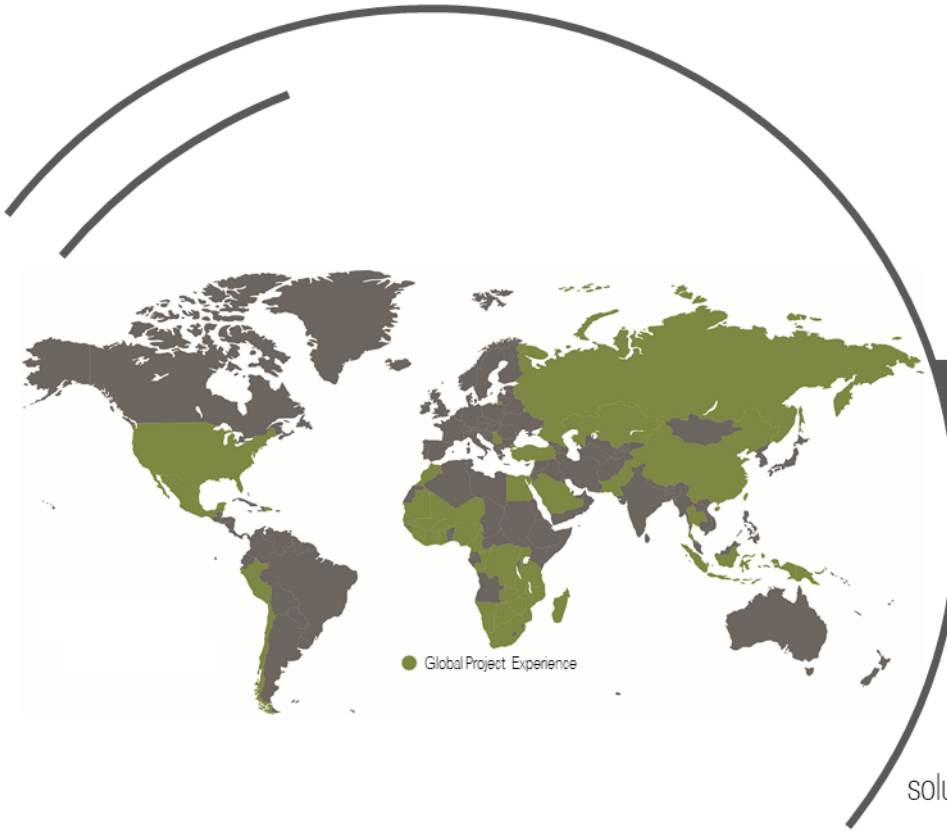

DIGBY WELLS
ENVIRONMENTAL

Your Preferred Environmental and Social Solutions Partner

Providing innovative and sustainable solutions throughout the resources sector

Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project

Rehabilitation Plan

Prepared for:
Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP)

Project Number:
SAS6986

March 2021

Digby Wells and Associates
(South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

Turnberry Office Park,
Digby Wells House.
48 Grosvenor Road,
Bryanston,2191

Phone: +27 (0) 11 789 9495
Fax: +27 (0) 11 789 9495
E-mail: info@digbywells.com
Website: www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	Rehabilitation Plan
Project Name:	Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project
Project Code:	SAS6986

Name	Responsibility	Signature	Date
Aamirah Dramat	Report Writer		March 2021
Kathryn Terblanche	Site Surveyor and Report Writer		March 2021
Danie Otto	Reviewer		March 2021

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) has been requested by Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) to undertake the regulated Basic Assessment (BA) Process to obtain an Environmental Authorisation (EA) for the construction of a pump station and associated infrastructure (i.e., pump station and pipeline through a wetland) at and from Wollie se Gat. Wollie se Gat is an old quarry located in close proximity to Sasol Synfuels Operations (SSO) and the TEP Fine Coal and Discard Facility. As part of this process, a rehabilitation plan is required.

A site assessment took place on 16 March 2021 along the proposed servitude for the pipeline as well as the surrounding area. During the site visit it was noted that the area in which the proposed pipeline and the pump station are to be located is already highly disturbed, with roads, railways and other infrastructure already in place. High infestations of Alien and Invasive Plant (AIP) species were also noted. Additionally, the pipeline route has already been cleared of vegetation in preparation for pipeline installation. This was undertaken to ensure that the machinery required to determine the presence of existing buried infrastructure could manoeuvre over the area. The machinery used to clear the vegetation has however disturbed the soil, often in a larger area than is necessary. Construction of the pump station has not yet occurred.

Soils samples were collected during the site visit to determine the baseline conditions of the soils. However, the results were not received from the laboratory and as such will be added to this report when they become available and thus included in the final BA Report for submission to the competent authority; Department of Mineral Resources and Energy (DMRE).

This rehabilitation plan provides the measures required during the construction, operational and decommissioning phases of the pipeline to reduce the impact of the pipeline and pump station. Monitoring measures have also been included.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS, ABBREVIATIONS AND DEFINITION

°C	Degree Celsius
AIP	Alien Invasive Plant
BA	Basic Assessment
CBA	Critical Biodiversity Area
Digby Wells	Digby Wells Environmental
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP	Environmental Practitioner
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
GIS	Geographic Information System
HDD	Horizontal Directional Drilling
IWUL	integrated Water Use License
Km	Kilometre
M	Metre
MBSP	Mpumalanga Biodiversity Sector Plan
Mm	Millimetre
MTPA	Mpumalanga Tourism and Parks Agency
NBA	National Biodiversity Assessment
NBF	National Biodiversity Framework
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act, 1998 (Act No. 36 of 1998)
ONA	Other Natural Area
PA	Protected Areas
SSO	Sasol Synfuels Operations
TEP	Twistdraai Export Plant

1 Introduction

Digby Wells Environmental (Digby Wells) has been requested by Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) to undertake the regulated Basic Assessment (BA) Process to obtain an Environmental Authorisation (EA) for the construction of a pump station and associated infrastructure (i.e., pump and pipeline through a wetland) at and from Wollie se Gat. Wollie se Gat is an old quarry located in close proximity to Sasol Synfuels Operations (SSO) and the TEP Fine Coal and Discard Facility. As part of this process, a rehabilitation plan is required.

1.1. Project Description

The TEP is Sasol Mining's export coal beneficiation plant and processes coal from the Twistdraai Colliery Thubelisha Shaft for the export market. This application relates to the construction of a pump station and a pipeline within a wetland and its associated 500 m buffer zone. The pump station will be constructed at Wollie se Gat, and a pipeline will connect the pump station to the cut-off trenches of the TEP Fine Coal and Discard Facility to transport dirty water to the Return Water Dam (RWD) where it will be reused as process water. The proposed project triggers activities included in Listing Notice 1 of the Environmental Impact Assessment (EIA) Regulations, 2014 (GN R983 of 04 December 2014, as amended) promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

The following activities relate to this EA Application.

1.1.1. Construction of the pump station

A drywell will be constructed approximately 10 metres (m) away from the edge of the existing quarry (Wollie se Gat). Horizontal Directional Drilling (HDD) will be used to drill a hole into the quarry which will then be used to abstract the water from the quarry. Ready mix concrete and high tensile reinforcement will be used to construct the entire structure of the drywell. Ready mix concrete will be sourced from a service provider to construct the walls of the well.

The pumps will be placed at the bottom of the well and coupled to the pipeline once the pipeline construction is completed.

1.1.2. Construction of the pipeline

The pipeline will be constructed within an already disturbed area. The pipeline will extent from the pump station in a south eastern direction towards to the solution trench at the discard dump facility which is approximately 380 m in length. The pipeline will run for 100 m through a wetland before discharging into the solution trench.

1.2. Project Location

The Project Area is located at Wollie se Gat, an artificial pan created through the excavation of a quarry located at near TEP and SSO. It falls under the jurisdiction of the Govan Mbeki Local Municipality which is located in the Gert Sibande District Municipality, Mpumalanga

Province (Figure 1-1; Figure 1-2; Figure 1-3; Table 1-1). The Project Area is approximately 4 kilometres (km) south of Secunda, 8 km south-west of Trichardt and 10 km east of Embalenhle. The Bossiespruit Dam is located directly south of the Project Area.

Table 1-1: Summary of Project Location Details

Province	Mpumalanga
District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki Local Municipality
Nearest Town	Secunda (4 km), Trichardt (8 km), Embalenhle (10 km)
GPS Co-ordinates (relative centre point of study area)	26°33'28.85"S
	29°11'38.02"E

