competent Authority.

(n) The water user must ensure that in- stream flow, both upstream and downstream from the works, is measured on an ongoing basis by means of instruments and devices certified by the South African Bureau of Standards ("SABS "), and that such measurement commences at least one week prior to the initiation of the works, including for emergency alterations or the rectification of reportable incidents – *this measure will only apply if there is sufficient flow in watercourses, and this is unlikely as watercourses are ephemeral. Frequency of water flow measurements should be confirmed with the Competent Authority.*

(o) During the carrying out of any works, the water user must take the photographs and video- recordings referred to in paragraph (p) below, on a daily basis, starting one (1) week before the commencement of any works, including for emergency structures and the rectification of reportable incidents, and continuing for one (1) month after the completion of such works (*this will be applicable to the construction and operational time. Photographs are recommended to be taken monthly during construction and quarterly during operation.*):

(p) The following videos recordings and photographs must be taken as contemplated in paragraph (o) above:

(i) one or more photographs or video -recordings of the watercourse and its banks at least 20 meters upstream from the structure;

(ii) one or more photographs or video -recordings of the watercourse and its banks at least 20 meters downstream from the structure; and

(iii) two or more photographs or video -recordings of the bed and banks at the structure, one of each taken from each opposite bank.

10.2. Rehabilitation

1. Upon completion of the construction activities related to the water use –

(a) a systematic rehabilitation programme must be undertaken to restore the watercourse to its condition prior to the commencement of the water use;

(b) all disturbed areas must be re- vegetated with indigenous vegetation suitable to the area [*if vegetation does not re-establish naturally after one growth cycle (to be determined in February – April of the year following end of construction, and/or should erosion be evident on or around the footprint)]* ; and

(c) active alien invasive plant control measures must be implemented to prevent invasion by exotic and alien vegetation within the disturbed area.

2. Following the completion of any works, and during any annual inspection to determine the need for maintenance at any impeding or diverting structure, the water user must ensure that all disturbed areas are –

(i) cleared of construction debris and other blockages;

(ii) cleared of alien invasive vegetation;

(iii) reshaped to free -draining and non -erosive contours, and

(iv) re- vegetated with indigenous and endemic vegetation suitable to the area (*if vegetation cover was present prior to construction and/or if vegetation does not re-establish naturally after one growth cycle (to be determined in February – April of the year following end of construction), and/or should erosion be evident on or around the footprint)*.

3. Upon completion of any works, the water user must ensure that the hydrological functionality and integrity of the watercourse, including its bed, banks, riparian habitat and aquatic biota is equivalent to or exceeds that what existed before commencing with the works.

10.3. Monitoring and reporting

(1) The water user must ensure the establishment and implementation of monitoring programmes to measure the impacts on the resource quality to ensure water use remains within the parameters of Section 10.1.(3)(m) to (o) and results are stored – *if any water flow during construction and operation*;

(2) Upon the written request of the responsible authority the water user must –

(a) ensure the establishment of any additional monitoring programmes; and

(b) appoint a competent person to assess the water use measurements made in terms of the General Authorisation (GN 506 of 2016) and submit the findings to the responsible authority for evaluation.

(3) The water user shall monitor and determine present day values for water resource quality before commencement of water uses in terms of section 21(c) or (i) of the Act -– *if any water flow during planning, construction and operation*.

(4) Upon completion of construction activities related to the water use, the water user must undertake an Environmental Audit annually for three years to ensure that the rehabilitation is stable, failing which, remedial action must be taken to rectify any impacts.

(5) Rehabilitation structures must be inspected regularly for the accumulation of debris, blockages, instabilities and erosion with concomitant remedial and maintenance actions.

(6) Copies of all designs, method statements, risk assessments as done according to the Risk Matrix, rehabilitation plans and any other reports required must be made available to the responsible authority when requested to do so.

10.4. Budgetary provisions

(1) The water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this General Authorisation.

(2) The Department may at any stage of the process request proof of budgetary provisions.

10.5. Registration

(1) Subject to the provisions of the General Authorisation (GN 506 of 2016), a person who uses water as contemplated in the General Authorisation (GN 506 of 2016) must submit the relevant registration forms to the responsible authority.
(2) Upon completion of registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission.
(3) On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can only then commence with the water use as contemplated in the General Authorisation (GN 506 of 2016).

10.6. Record -keeping and disclosure of information

(1) The water user must keep a record of all the documents referred to in Section 10.3 above for a minimum period of five years.
(2) The records referred to in this Section must be made available to the responsible authority upon written request.

10.7. Inspection

Any property in respect of which a water use has been registered in terms of the General Authorisation (GN 506 of 2016) is subject to inspection in accordance with the relevant provisions of the Water Act.

10.8. Compliance by the water user

(1) The responsibility for complying with the provisions of this authorisation lies with the water user.
(2) The General Authorisation (GN 506 of 2016) is subject to the Water Act, any other applicable law, and regulation.

11. CONCLUSION

The proposed mining footprint is upstream from an ephemeral watercourse, but outside the 100m regulated area. Based on impacts observed on site from and old mine (adjacent to the proposed mining area), the posed mine can potentially impact the regulated area of the watercourse, and the ephemeral watercourse that it is connected to.

Two location alternatives were provided for the proposed mine. A berm, adjoining an artificial dam wall to the north of the proposed mine, has been constructed around the eastern boundary of the old mine, and it effectively divert surface water that would have flown through the non-perennial watercourse. For this reason, choosing the preferred alternative will not differ significantly from the second alternative in terms of impacts on watercourses; as the watercourse indicates on GIS databases have been transformed by mining. Using the

preferred alternative could however provide opportunity in the future to restore the transformed watercourses and could re-establish the more natural and meandering flow path, as opposed to the more rigid and straightened path created by the berm's diversion. The second alternative was thus excluded from further assessment during the study.

The ephemeral watercourse can be classified as having a PES of C, thus it is moderately modified. A loss and change of natural habitat, hydrology and biota have occurred, but the basic ecosystem functions are still predominantly unchanged, despite the significant impact in changes in hydrology and disturbance within the regulated area and part of the ephemeral watercourse.

The EIS for the ephemeral drainage line is C, thus ecologically important and sensitive on a local scale only. Biodiversity not usually sensitive to flow and habitat modifications.

The inherent soil properties on the site make them prone to erosion, and this is confirmed by the features of soil sealing and erosion observed on the old mine. This means vegetation clearing, soil disturbance and stored soil will require specific management measures to manage and mitigate the impacts of the proposed mine. Clearing of vegetation, disturbance of soil and creating stockpiles leaves bare soil vulnerable to soil sealing and erosion. Sealed soil will generate increased run-off with higher erosion potential downstream. This in turn can erode watercourses and increase sedimentation in the system downstream. Exposed or bare soil (and stockpiles) will also be vulnerable to erosion, this will also increase the impact of sedimentation downstream. Given the infrequency of rainfall in the area, these impacts may fortunately happen at a relatively slow rate.

The mining activities in the mining permit application areas do not fall within the regulated area according to the definition in the NWA (in the absence of a 1:100 year flood line delineation) (within 100m of a watercourse) but the proposed mining will impact upon the regulated areas, which is in turn connected to the ephemeral watercourse; thus even though the proposed mining permit footprint is not directly in the regulated area of the watercourse it can impact the regulated area and consequently the watercourse. This assessment assumed that no new access roads will be created. The existing access roads on site pass though the ephemeral watercourse and its regulated area, thus if the access roads have not yet been registered for c & I water uses, it should be done now. For this reason, it is recommended that the proposed mine and associated infrastructure be registered for a c & i water use. If any activities will take place within the regulated area of the ephemeral watercourse, it should be properly assessed and licenced/registered of a c & i water use.

The potential impact of changes in water quality and quantity are also a risk of the proposed development. Since the ephemeral watercourse has a relatively high vegetation cover, water quality and sedimentation impacts are expected to be filtered by the vegetation. Significant downstream impacts on the ephemeral watercourse and Wiedou River (> 2.5 km south) are thus expected to be buffered, especially considering the arid nature of the environment.