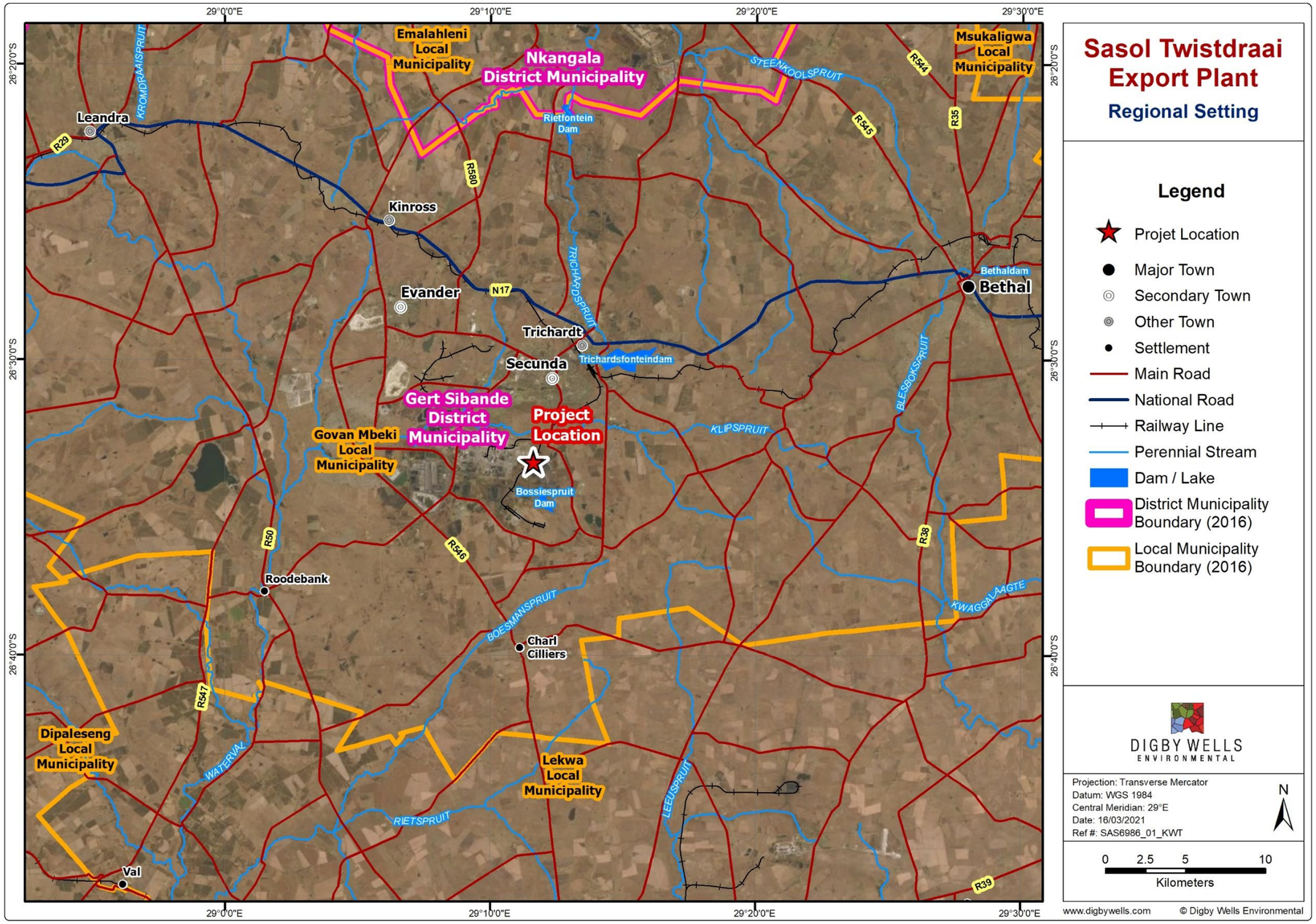

Figure 1-1: Regional Setting

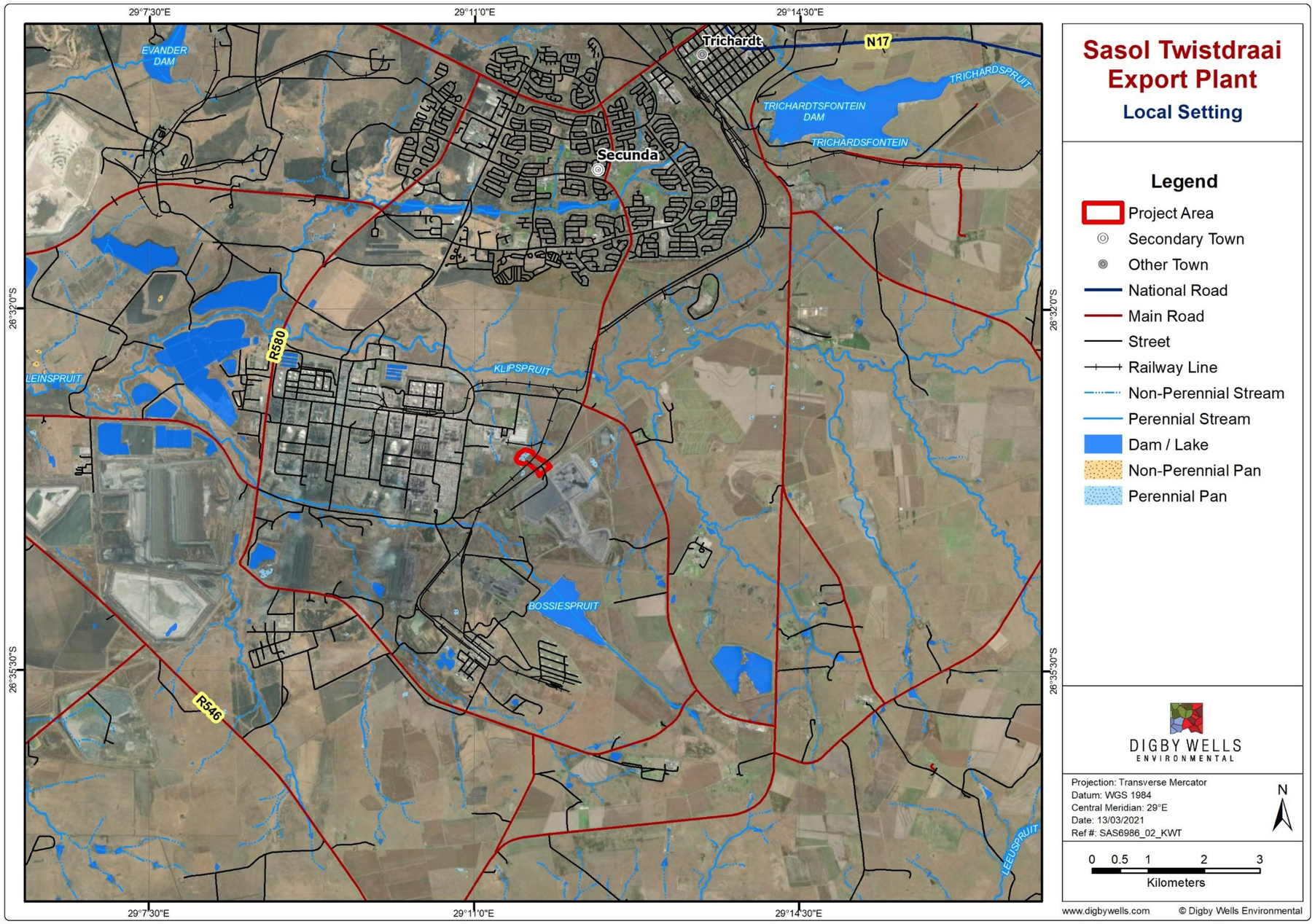

Figure 1-2: Local Setting

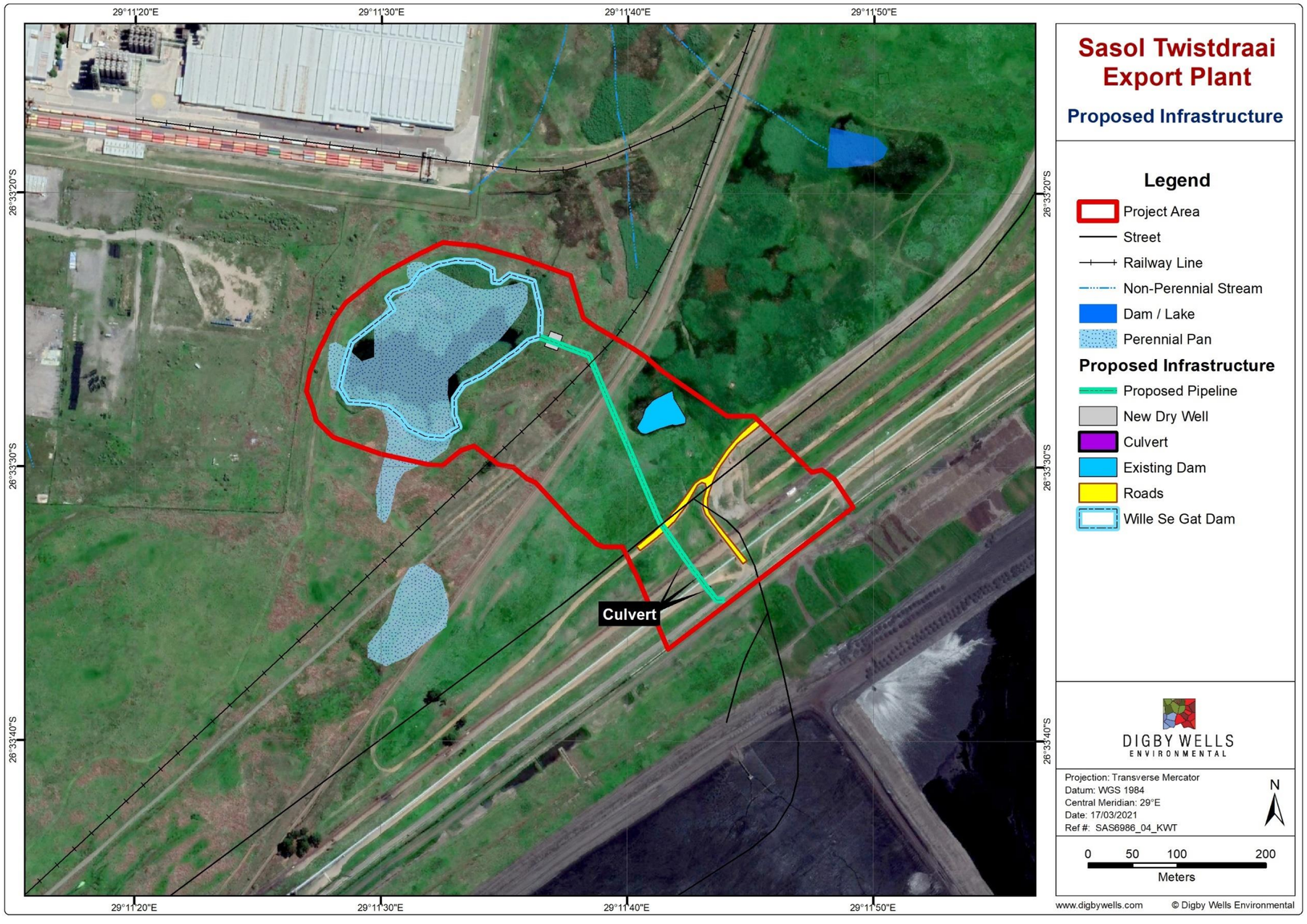

Figure 1-3: Infrastructure Layout

1.3. Terms of Reference

TEP appointed Digby Wells to compile a Rehabilitation Plan as the construction of a pump station within 500 m from a watercourse and a pipeline through a wetland will require an EA as the activity triggers Activity 19 of Listing Notice 1 of the Environmental Impact Assessment Regulations, 2014 (GN R982 of 04 December 2014, as amended) (the EIA Regulations, 2014) promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998). The Rehabilitation Plan will provide mitigation and rehabilitation measures (including opportunities and constraints) to improve, manage and mitigate impacts on the freshwater and wetland ecology of the area.

1.4. Assumptions and Limitations

The following key assumptions and limitations apply to this Rehabilitation Plan:

- The Rehabilitation Plan is based on the documents provided by TEP and contractor and supplemented by site specific information obtained during a site visit. It is assumed that these are accurate:
- If there is a significant change or addition of other infrastructure the rehabilitation plan will need to be updated to cater for this change;
- The recommendations contained within this report exclude any comments or issues raised by stakeholders and/or Interested and Affected Parties (I&APs); and
- This report must be considered as a dynamic document and will be updated as information becomes available and monitoring and rehabilitation progresses.

2. Details of the Specialist

The following is a list of Digby Wells' staff who was involved in the Rehabilitation Plan:

- **Danie Otto** manages the South African Operations and Technical Services at Digby Wells. He holds an M.Sc. in Environmental Management with B.Sc. Hons (Limnology & Geomorphology, and GIS & Environmental Management) and B.Sc. (Botany and Geography & Environmental Management). He is a biogeomorphologist that specialises in ecology of wetlands and rehabilitation. He has been a registered Professional Natural Scientist since 2002. Danie has 25 years of experience in the mining industry in environmental and specialist assessments, management plans, audits, rehabilitation, and research. He has experience in 8 countries and his experience is in the environmental sector of coal, gold, platinum (PGMs), diamonds, asbestos, rock, clay & sand quarries, copper, phosphate, andalusite, base metals, heavy minerals (titanium), uranium, pyrophyllite, chrome, nickel etc. He has wetland and geomorphology working experience across Africa including specialist environmental input into various water resource related studies. These vary from studies of the wetlands of the Kruger National Park to swamp forests in central Africa to alpine systems in Lesotho.

- **Kathryn Terblanche** is the Rehabilitation and Soils Manager at Digby Wells. She received a Bachelor of Science in Ecology and Environmental Science and an Honours degree in Environmental Management from the University of Cape Town. She also has received her M.Sc. in Restoration Ecology through the University of KwaZulu-Natal. Kathryn is an ecologist with fields of interest in wetlands, flora, restoration and rehabilitation. In her 7 year career she has undertaken various wetland delineations and assessments, flora assessments, rehabilitation assessments and audits, as well as project management of various implementation projects. She has also worked extensively with alien invasive species removal programmes, ecological restoration projects and sustainable development programmes within the Government Sector. She has published a variety of environmental documents/articles and presented at various South African and international conferences.
- **Aamirah Dramat** is an Assistant Rehabilitation Consultant in the Rehabilitation, Closure and Soils Department at Digby Wells. She received her Bachelor of Science Degree in Applied Biology and Environmental and Geographical Science (EGS) as well as her Honours Degree in Biological Sciences from the University of Cape Town. She joined Digby Wells in 2020 as a Rehabilitation Intern and has since gained experience in the environmental services sector with specialised focus in Soils, Wetlands and Rehabilitation, both locally and internationally. She has been involved in the report compilation and undertaking of Baseline Assessments, Environmental Impact Assessments (EIAs), Rehabilitation and Closure Plans (RCPs), Rehabilitation Strategy and Implementation Plans (RSIPs), Alien Invasive Plant (AIP) Assessments, Rehabilitation Audits, Re-vegetation Trial Studies and Monitoring Assessments. Aamirah is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.

3. Methodology

This section provides the methodology used in the compilation of the Rehabilitation Plan. A detailed methodology is described in Appendix A and is summarized in Figure 3-1 below.

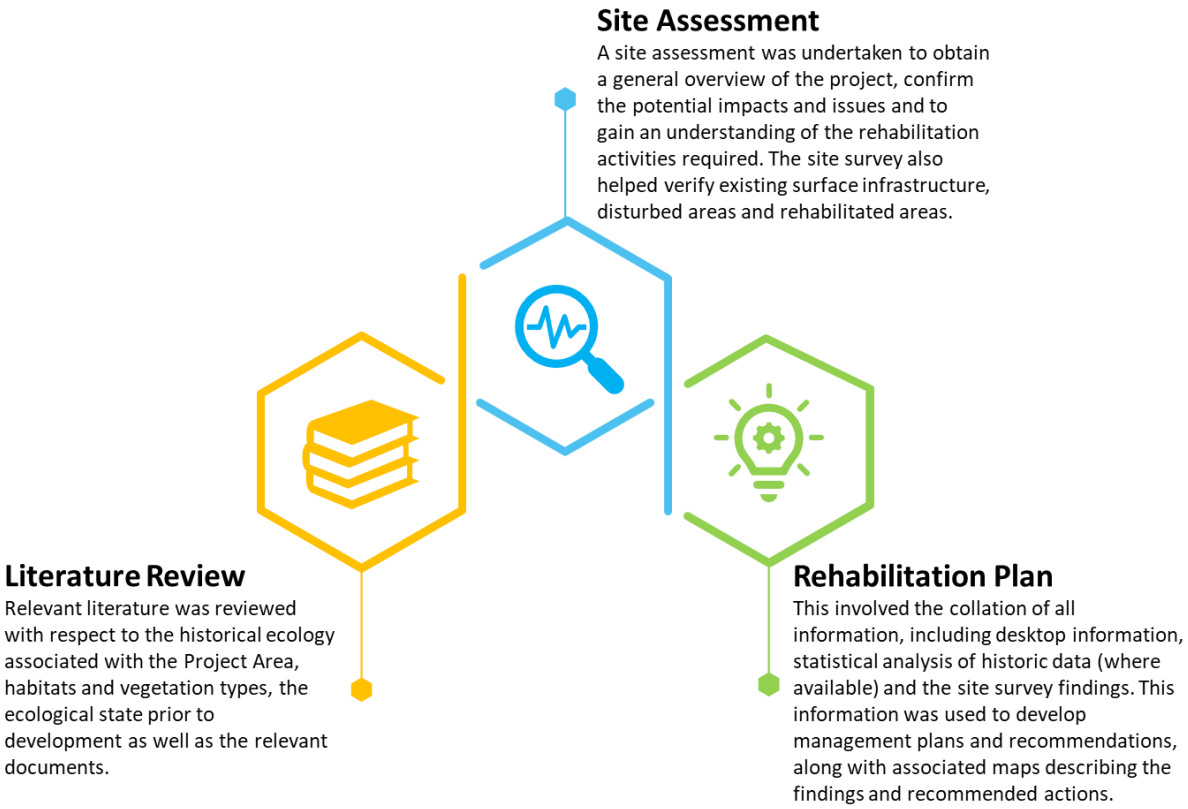

Figure 3-1: Rehabilitation Plan Methodology

4. Baseline Environment

The baseline environment of the area prior to disturbance is indicated in Table 4-1.

Table 4-1: Baseline Environment of the Project Area

Bioregional Context (Darwell, Smith, Tweddle, & Skelton, 2009)		**Plant Species Characteristic of the Soweto Highveld Grasslands** (Mucina & Rutherford, 2012) **(**Error! Not a valid result for table.**)**	
Level 1 Ecoregion	Highveld	Graminoid	*Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, E. chloromelas, E. curvula, E. plana, E. planiculmis, E. racemosa, E. superba, E. micrantha, Heteropogon contortus, Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.*
Freshwater Ecoregion	Southern Temperate Highveld	Tall, Low and Succulent Shrubs	*Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
WMA	Vaal	Woody, Succulent and Herbaceous Climbers	*Haemanthus humilis subsp. hirsutus, H. montanus.*
Sub-WMA	Upper Vaal	Climber	*Rhynchosia totta.*
Quaternary Catchment	C12D	Herbs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*
Watercourse	Bossiespruit and Klipspruit.	Status	Endangered.

Characteristics of the Highveld Ecoregion (Kleynhans, Thirion, & Moolman, 2005)		**Mpumalanga Biodiversity Sector Plan** (MTPA, 2014) **(Figure 4 2)**	
Terrain Morphology	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.	The Project Area is predominantly classified as **Other Natural Areas** with minor areas classified as **Moderately Modified – Old Lands** and **Heavily Modified.**	
Vegetation Types	Mixed Bushveld (limited); Rocky Highveld Grassland; Dry Sandy Highveld Grassland; Dry Clay Highveld Grassland; Moist Cool Highveld Grassland; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).	**National Freshwater Ecosystem Priority Area (NFEPA) Wetland and River Freshwater Ecosystem Priority Area (FEPA) Classification (Nel, et al., 2011) (Figure 4 3 and Figure 4 4)**	
Altitude (m.a.m.s.l.)	1 100-2 100, 2 100-2 300 (very limited)	NFEPA Wetlands	The Project Area comprises of a **Depression (Rank 5) NFEPA Wetland**.
Mean Annual Precipitation (MAP) (mm)	400 to 1 000	River FEPA	The entire Project Area is classified as an **Upstream Management Area**.

Rainfall Seasonality	Early to late summer	**Mining and Biodiversity Guideline Category (DEA, 2013) (Figure 4 5)**
Mean Annual Temp. (°C)	12 to 20	The Project Area is predominantly classified as **D: Moderate Biodiversity Importance – Moderate Risk for Mining**.
National Biodiversity Assessment (NBA) (SANBI, 2018) **(Figure 4-6)**		**Protected Areas** (SAPAD, 2020) **(Figure 4-7)**
A **Least Concern** Wetland Ecosystem is located to the north of the Project Area. It is **Poorly Protected** according to the Wetland Ecosystem Protection Level.		No Protected Areas are located within or nearby the Project Area.