Surface water flowing from upslope of the proposed mining footprint in a south-western and western direction will likely flow through the proposed mining footprint, before flowing into the valley and ephemeral watercourse

downstream. It will be important to develop and implement a proper stormwater management plan, so that clean surface run-off be diverted around the proposed mine, 'dirty' water from the proposed mine footprint should be contained if contaminated with waste or hazardous matter and should be allowed to settle out sediments if sediment is picked up in the disturbed mining footprint, before entering into the natural environment or the regulated area of the ephemeral watercourse. Stormwater management should also prevent the proposed mine from impeding surface water flow to reach the downstream watercourse, thus the stormwater management should aim to maintain the natural hydrological flow (quantity, timing and speed of surface water run-off) in the landscape as best as possible.

With suitable mitigation measures the impacts can be decreased, and construction- and operation activities should not have any significant impact upon the regulated area and downstream watercourses.

The impacts of the proposed mine on the regulated area of the ephemeral watercourse are considered of low significance in their mitigated state. Provided the site is well managed during the construction and operational phase, following suggested mitigation measures, the development is not considered to pose and unacceptable risk to the watercourses.

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APPENDIX A

Detail of the specialist

A.1.1. Elana Mostert CV – Environmental & Ecological Specialist

Name:	Elana
Surname:	Mostert
Highest qualification:	MSc Botany (SU)
IAIAsa registered:	No. 5631
South African Association of Botanists	No. 649
Postal address:	PO Box 1064 Private Bag x2 Century City 7446
Physical address:	Block B2 Edison Square, Ground floor c/o Century Avenue and Edison Way Century City 7441
Cell phone:	076 838 3058
E-mail:	elana@enviroworks.co.za

RELEVANT QUALIFICATIONS

- MSc Botany (SU): Specialising in Invasion Biology & Fynbos Restoration
- BSc Hons Plant Sciences- Ecology (UP)
- BSc Environmental Sciences (UP)
- Section 21 (c) and (i) Training: Roodeplaat (November 2017)
- SASS5 Aquatic Biomonitoring Training (November 2018)

WORK EXPERIENCE

- March 2016 - May 2017: Field assistant, Plant Ecologist at Department of Environmental Affairs (Oceans & Coasts)
- June 2017 - current: Environmental Consultant & Ecological Specialist at Enviroworks
- January 2019 – June 2021: Office Manager for Enviroworks, Cape Town
- July 2021 – current: Project Manager for Enviroworks (Cape Town, Bloemfontein & George)

Published popular Science article:

- Mostert, E., Gaertner, M., Hall, S., Mukundamago, M., Holmes, P. 2015. *Solving the puzzle of restoring the missing fynbos*. Quest, Volume 11, Number 3.

Publication accepted for journal publication:

- Mostert, E., *et al*., Impacts of invasive alien trees on threatened lowland vegetation types in the Cape Floristic Region, South Africa, South African Journal of Botany 108 (2017) 209–222. **DOI** https://doi.org/10.1016/j.sajb.2016.10.014
- Mostert E., et al, A multi-criterion approach for prioritizing areas in urban ecosystems for active restoration following invasive plant control, Environmental Management, 1-20, **DOI** 10.1007/s00267-018-1103-9
- Snyman, A., Mostert, E. and Ludynia, K., 2021. Sex determination of Kelp Gull *Larus dominicanus vetula* using head and bill measurements. *Ostrich*, *92*(2), pp.147-150. **DOI** https://doi.org/10.2989/00306525.2021.1887951