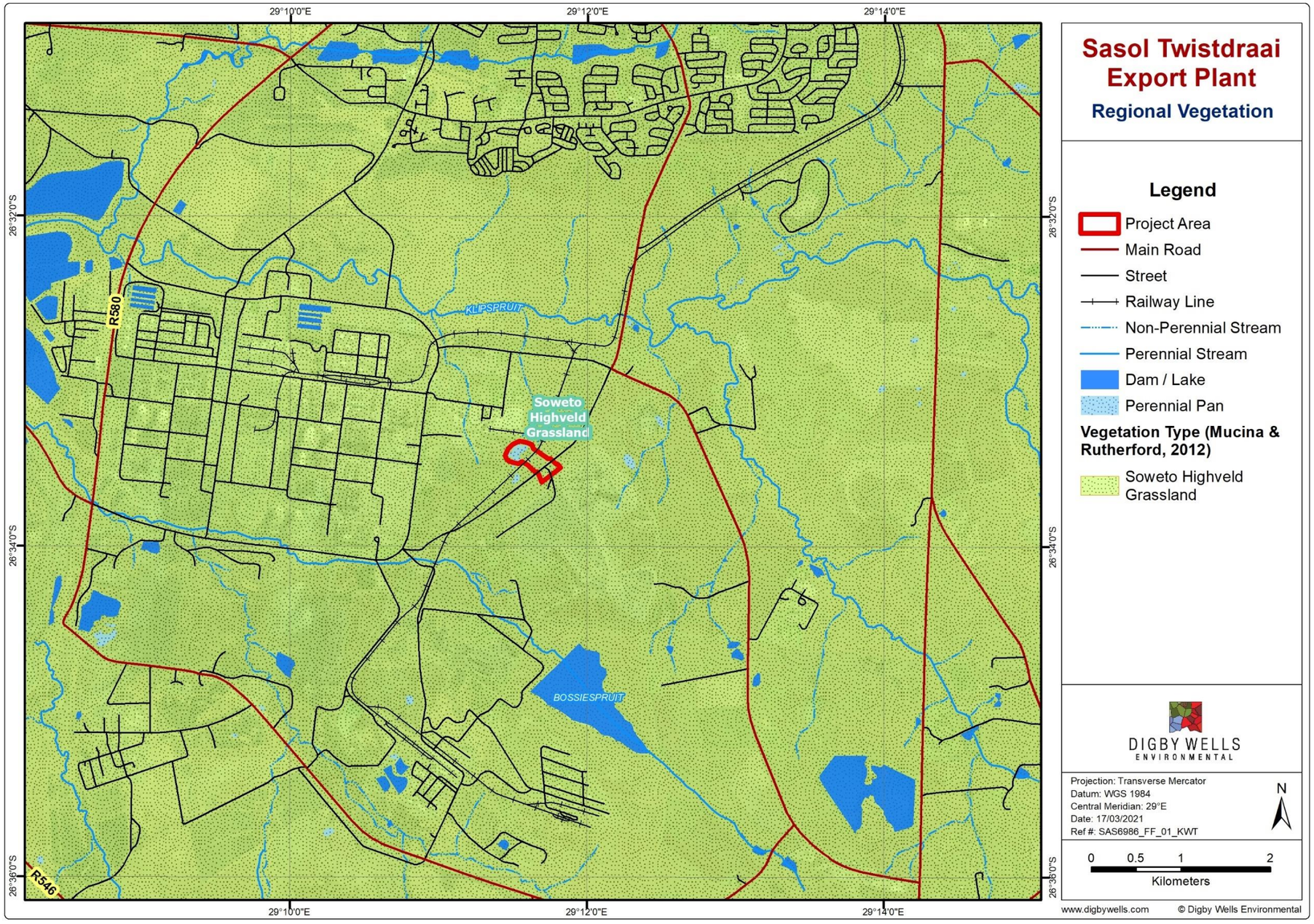

Figure 4-1: Regional Vegetation

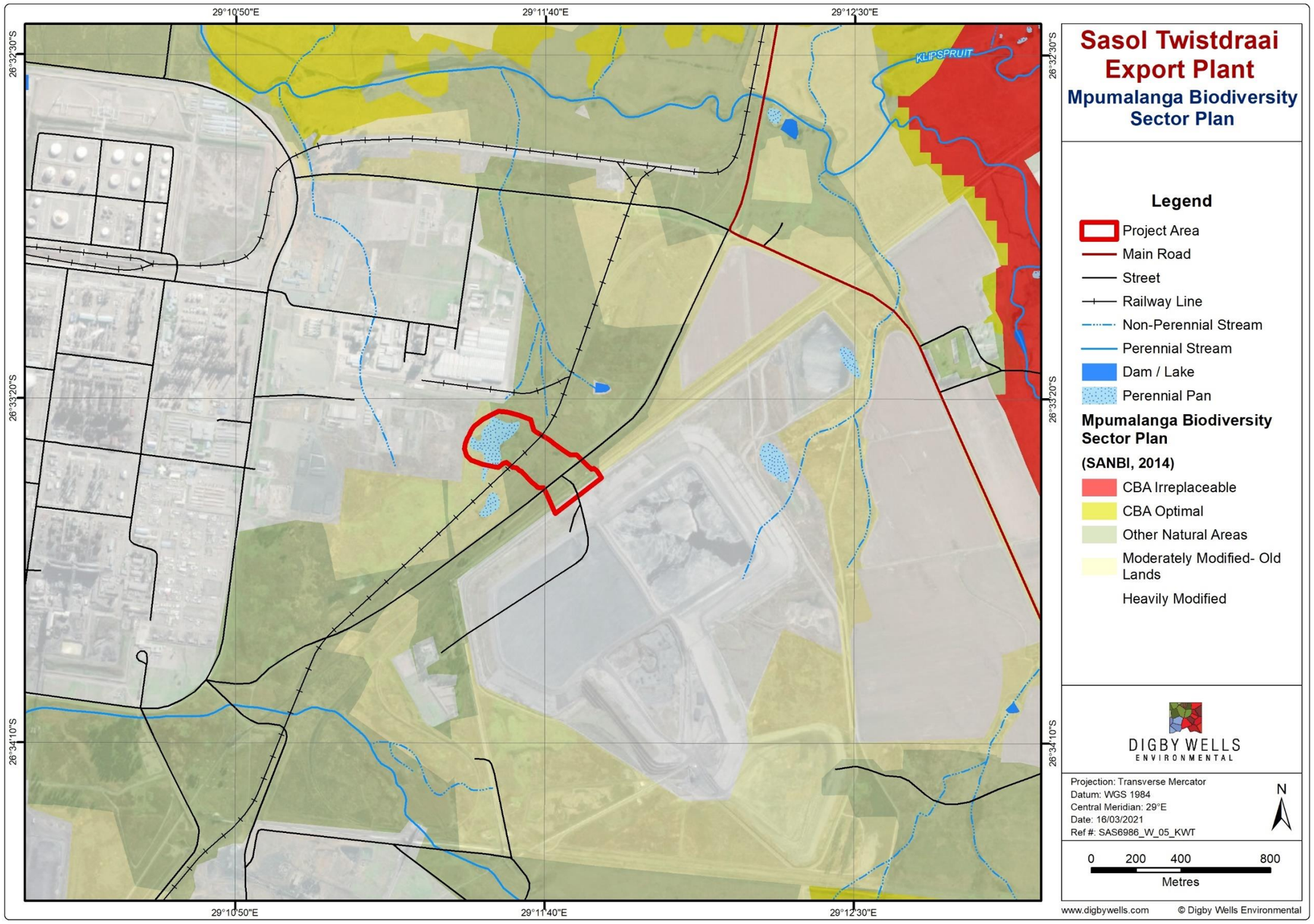

Figure 4-2: Mpumalanga Biodiversity Sector Plan

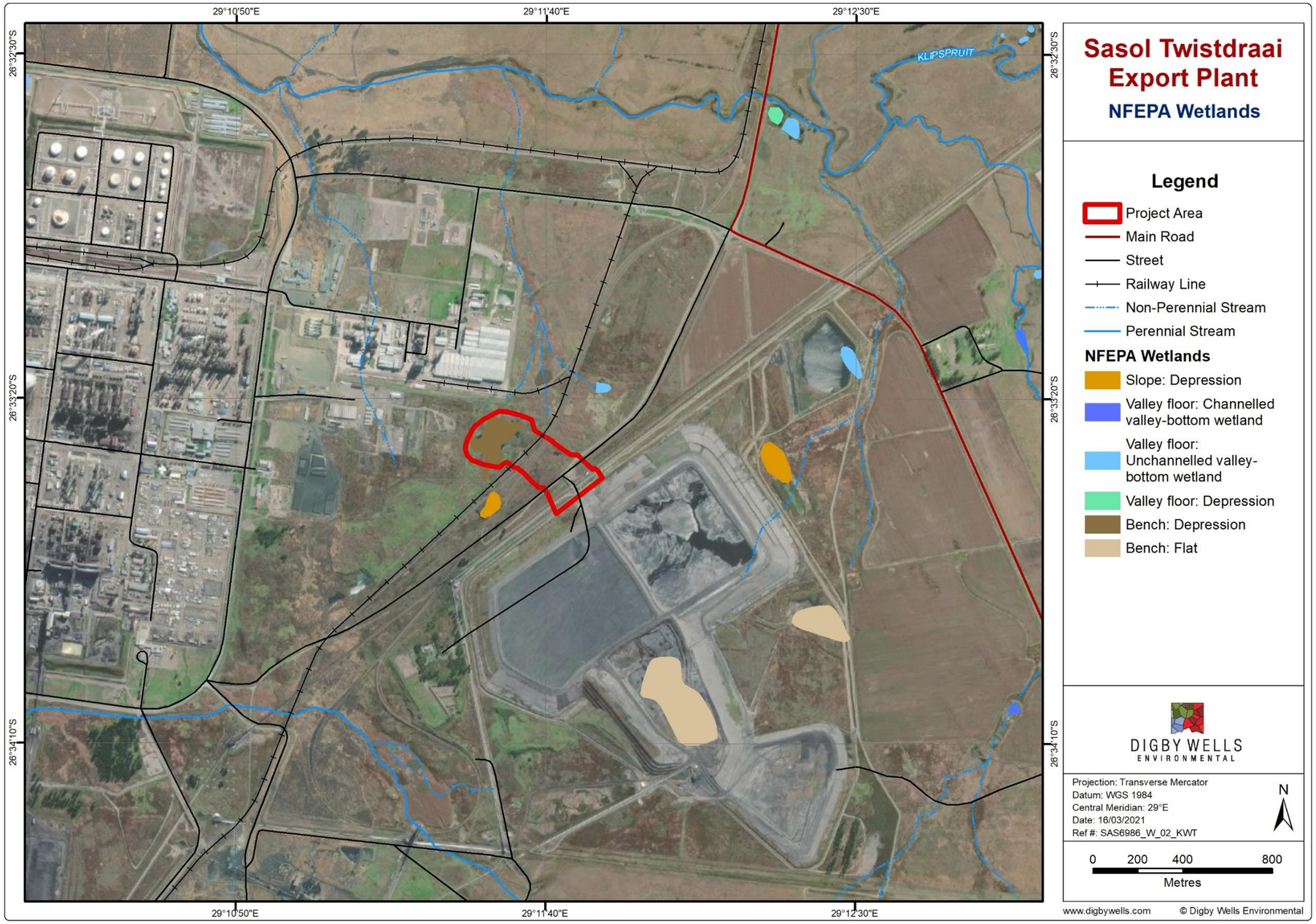

Figure 4-3: NFEPA Wetlands

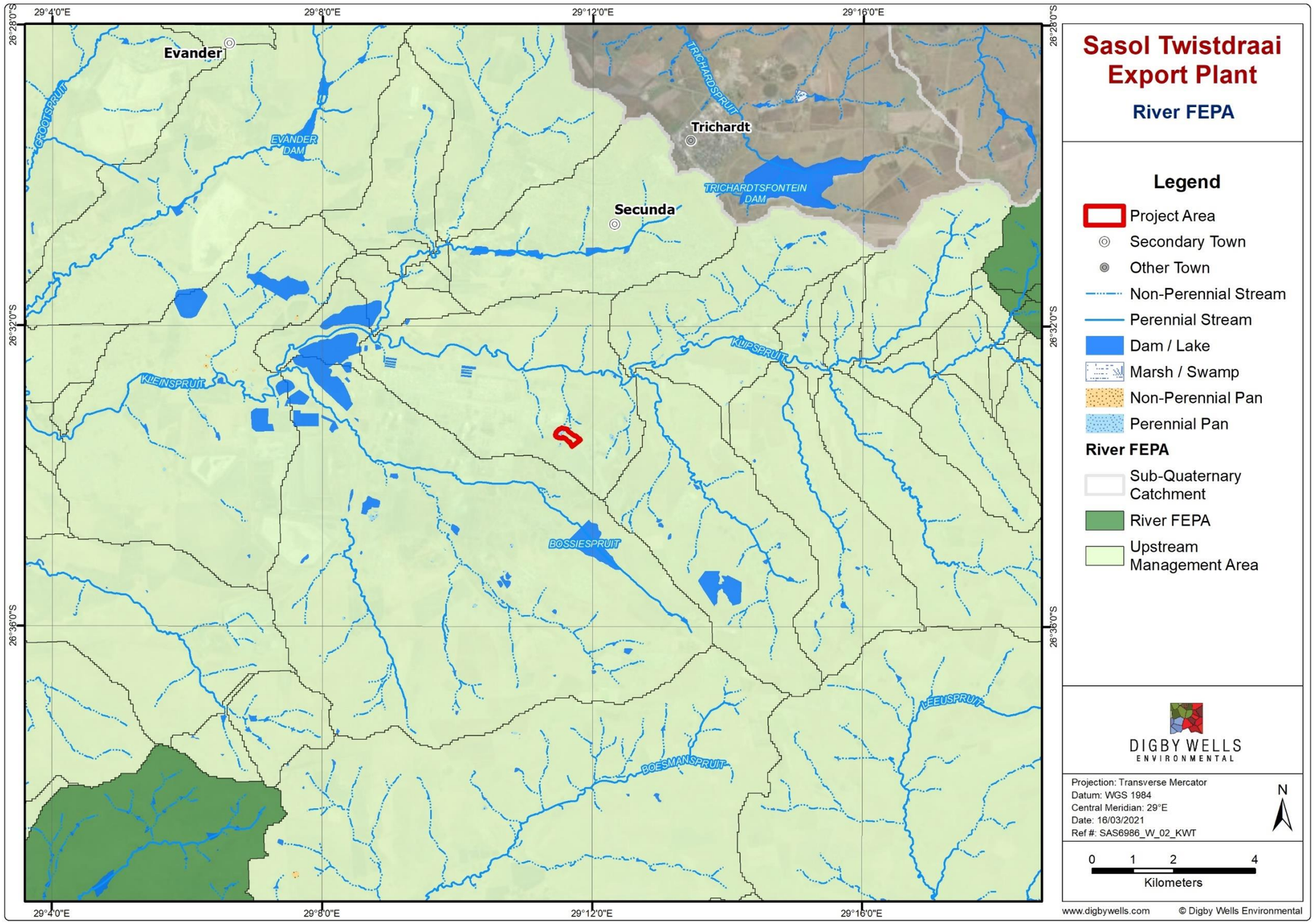

Figure 4-4: River FEPA

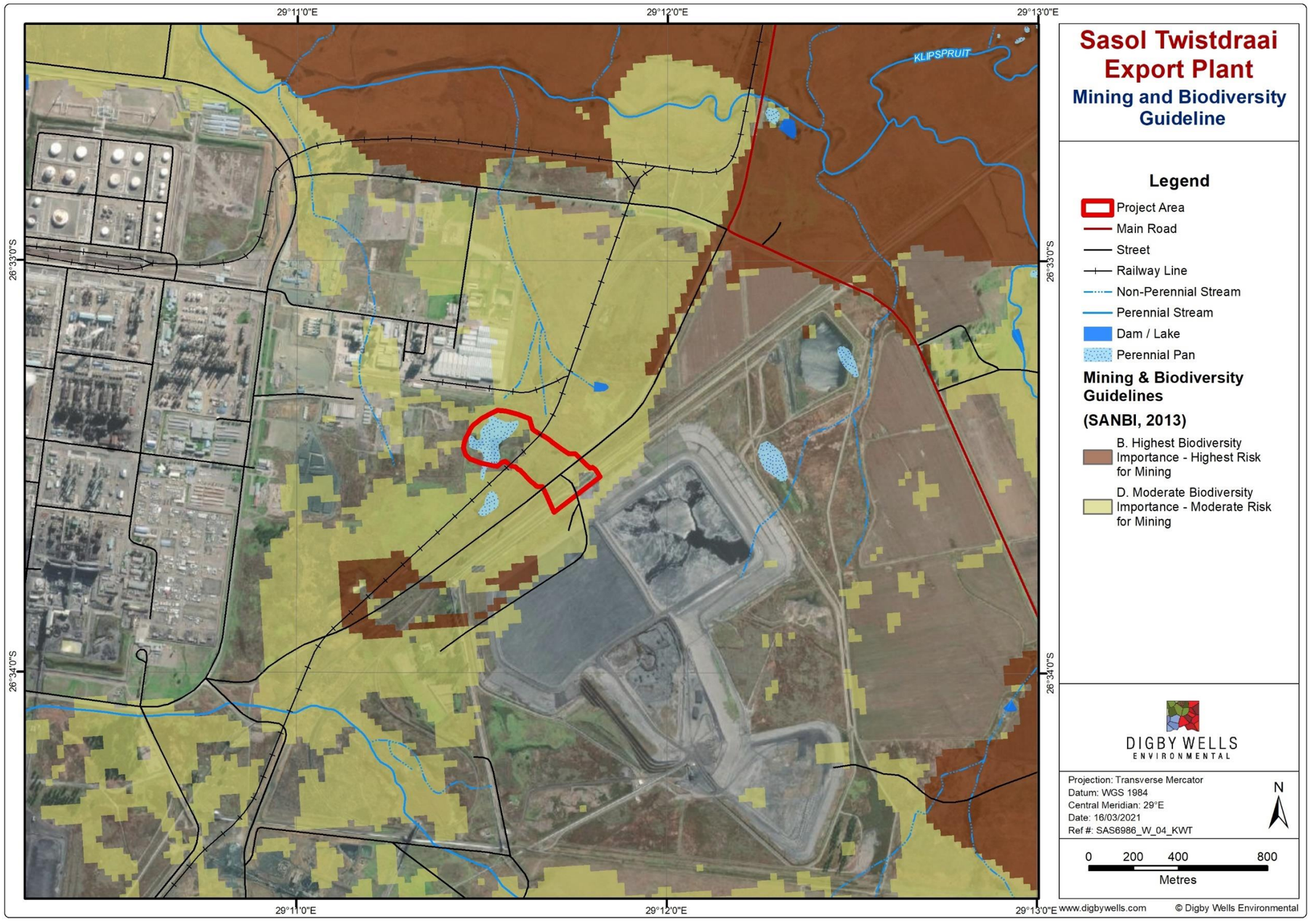

Figure 4-5: Mining and Biodiversity Guidelines

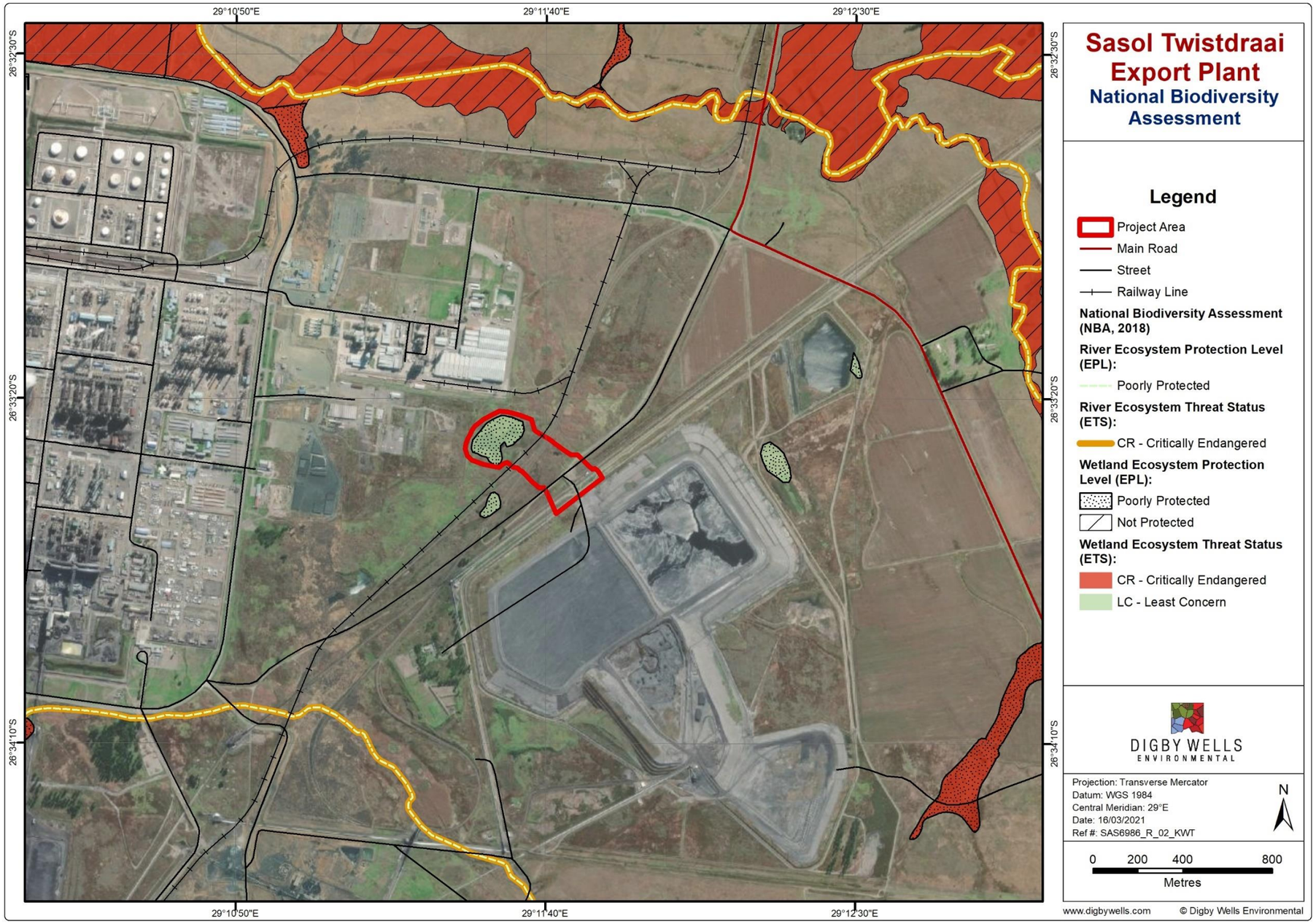

Figure 4-6: National Biodiversity Assessment

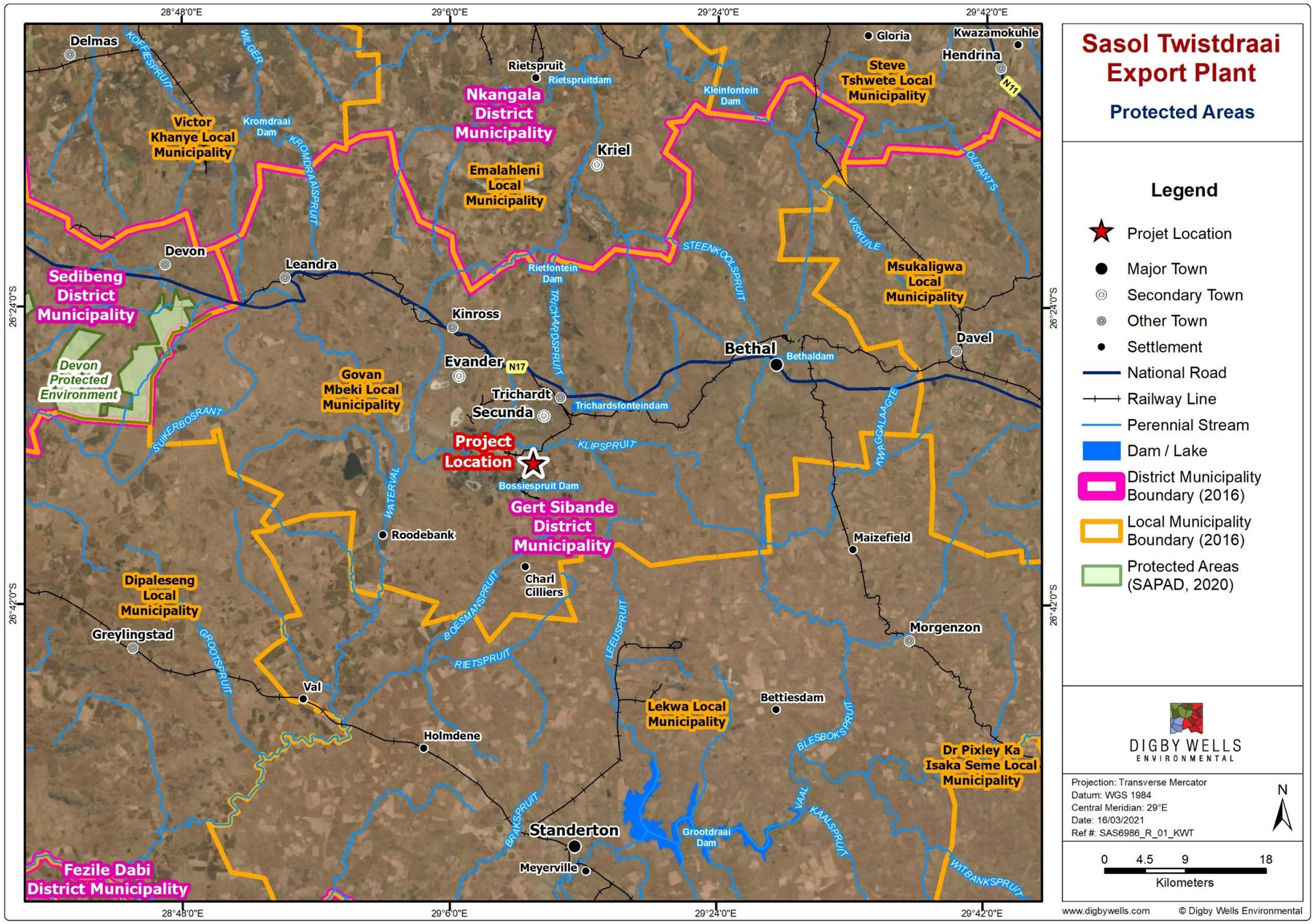

Figure 4-7: Protected Areas

5. Rehabilitation Assessment Findings

The current conditions of the Project Area, which was assessed during the survey on 16 March 2021, are illustrated in

Figure 5-1 below. During the site visit it was noted that the area in which the proposed pipeline and the pump station are to be located is already highly disturbed, with roads, railways and other infrastructure already in place. High infestations of Alien Invasive Plant (AIP) species were also noted. Additionally, the pipeline route has already been cleared of vegetation in preparation for pipeline installation. This was undertaken to ensure that the machinery required to determine the presence of existing buried infrastructure could manoeuvre over the area. The machinery used to clear the vegetation has however disturbed the soil, often in a larger area than is necessary. Construction of the pump station has not yet occurred.

	
Cleared Pipeline Route	Cleared Pipeline Route
	
Disturbed Soil Due To Vegetation Clearing	Disturbed Area

Figure 5-1: Current Conditions

	
Prescence of *Bovidae* species	Possible Serval Sign

Figure 5-2: Evidence of Animal Activity

6. Mitigation and Rehabilitation Measures

The following mitigation and rehabilitation measures are related to the construction of a pump station within 500 m from a watercourse and a pipeline through the wetland. A detailed guide is provided in Appendix B.

6.1. Construction Phase

The following mitigation and rehabilitation measures are recommended during the Construction Phase:

- Construct infrastructure during the dry season where practically possible to reduce impacts on the watercourse and the watercourses downstream;
- Construction activities should commence up-stream and proceed downstream to ensure recovery processes can begin without further disturbance from upstream works;
- Minimise habitat disturbance during construction. Indiscriminate use of machinery within the instream and riparian habitat must be avoided;
- Rehabilitation activities must not result in the siltation of the watercourse. Implement erosion and siltation measures;
- Remove construction waste at the end of construction;
- Remove all left over construction materials within one month after construction has been completed;
- Once the pipeline is installed and the pump station constructed the following must take place:
    - Shape the areas around the pipeline and pumpstation to be free-draining, if practicably possible, and to emulate the surrounding surface topography. Rip the footprint area. Due to the vertic nature of the soils the following should be undertaken;
        - Only rip at the end of the wet season/beginning of the dry season to prevent breakdown of soil aggregates;