FRESHWATER ECOLOGICAL ASSESSMENTS

- Freshwater Impact Assessment for the Environmental Screening Process for the proposed Gromis-Nama-Aggeneis 400kV IPP integration power line, Northern Cape Province, Eskom SOC Ltd.
- Wetland delineation and DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed development of 100 erven on Erf 210 in Sutherland, Karoo Hoogland Local Municipality, Northern Cape, COGHSTA.
- Wetland delineation and DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed Zachtevlei Dam And Bulk Conveyance Infrastructure, Lady Grey, Eastern Cape, Indwe Environmental Consulting for Joe Gqabi District Municipality.
- DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed development of Erf 3976 for a mixed use development in Hartswater, Phokwane Municipality, Northern Cape, Makespace Architects.
- DWS Section 21 (c) & (i) Water Use Risk matrix for the proposed construction of a cellular telecommunications base station and associated infrastructure in Roodekrans, Gauteng, Coast to Coast Towers (Pty) Ltd.
- Wetland delineation for the proposed development of the Sarah Baartman Agricultural Hub, Eastern Cape, FemPlan.
- Wetland delineation for the proposed development of the Alfred Nzo Agricultural Hub, Eastern Cape, FemPlan.
- Wetland delineation for the proposed development of the OR Tambo Agricultural Hub, Eastern Cape, FemPlan.
- DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed expansion of a granite mine in Biesjesfontein, Springbok, Northern Cape, Greenmined.
- DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed development of new sports grounds at Waterstone College, Olifantsvlei, Gauteng, CURRO.
- Wetland delineation and DWS Section 21 (c) & (i) Water Use Risk Matrix for the 24G Application for the unlawful clearing of indigenous vegetation and construction of chicken lay houses, Molote City, North West Province, Baramakama Poultry (Pty) Ltd.
- Freshwater specialist study for the extension of a canal by 10 metres at km0.1 along Minor Road 6924, Western Cape Province, Garden Route District Municipality.
- Wetland delineation and DWS Section 21 (c) & (i) Water Use Risk Matrix for the 24G Application for the unlawful construction of a poultry farm, Belgie, Thaba 'Nchu, Free State, Country Bird Holdings.
- Freshwater Study and DWS Section 21 (c) & (i) Water Use Risk Matrix for the periodic maintenance of TR1/2, TR1/3, TR44/1, TR88/1, MR401, MR402 and DR1834, near Uniondale, Western Cape Province, Western Cape Department of Transport and Public Works.
- DWS Section 21 (c) & (i) Water Use Risk Matrix for the rehabilitation of Divisional Road 1688 from Calitzdorp (KM 1.00) to the Calitzdorp Spa Turnoff (KM 15.64), Western Cape Province, Western Cape Province, Western Cape Department of Transport and Public Works.
- Freshwater Impact Assessment and DWS Section 21 (c) & (i) Water Use Risk Matrix for the proposed construction of a water pipeline between Noenieput and Swartkop Dam, Northern Cape Province, Kalahari-East Water Users Association.
- Water Use License Requirements (Environmental Operation, Emergency & Management Plan; Monitoring Programme; Rehabilitation Plan) for the upgrade of the Caledon Bulk Sewerage pipeline along the Bath River between Caledon and Myddleton, Western Cape Province, Theewaterskloof Local Municipality.
- Freshwater Risk Assessment Statement for the Proposed Upgrades to Avondale Heights Block of Flats, 1 Avondale Terrace, Cape Town, Western Cape Province, UF Architects.
- Freshwater Assessment and DWS Section 21 (C) & (I) Risk Matrix for the Proposed Development of an Approximate Six Point Three Kilometre (6.3km) Long Pipeline Along Macassar Road, Between the Zandvliet and Macassar WWTW, Cape

Town, Western Cape Province, BVi Consulting Engineers Western Cape (Pty) Ltd on Behalf of The City of Cape Town Metropolitan Municipality.

- Aquatic- and Terrestrial Biodiversity Assessment and DWS Section 21 (C) & (I) Risk Matrix for the Proposed Rotondo Dam on Farm 1093 (Rotondo Farm) to Act as a Storage Dam for the Rotondo Walnut Operation in the Rouxville District, Free State Province, Indwe Environmental Consulting in Association with Moira Cloete Environmental Consulting (MCEC).
- PES monitoring procedure of the Orange River for the Xina Solar One thermal plant (Phase 2) and its associated infrastructure, Northern Cape Province, Abengoa Solar.

ENVIRONMENTAL REHABILITATION PLAN

- Environmental rehabilitation plan for all the areas affected by the continuous spillage of raw sewage in and around Upington, Northern Cape Province, Dawid Kruiper Local Municipality.

EXPERIENCE IN PERMITS AND LICENCING

- Flora removal permit and translocation guidelines for the periodic maintenance of National Route 2 Section 4 between Riviersonderend (km 0.0) and Swellendam (km 56.9), Western Cape Province, SANRAL.
- Flora removal permit for the re-surfacing of the Donkergat Access Road located within the Langebaan 4 Special Forces Regiment Base, Langebaan, Western Cape, Department of Public Works**.**
- Fauna and flora removal permits for the upgrading of intersections and resealing of road sections between Hotazel and Black Rock, Northern Cape, SMEC.
- Flora removal permit for the rehabilitation of Divisional Road 1688 from Calitzdorp (KM 1.00) to the Calitzdorp Spa Turnoff (KM 15.64), Western Cape Province, BVi Consulting Engineers.