        - Do not rip in the wet season as this will cause damage to the soil;
        - Rip to at least 400 mm to prevent deep compaction and therefore waterlogging of newly vegetated areas; and
        - Re-vegetate the area as soon as ripping has occurred to prevent soils from being exposed for long periods. The vertic soils are highly susceptible to erosion.
- Establish vegetation to stabilise the area, reduce erosion and enhance natural succession as per Section 6.4.1; and

- Continually remove and manage AIPs until natural vegetation has established, as per Section 6.4.2.

6.2. Operational Phase

The following mitigation and rehabilitation measures are recommended during the Operational Phase:

- Regularly monitor pipeline to ensure that there are no leakages;
- Continual monitoring as per (Table 6-5);
- Existing vegetation composition must be maintained or improved;
- Annually remove AIPs;
- Undertake an annual habitat assessment study for three years during the operational phase to ensure rehabilitation post-construction is stable, failing which remedial action must be taken to rectify impacts.

6.3. Decommissioning, Rehabilitation and Closure Phase

The following mitigation and rehabilitation measures are recommended for the Pump Station and Pipeline:

- Remove pump station.
- Discard unusable items at the appropriate licenced waste disposal facility;
- Remove all pipelines and any concrete;
- Keep disturbance footprint to a minimum;
- Avoid removing/damaging indigenous plant species in the vicinity of the pump station;
- Avoid disturbing indigenous fauna in the vicinity of the pumpstation as there is evidence that this area is inhabited by wildlife (Figure 5-2);
- Test soil for contamination. If contamination is discovered, this must be removed and disposed of in an appropriate, licenced waste disposal facility;
- Reprofile the road area to emulate the surrounding wetland area, to ensure that water is not impeded and the flow resumes a natural pattern (restrict and ensure no additional disturbance to the original and surrounding wetland surface or substrate);
- Rip the footprint area. Due to the vertic nature of the soils the following should be undertaken:
    - Only rip at the end of the wet season/ beginning of the dry season to prevent breakdown of soil aggregates;
    - Do not till/rip in the wet season as this will cause damage to the soil;

- Rip to at least 400 mm to prevent deep compaction and therefore waterlogging of newly vegetated areas; and
- Revegetate the area as soon as ripping has occurred to prevent soils from being exposed for long periods. The vertic soils are highly susceptible to erosion.

- Ameliorate soil through addition of fertiliser and lime, if required. This will be determined through soil fertility testing once the rehabilitated footprint has been ripped;
- Establish vegetation to stabilise the area, reduce erosion and enhance natural succession as per Section 6.4.1. Although it is expected that the existing *Phragmites sp*. and *Typha sp*. will spread and colonise the newly rehabilitated area, it is important to seed the area to promote stabilisation and reduce the possibility of weed infestation, erosion and/or associated sedimentation of the wetland system both in the immediate surrounds or further downstream; and
- Remove and manage AIPs until natural vegetation has established, as per Section 6.4.2.

6.4. Vegetation Management Plan

6.4.1. Plant Species Plan

Suitable species for the area are suggested in Table 6-1. Species suitability is based on the vegetation types and the characteristics of the species such as ecological succession, speed of growth and availability of seeds/plants.

A combination of species with varying characteristics are proposed to enhance biodiversity and functional diversity. This suite of species has a mix of:

- Pioneer and climax species to enhance ecological succession within the Soweto Highveld Grassland;
- Fast-growing species to ensure that bare areas are covered quickly;
- Stoloniferous/rhizomatous species have been selected as part of the species mix. These species have the ability to stabilise the areas they are grown in and are, by their nature, considered to be rehabilitation grasses and are easily available and fast-growing; and
- The Soweto Highveld Grassland is an endangered vegetation type in South Africa and therefore it is important to conserve and rehabilitate disturbed areas with species found within that vegetation type. Some of these species won't be as easily available, however, they are available at some nurseries within the region and should be seeded/planted.

Table 6-1: Suggested Species Mix

Species Name	Common Name	Characteristics	Succession	Availability	Comments	Kg/ha
Chloris gayana	Rhodes Grass	A stoloniferous soil stabiliser.	Sub-climax	Easily available	All types of soil, including wet areas.	5
Cynodon dactylon	Couch Grass	A short, mat-forming grass acting as a soil stabiliser.	Pioneer	Easily available	All types of soil, including wet areas.	5
Digitaria eriantha	Common Finger Grass	A stoloniferous soil stabiliser.	Climax	Easily available	Most types of soil, wet areas.	5
Imperata cylindrica	Cottonwool Grass	A fast-growing, creeping grass acting as a soil stabiliser.	Pioneer	Rhizome cuttings	Grows well in wet soils.	2.5
Themeda triandra	Rooigras	A tall and hardy evergreen tufted grass.	Climax	Some nurseries	Grows well in most soils.	2.5

6.4.2. Alien Invasive Plant Management Plan

The South African government has enacted a set of national and provincial laws,of which a few are a framework in nature and majority sectoral that are aimed at regulating alien and invasive vegetation for four main purposes which are: biodiversity conservation, water conservation, agricultural management and fire risk management.

The National Environmental Management: Biodiversity Act (NEM:BA) (Act 10 of 2004); Alien and Invasive Species Regulations 2020 (GNR 1003 in GG 43726 dated 18 September 2020 – effective from 18 October 2020), legally governs the management of alien invasive species. To ensure legislative compliance, AIPs which may have established need to be adequately managed per the requirements of the legal categories into which they fall and this needs to be per legislation. The categorisation of listed AIPs is significant as the regulations ascribe differing obligations vis-à-vis each Category.

The NEM:BA Alien and Invasive Species Regulations (2020) categories are summarised in Table 6-2 below and the detailed descriptions are given in Table 6-3.