ECOLOGICAL IMPACT ASSESSMENT EXPERIENCE

- Botanical Impact Assessment for the Environmental Screening Process for the proposed Gromis-Nama-Aggeneis 400kV IPP integration power line, Northern Cape Province, Eskom SOC Ltd.
- Ecological Impact Assessment for the proposed development of 100 erven on Erf 210 in Sutherland, Karoo Hoogland Local Municipality, Northern Cape, COGHSTA Northern Cape.
- Ecological Impact Assessment for the periodic maintenance of National Route 2 Section 4 between Riviersonderend (km 0.0) and Swellendam (km 56.9), Western Cape Province, SANRAL.
- Flora identification study for the re-surfacing of the Donkergat Access Road located within the Langebaan 4 Special Forces Regiment Base, Langebaan, Western Cape, Department of Public Works.
- Quarterly monitoring assessment for the rehabilitation efforts on Portion 5 of Farm 830 Doornekraal, Malmesbury, Western Cape.
- Rehabilitation feedback and framework report for the rehabilitation efforts on Portion 5 of Farm 830 Doornekraal, Malmesbury, Western Cape.
- Botanical inspection and recommendations for vegetation rehabilitation at 13 Duikerweg, Melkbosstrand, Western Cape.
- Botanical inspection along R60 selected road crossing and road widening between Worcester and Ashton, Western Cape, BVi Consulting Engineers.

- Ecological Impact Assessment for the proposed development of the Mapungubwe Visitor Interpretation Centres and Overnight Facilities, Limpopo Province, SANParks.
- Ecological Impact Assessment for the proposed upgrade of the existing R27 entrance gate to the West Coast National Park, Western Cape Province, SANParks.
- Ecological Impact Assessment for the proposed development of Erf 3976 for a mixed use development in Hartswater, Phokwane Municipality, Northern Cape, Makespace Architects.
- Ecological Impact Assessment for the proposed construction of a cellular telecommunications base station and associated infrastructure in Roodekrans, Gauteng, Coast to Coast Towers (Pty) Ltd.
- Ecological Impact Assessment for the proposed construction of six lay houses and two new production (hen) houses at Frans Dam Farm, No. 803 Portion 3 in Brandfort, Free State, Moreson Pluimvee Boerdery (Pty) Ltd.
- Ecological Impact Assessment for the 24G Application for the unlawful clearing of indigenous vegetation and construction of chicken lay houses, Molote City, North West Province, Baramakama Poultry (Pty) Ltd.
- Ecological Impact Assessment for the proposed construction of a composting facility on Farm No. 1136 Terugval Portion 1 in Brandfort, Free State, Moreson Pluimvee Boerdery (Pty) Ltd.
- Ecological Impact Assessment for the 24G Application for the unlawful construction of a poultry farm, Belgie, Thaba 'Nchu, Free State, Country Bird Holdings.
- Ecological Impact Assessment for the the periodic maintenance of TR1/2, TR1/3, TR44/1, TR88/1, MR401, MR402 and DR1834, near Uniondale, Western Cape Province, Western Cape Department of Transport and Public Works.
- Botanical Survey for the proposed 20m monopole mast and base station on Erf 455, Simon's Town, Western Cape Province, Atlas Tower (Pty) Ltd.
- Flora- and Terrestrial Biodiversity Impact Assessment for the proposed construction of a water pipeline between Noenieput and Swartkop Dam, Northern Cape Province, Kalahari-East Water Users Association.
- Ecological close-out report for the Xina Solar One thermal plant (Phase 2) and its associated infrastructure, Northern Cape Province, Abengoa Solar.

ALIEN INVASIVE SPECIES MANAGEMENT EXPERIENCE

- Preparation of a plan to control and eradicate invasive species as contemplated in Section 76 of the Act, National Environmental Management: Biodiversity Act, 2004 (Act No.10 Of 2004) (NEMBA) for Theewaterskloof Local Municipality**.**
- Baseline Biodiversity Database and Alien Management Strategy Recommendations, Drakenstein, Western Cape, Drakenstein Municipality.
- Review and presentation of Lafarge Saldanha Alien Invasive Species Management Plan, Saldanha, Western Cape Province, Lafarge South Africa.
- Alien Invasive Species Training for staff and management, Saldanha, Western Cape Province, Lafarge South Africa.
- The Alien invasive species management plan for the Roads Services of the Garden Route District Municipality, Western Cape Province, Garden Route District Municipality (Review of final plan, project management and fieldwork).

A.1.2. Statement of independence – specialist

I, Elana Mostert, **ID 9105230099085**, declare that I:

- am an Environmental Specialist at Enviroworks.
- act as an independent Environmental Specialist.
- have compiled this Impact Assessment.

- I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference.
- remuneration for services by the Proponent in relation to this proposal is not linked to approval by decision-making Authorities responsible for permitting this proposal.
- the specialist has no interest in secondary or downstream developments as a result of the outcome of this Impact Assessment Report.
- have no and will not engage in conflicting interests in the undertaking of the Activity.
- undertake to disclose to the Client and the Competent Authority any material, information that have or may have the potential to influence the decision of the Competent Authority required in terms of the Environmental Impact Assessment Regulations 2014, as amended.
- will provide the Client and Competent Authority with access to all information at my disposal, regarding this project, whether favourable or not.

Signature:

Elana Mostert

A.2. Details of the review specialist

Business name of Specialist:	Enviroworks
Specialist Name:	Elbi Bredenkamp
IAIAsa registered:	No. 3893
SACNASP Registration	Pr.Sci.Nat. 400328/11
Physical address:	Block B2, Edison Square, c/o Century Avenue and Edison Way, Century City, Western Cape
Postal address:	Suite 1064 Private Bag X2, Century City
Postal code:	7446
Telephone:	021 527 7051
E-mail:	elbi@enviroworks.co.za
Fax:	086 601 7507

A.2.1. Expertise of the review specialist

Elbi Bredenkamp is an Ecological Specialist. Her qualifications include a M.Sc. in Botany (UFS) and over 20 years' experience in the environmental field.

A.2.2. Statement of independence – specialist

I, Elbi Bredenkamp, **ID 6402130036082** , declare that I:

- am an Environmental Specialist at Enviroworks.
- act as an independent Environmental Specialist.
- have reviewed this Impact Assessment.
- I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference.

- remuneration for services by the Proponent in relation to this proposal is not linked to approval by decision-making Authorities responsible for permitting this proposal.
- the consultancy has no interest in secondary or downstream developments as a result of the outcome of this Impact Assessment Report.
- have no and will not engage in conflicting interests in the undertaking of the Activity.
- undertake to disclose to the Client and the Competent Authority any material, information that have or may have the potential to influence the decision of the Competent Authority required in terms of the Environmental Impact Assessment Regulations 2014, as amended.
- will provide the Client and Competent Authority with access to all information at my disposal, regarding this project, whether favourable or not.

Signature:

Elbi Bredenkamp

APPENDIX B

RISK ASSESSMENT KEY (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

Negative Rating

TABLE 1- SEVERITY

How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)?

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

TABLE 2 – SPATIAL SCALE

How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighboring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

TABLE 3 – DURATION

How long does the aspect impact on the resource quality?

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5
PES and EIS (sensitivity) must be considered.	

TABLE 4 – FREQUENCY OF THE ACTIVITY

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT

How often does the activity impact on the resource quality?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

TABLE 6 – LEGAL ISSUES

How is the activity governed by legislation?

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

TABLE 7 – DETECTION

How quickly/easily can the impacts/risks of the activity be observed on the resource quality, people and property?

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

TABLE 8: RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderat e Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. License required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. License required.