Table 6-2: Summary of NEM:BA Alien and Invasive Species Regulations (2020) Categories

Category	Compulsory Eradication by the Landowner	Compulsory Control by the Landowner (Prevent Species from Spreading)	Permit Required for Restricted Species	Compliance with Invasive Species Management Plan
Category 1a	X	X	X	X
Category 1b			X	X
Category 2		X	X	X (if applicable)
Category 3				X (if applicable)

Table 6-3: NEM:BA Alien and Invasive Species Regulations (2020) Categories Detailed Description

Category	Description
Category 1a Listed Invasive Species	(1) Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combatted or eradicated
	(2) A person in control of a Category 1a Listed Invasive Species must:
	(a) comply with the provisions of section 73(2) of the Act;
	(b) immediately take steps to combat or eradicate listed invasive species in compliance with sections 75(1), (2) and (3) of the Act; and
	(c) allow an authorised official to inspect a property as provided for in terms of section 31K of the National Environmental Management Act and to monitor, assist with or implement the combatting or eradication of the listed invasive species.
	(3) If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must combat or eradicate the listed invasive species per such programme.
Category 1b Listed Invasive Species	(1) Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled.
	(2) A person in control of a Category 1 b Listed Invasive Species must control the listed invasive species in compliance with sections 75(1), (2) and (3) of the Act.
	(3) If an Invasive Species Management Programme has been developed in terms of section 75(4) of the Act, a person must control the listed invasive species per such programme.
	(4) A person contemplated in sub-regulation (2) must allow an authorised official to inspect a property as provided for in terms of section 31K of the National Environmental Management Act and to monitor, assist with or implement the control of the listed invasive species, or compliance with the Invasive Species Management Programme contemplated in section 75(4) of the Act.
	(5) The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species, which plan must be submitted to the Minister for approval, and such Control Plan must include the following: (a) species identification; (b) extent of invasion; (c) control measures to be used; (d) an action plan or schedule including timeframes for the clearing of each species; (e) whether any species can be utilised as biomass; and (g) any other information which the Minister may require.
Category 2 Listed Invasive Species	Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be.
	(2) Unless otherwise indicated in the Notice, no person may carry out a restricted activity in respect of a Category 2 Listed Invasive Species without a permit.
	(3) A person in control of a Category 2 Listed Invasive Species, or person in possession of a permit, must ensure that the specimens of the species do not spread outside of the land or the area specified in the Notice or permit.
	(4) Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in subregulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3.
	(5) Notwithstanding the specific exemptions relating to existing plantations in respect of Listed Invasive Plant Species, any person or organ of state must ensure that the specimens of such Listed Invasive Plant Species do not spread outside of the land over which they have control, or the specified area on such land, where any restricted activity is authorised in respect of any Listed Invasive Plant Species.
Category 3 Listed Invasive Species	(1) Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice.
	(2) Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purposes of these regulations, be a Category 1b Listed Invasive Species and must be managed according to regulation 3.

6.4.2.1. Alien Invasive Species Identified on Site

A variety of AIPs were observed on site during the March 2021 site visit., with *Cosmos bipinnatus* being the most prevalent. Table 6 4 and Figure 6 1 indicate the various AIP species that were observed on site, as well as the Listed Invasive Species according to the National Environmental Management Biodiversity Act (NEM:BA) Alien and Invasive Species Regulations 2020 (GNR 1003 in GG 43726 dated 18 September 2020 – effective from 18 October 2020). As the density of AIP infestation is high, it is likely that these species will colonise the newly disturbed area. It is therefore vital that an AIP management plan is followed.

Table 6-4: Alien Invasive Plant Species Observed on Site

Species Name	Common Name	Habit	NEM:BA Category
Bidens pilosa	Common Blackjack	Herb	Alien, uncategorised.
Cirsium vulgare	Spear Thistle	Herb	1b
Cosmos bipinnatus	Garden Cosmos	Herb	Alien, uncategorised.
Ipomea purpurea	Morning Glory	Climber	1b
Oenothera rosea	Rose Evening Primrose	Herb	Alien, uncategorised.
Pennisetum clandistenum	Kikuyu Grass	Grass	1b
Tagetes minuta	Tall Khaki Weed	Herb	Alien, uncategorised.
Verbena brasiliensis	Brazilian Vervain	Herb	1b

Cosmos bipinnatus (Alien, uncategorised)

Cirsium vulgare (NEM:BA Category 1b)

Figure 6-1: Alien Invasive Plant Species Observed on Site

6.5. Monitoring, Auditing and Reporting Programme

Table 6-5: Monitoring, Auditing and Reporting Programme

Component / Aspect	Monitoring		Performance / Success Criteria	Corrective Action
	Methodology	Frequency / Duration		
Erosion	• Conduct a visual assessment to determine areas of potential erosion.	During Construction, Operational and Rehabilitation Phases on a quarterly basis or after heavy rains.	• No evidence of significant erosion; • No evidence of sedimentation in the watercourse; and • The final profile achieved should be acceptable in terms of surface water drainage requirements and the end land use objectives.	As required: • Re-shape areas to ensure that they are free draining, of practicably possible; • Establish vegetation to reduce future erosion; and • Limit access to rehabilitated areas.
Vegetation Establishment	• Conduct evaluation of rehabilitated areas by means of field inspections.	Annually during Operational Phase and annually for at least three years post-closure.	• Limited to no erosion present; and • Self-sustaining, indigenous vegetation ecosystem, limited to no AIPs.	As required: • Re-vegetate poorly established rehabilitated areas; • Re-seed bare patches; and • Apply additional fertiliser and/or organic matter, depending on the condition of the vegetation and the initial organic material application.
Invasive Alien Species	• Visually inspect rehabilitated areas for invasive species; • Visually inspect areas where invasive species have been previously eradicated and areas prone to invasive species (e.g. eroded/degraded areas, along drainage lines, etc.); and • Undertake surveys on relevant sites where bush encroachment has previously been identified to determine the status quo of invasive vegetation.	Annual audit during Operational Phase and annually for at least three years post-closure.	• Limit and/or prevent declared Category 1a, 1b, 2 and 3 invader species establishing.	• Revisit mitigation measures; and • Continue control and management.
Stormwater Control	• Erosion shall be prevented; and • Stormwater flow shall not be concentrated so that it results in erosion.	Duration of the project life.	• No contamination of surface runoff; and • No erosion.	As required: • Repair erosion, if present; • Remove contamination, if present; and • Repair systems/processes that may have caused contamination/erosion.
Waste Management	• Safe disposal certificates shall be obtained and kept and be made available on request; • All incidents/complaints to be logged in a register and these must be remedied; and • Reports to be compiled regularly on the exact quantities of all waste streams.	Ongoing during Construction, Operational Phase.	• No soil contamination; • No water contamination; • No complaints; • Successful internal and external audits; and • Provision of waste manifests.	As required: • Follow Environmental Management Plan (EMP) requirements; and • Rectify complaints/spills/ contamination.

Component / Aspect	Monitoring		Performance / Success Criteria	Corrective Action
	Methodology	Frequency / Duration		
Auditing	• Annual external auditing against the conditions outlined within the approved EMP, EA and integrated Water Use License (IWUL) in terms of Section 34 of NEMA; and • Keep record of all activities on site, problems identified, transgressions and task schedules undertaken.	Annually and must be audited by an independent auditor.	• Annual external environmental audit.	As required: • Environmental Practitioner (EP) to update annually.
General Site Status	• Conduct a visual assessment with respect to compliance of the afore-mentioned rehabilitation measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site.	Ongoing audits shall be undertaken following implementation of rehabilitation measures to measure effectiveness.	• Waste/rubble free sites.	As required.

7. Conclusion and Recommendations

Digby Wells was appointed to undertake the regulated BA Process to obtain an EA for the construction of a pump station and associated infrastructure (i.e., pump and pipeline through a wetland) at and from Wollie se Gat. Wollie se Gat is an old quarry located in close proximity to SSO and the TEP Fine Coal and Discard Facility. As part of this process, a rehabilitation plan is required.

A site assessment took place on 16 March 2021. During the site visit it was noted that the area in which the proposed pipeline and the pump station are to be located is already highly disturbed, with roads, railways and other infrastructure already in place. High infestations AIP species were also noted. Additionally, the pipeline route has already been cleared of vegetation in preparation for infrastructure surveys. The machinery used to clear the vegetation has disturbed the soil, often in a larger area than is necessary. Digging of the trenches and construction of the pump station has not yet occurred.

This rehabilitation plan provides the measures required during the construction, operational and decommissioning phases of the pipeline to reduce the impact of the pipeline and pump station. Monitoring measures have also been included.

8. References

Darwell, W., Smith, K., Tweddle, D., & Skelton, P. (2009). *The status and distribution of freshwater biodiversity in southern Africa.* Grahamstoen, South Africa: SAIAB: Gland, Switzerland: IUCN.

Department of Environmental Affairs. (2016). *National Protected Area Expansion Strategy for South Africa.* Pretoria, South Africa.

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute. (2013). *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.* Pretoria.

Driver, A., Nel, J., Snaddon, K., Murray, K., Roux, D., & Hill, L. (2011). *Implementation Manual for Freshwater Ecosystem Priority Areas. Draft Report for the Water Research Commission.* Retrieved from http://www.wrc.org.za/Knowledge Hub D

Kleynhans, C., Thirion, C., & Moolman, J. (2005). *A Level 1 River Ecoregion classification System for South Africa, Lesotho and Swaziland.* Water.

MTPA. (2014). *Mpumalanga Biodiversity Sector Plan Handbook.* Mbombela (Nelspruit): Mpumalanga Tourism & Parks Agency.

Mucina, L., & Rutherford, M. C. (2012). *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

Mucina, L., & Rutherford, M. C. (2012). *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

Nel, J., Murray, K., Maherry, A., Petersen, C., Roux, D., Driver, A., . . . Nienaber, S. (2011). *Technical Report for the National Freshwater Priority Areas project.* WRC: 1801/2/11.

SANBI. (2018). *National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report.* Pretoria: South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries.

SAPAD. (2020). *South African Protected Areas Database.*

DIGBY WELLS
ENVIRONMENTAL

Appendix A: Methodology

Methodology

Literature Review and Desktop Assessment

Relevant literature was reviewed with respect to the overall environment associated with the Project Area, habitats and vegetation types as well as the state prior to development. This was completed to obtain relevant information on the ecology of the Project Area and its vicinity to acquire enough information to compile a Rehabilitation Plan

Mpumalanga Biodiversity Sector Plan

The MBSP is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for national legislation and policy. The MBSP was published in 2014 by the Mpumalanga Tourism and Parks Agency (MTPA) and comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management (MTPA, 2014). Strategically the MBSP enables the province to:

- Implement the NEM:BA, 2004 provincially, and comply with requirements of the National Biodiversity Framework, 2009 (NBF) and certain international conventions;
- Identify those areas of highest biodiversity that need to be considered in provincial planning initiatives; and
- Address threat of climate change (ecosystem-based adaptation).

The publication includes terrestrial and freshwater biodiversity areas that are mapped and classified in Protected Areas (PAs), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) or Other Natural Areas (ONAs) (Table 1).

Wetlands in Mpumalanga Province have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices, development, agriculture and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good water quality for anthropological and animal use yet they are vulnerable to undesirable impacts. It is therefore in the interest of national water security that all wetlands are protected by law.

Table 1: Mpumalanga Biodiversity Sector Plan Categories

Map Category	Definition	Desired Management Objectives
PA	Those areas that are proclaimed as protected areas under national or provincial legislation, including gazette protected environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.