A low risk class must be obtained for all activities to be considered for a GA

TABLE 9: CALCULATIONS

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

DWS RISK MATRIX: MINING PERMIT ON A PORTION OF PORTION 3 OF THE FARM WELVERDIEND NO. 511

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)
NAME and REGISTRATION No. of SACNASP Professional member: Elbi Bredenkamp Pr.Sci.Nat. 400328/11)
Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.
PART 1: RISK RATINGS AND SIGNIFICANCE OF IMPACTS

					Severity																
No.	**Phases**	**Activity**	**Aspect**	**Impact**	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	PES AND EIS OF WATERCOURSE
1.1.	Construction (without mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat	1. Loss of watercourses, aquatic habitat and ecological structure	1	3	3	2	2,25	3	3	8,25	5	4	5	1	15	123,75	Moderate	95	PES- C; EIS- C
1.1.	Construction (with mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat	1. Loss of watercourses, aquatic habitat and ecological structure	1	1	1	1	1	1	1	3	1	1	5	1	8	24	Low	95	PES- C; EIS- C
1.1.	Operation (without mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat	1. Loss of watercourses, aquatic habitat and ecological structure	1	3	3	2	2,25	3	3	8,25	5	4	5	1	15	123,75	Moderate	95	PES- C; EIS- C
1.1.	Operation (with mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to loss of habitat	1. Loss of watercourses, aquatic habitat and ecological structure	1	1	1	1	1	1	1	3	1	1	5	1	8	24	Low	95	PES- C; EIS- C
2.1	Construction & Operation (without	Site clearing, removal of vegetation and earthworks in the	Increased run-off and erosion potential, erosion and sedimentatio	2. Loss of hydrological functioning and impacting water quality	1	3	3	2	2,25	3	4	9,25	5	4	5	1	15	138,75	Moderate	95	PES- C; EIS- C

	mitigation)	vicinity of the watercourses and stormwater system	n hydrological regimes from using access road to the east of the proposed mining footprint	and sediment balance																				
2.1	Construction & Operation (with mitigation)	Site clearing, removal of vegetation and earthworks in the vicinity of the watercourses and stormwater system	Increased run-off and erosion potential, erosion and sedimentation hydrological regimes from using access road to the east of the proposed mining footprint	2. Loss of hydrological functioning and impacting water quality and sediment balance	1		1		1		1		1	1	1		3		1	1	5	1		8	24	Low	95	PES- C; EIS- C
2.2	Construction & Operation (without mitigation)	Stormwater management	Poor stormwater management can lead to increased volume of contaminated water that needs to be manged in the footprint	2. Loss of hydrological functioning and impacting water quality and sediment balance	1		3		3		2		2,25	3	4		9,25		5	4	5	1		15	138,75	Moderate	95	PES- C; EIS- C
2.2	Construction & Operation (with mitigation)	Stormwater management	Poor stormwater management can lead to increased volume of contaminated water that needs to be manged in the footprint	2. Loss of hydrological functioning and impacting water quality and sediment balance	1		1		1		1		1	1	1		3		1	1	5	1		8	24	Low	95	PES- C; EIS- C
2.3	Construction & Operation (without mitigation)	Stormwater management	Poor stormwater management can lead to impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the natural environment and watercourses	2. Loss of hydrological functioning and impacting water quality and sediment balance	1		3		3		2		2,25	3	4		9,25		5	4	5	1		15	138,75	Moderate	95	PES- C; EIS- C
2.3	Construction &	Stormwater management	Poor stormwater	2. Loss of hydrological	1		1		1		1		1	1	1		3		1	1	5	1		8	24	Low	95	PES- C; EIS- C

	Operation (with mitigation)		management can lead to impact on water quality and availability as a result in ineffective dirty water separation, and dirty water entering into the natural environment and watercourses	functioning and impacting water quality and sediment balance																					
3.1	Construction (without mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas	3. Changes to ecological and socio-cultural service provisioning	1		3		3		2	2,25	3	4		9,25		5	4	5	1		15	138,75	Moderate	95	PES- C; EIS- C
3.1	Construction (with mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas	3. Changes to ecological and socio-cultural service provisioning	1		1		1		1	1	1	1		3		1	1	5	1		8	24	Low	95	PES- C; EIS- C
3.2	Operation (without mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas	3. Changes to ecological and socio-cultural service provisioning	1		3		3		2	2,25	3	4		9,25		5	4	5	1		15	138,75	Moderate	95	PES- C; EIS- C

3.2	Operation (with mitigation)	Stockpiling of soil, waste rock or mineralised material	Stockpiling of soil, waste rock or mineralised material within watercourses or their regulated areas leading to reduced functioning of watercourses or their regulated areas	3. Changes to ecological and socio-cultural service provisioning	1		1		1		1		1	1	1		3		1	1	5	1		8	24	Low	95	PES- C; EIS- C