Map Category	Definition	Desired Management Objectives
CBAs	Areas that are required to meet biodiversity targets, for species, ecosystems or ecological processes. CBA Wetlands are those that have been identified as FEPA wetlands that are important for meeting biodiversity targets for freshwater ecosystems.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESAs	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. ESAs Wetlands are those that are non-FEPA and ESA Wetland Clusters are clusters of wetlands embedded within a largely natural landscape that function as a unit and allow for the migration of species such as frogs and insects between individual wetlands.	Maintain in a functional, near-natural state, but some habitat loss is acceptable. A greater range of land-uses over wider areas is appropriate, subject to an authorization process that ensures the underlying biodiversity objectives are not compromised.
ONAs	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritized for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritized for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximize ecological functionality and authorization is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilized and restored where possible, especially for soil carbon and water-related functionality.

National Biodiversity Assessment (NBA)

The National Biodiversity Assessment (NBA) presents the best available science on South Africa's biodiversity (SANBI, 2018). It aims to inform policy, planning and decision making in a range of sectors for the conservation and sustainable use of biodiversity. The NBA 2018 builds on the National Spatial Biodiversity Assessment 2004 and 2011 thus providing a comprehensive picture of South Africa's biodiversity threat status and protection level over time (SANBI, 2018).

The NBA has four indicators, providing information on the threat status and protection level of ecosystems and species. The threat status indicators use the established IUCN Red List of Species and Red List of Ecosystems assessment frameworks. The risk of extinction (species) or collapse (ecosystems) is evaluated across all realms and for taxonomic groups for which sufficient data exists. The protection level indicators reflect how well our species and ecosystem types are represented in the protected area network (SANBI, 2018).

Protected Areas

The South African Protected Areas Database (SAPAD) is a GIS inventory of all protected areas in South Africa (SAPAD, 2020). The database contains spatial data for the conservation estate of South Africa. It includes spatial and attribute information for both formally protected areas and areas that have less formal protection. Data is collected by parcels which are aggregated to protected area level and is updated on a continuous basis. It forms the basis for the Register of Protected Areas which is a legislative requirement under the National Environmental Management: Protected Areas Act, Act 57 of 2003.

The purposed of SAPAD is to produce and maintain a comprehensive spatial database on the conservation estate in South Africa. SAPAD is suitable for a wide range of planning, assessment, and analysis and display purposes.

National Freshwater Ecosystem Priority Areas

The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011). The spatial layers (FEPAs) include the nationally delineated wetland areas that are classified into Hydro-geomorphic (HGM) units and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetlands.

The NFEPA Project represents a multi-partner Project between the CSIR, SANBI, WRC, DWS, DEA, WWF, SAIAB and SANParks. The NFEPA Project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel, et al., 2011).

More specifically, the NFEPA Project aims to:

1. Identify FEPAs to meet national biodiversity goals for freshwater ecosystems; and
2. Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

The first aim uses systematic biodiversity planning to identify priorities for conserving South Africa's freshwater biodiversity within the context of equitable social and economic development. The second aim is comprised of two separate components: the (i) national component aimed to align DWS and DEA policy mechanisms and tools for managing and conserving freshwater ecosystems, while the (ii) sub-national component is aimed to use three case studies to demonstrate how NFEPA products should be implemented to influence land and water resource decision-making processes. The Project further aimed to maximize synergies and alignment with other national level initiatives, including the National Biodiversity Assessment (NBA) and the Cross-Sector Policy Objectives for Inland Water Conservation (Driver, et al., 2011).

Based on a desktop-based modelled wetland condition and a combination of special features, including expert knowledge (e.g. intact peat wetlands, presence of rare plants and animals, etc.) and available spatial data on the occurrence of threatened frogs and wetland-dependent birds, each of the wetlands within the inventory were ranked in terms of their biodiversity importance and as such, Wetland FEPAs were identified in an effort to achieve biodiversity targets (Driver, et al., 2011). Table 2 below indicates the criteria that were considered for the ranking of each of these wetland areas. Whilst being a valuable tool, it is important to note that the FEPAs were delineated and studied at a desktop and relatively low-resolution level. Thus, the wetlands delineated via the desktop delineations and ground-truthing work done through this study may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective.

Table 2: NFEPA Wetland Classification Ranking Criteria (Nel et al., 2011)

Criteria	Rank
Wetlands that intersect with a Ramsar site.	1
• Wetlands within 500 m of an International Union for Conservation of Nature (IUCN) threatened frog point locality; • Wetlands within 500 m of a threatened water-bird point locality; • Wetlands (excluding dams) with most of their area within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes; • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented; and • Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands that are good, intact examples from which to choose.	2
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing wetlands of biodiversity importance, but with no valid reasons documented.	3
Wetlands (excluding dams) in A or B condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion).	4
Wetlands (excluding dams) within a sub-quaternary catchment identified by experts at the regional review workshops as containing Impacted Working for Wetland sites.	5
Any other wetland (excluding dams).	6

Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by SANBI, the DEA, the Department of Mineral Resources (DMR), the Chamber of Mines and the South African Mining and Biodiversity Forum (2013). The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining development and environmental authorisations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining Project. The country has been mapped into biodiversity priority areas including the four categories each with associated risks and implications (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013) (Table 3).

Table 3: Mining and Biodiversity Guideline Categories (DEA et al., 2013)

Category	Risk and Implications for Mining
Legally Protected	Mining prohibited; unless authorised by ministers of both the DEA and DMR.
Highest Biodiversity Importance	Highest Risk for Mining: the EIA process must confirm significance of the biodiversity features that may be a fatal flaw to the proposed Project. Specialists must provide site-specific recommendations for the application of the mitigation hierarchy that informs the decision-making processes of mining licences, water use licences and environmental authorisations. If granted, authorisations should set limits on allowed activities and specify biodiversity related management outcomes.
High Biodiversity Importance	High Risk for Mining: the EIA process must confirm the significance of the biodiversity features for the conservation of biodiversity priority areas. Significance of impacts must be discussed as mining options are possible but must be limited. Authorisations may set limits and specify biodiversity related management outcomes.
Moderate Biodiversity Importance	Moderate Risk for Mining: the EIA process must confirm the significance of the biodiversity features and the potential impacts as mining options must be limited but are possible. Authorisations may set limits and specify biodiversity related management outcomes.

DIGBY WELLS
ENVIRONMENTAL

Appendix B: General Rehabilitation Guidelines

1. Standard Land Preparation Guidelines

The following points should be considered during the mining of new areas:

- All soil stockpiles should be located in areas where they will not have to be removed prior to final placement. Materials should thus be placed in their final closure location or as close as practicable to it;
- Soils which cannot be replaced directly onto rehabilitated land should be stockpiled. All stockpiles should be clearly and permanently demarcated and located in defined no-go areas, re-vegetated and monitored on an annual basis; and
- Soil stripping is a very important process which determines rehabilitation effectiveness. It should be done in strict compliance with the soil stripping guidelines, which should define the soil horizons to be removed.

Soil Stripping

This section explains the correct measures that should be followed during the stripping of soil. This is a key rehabilitation activity because soils lost cannot be regenerated in the lifetime of the mine.

Correct stripping of soils will firstly ensure that enough soils are available for rehabilitation and secondly, that the soils are of adequate quality to support vegetation growth and thus ensure successful rehabilitation.

The steps that should be taken during soil stripping are as follows:

- Determine stripping depths, which is dependent on the type of soil identified in the area to be cleared;
- Stripping should be supervised to ensure that the various soils are not mixed;
- Soils should only be stripped when the moisture content will minimise the compaction risk (i.e. when they are dry);
- The subsoil clay layers which can be found under certain hydromorphic soils need to be stripped and stockpiled separately. This clay material can be used as a compacted clay cap over rehabilitated pit areas that will become wetlands post-rehabilitation (stripping of wetland soils should be avoided, however if stripping does occur the above is recommended for stripping and stockpiling);
- Where possible, soils should be stripped and replaced in one action i.e. soils should only be handled once instead of moving it around two or more times; and
- Truck and shovel should preferably be used as a means of moving soil, instead of bowl scrapers.

Supervision

A very important aspect is the supervision and monitoring during the stripping process. Close supervision will ensure that soils are being stripped from the correct areas and to the correct depths and placed on the correct stockpiles with a minimum of compaction. Monitoring requires an assessment of the depth of the soil, the degree of mixing of soil materials and the volumes of soils that are being replaced directly or being placed on stockpiles.

Contracts for the stripping of soils should not only be awarded on the volumes being stripped but also on the capability to strip and place soil accurately.

Stockpiling

Stockpiling should be minimised as far as possible since it increases compaction and decreases the viability of the seed bank and microbes within the soil. Stripped soil should not be stockpiled but placed directly wherever possible. Appropriate mitigation measures for the management of these stockpiles needs to be implemented to ensure that wetlands and drainage paths are not affected and that the loss of topsoil is mitigated against.

The steps that should be taken during soil stockpiling are as follows:

- Mark stockpile locations accurately on a plan to ensure that re-handling is minimised (i.e. soils will not have to be moved a second or third time);
- Ensure that the location is free draining to minimise erosion loss and waterlogging;
- Minimise compaction during stockpile formation. The soils should be kept loose by, preferably, tipping at the edge of the stockpile not driving over the stockpile (avoid end-tipping as this causes compaction);
- Ensure that the stockpiled soil is only used for the intended purposes; and
- Cover topsoil if standing for longer than 1 month.

Compaction

Soils should be stockpiled loosely. Achieving this will depend on the equipment being used during the stripping and stockpiling process.

Soils should be dumped in a single lift if truck and shovel methods are used.

The use of heavy machinery should be avoided as it results in the compaction of soils and destruction of the soil structure. It is not recommended that a bowl scraper or grader be used to level and shape the stockpiles. If heavy machinery must be used, then compaction can be reduced by stripping and dumping as thick a cut as possible. Deposition of soils in a single track line may also reduce the compaction of the dumped or replaced soil.

Compaction and Equipment Used During Soil Replacement

Compaction limits the effectiveness of replaced soils. The equipment used during the replacement of the soils has a major impact on the compaction levels. Ideally heavy machinery should not be used to spread and level soils during replacement. The truck and shovel method should be used since it causes less compaction than, for example, a bowl scraper.

When using trucks to deposit soils, the full thickness of the soil required can be placed in one lift. This does, however, require careful management to ensure that the correct volumes of soil are replaced. The soil piles deposited by the trucks will have to be smoothed before re-vegetating the area.

Smoothing Equipment

The soils that are deposited need to be smoothed before re-vegetation can take place. A dozer (rather than a grader) should preferably be used to smooth the soils since it exerts a lower bearing pressure and thus compacts less than wheeled systems.

If the top- and sub-soils have been mixed during the stripping process, then the seed-bank has been diluted excessively and the creation of a seed-bed for planting purposes will be required.

2. Vegetation Establishment

The main aim of this re-vegetation process is to establish a stable, sustainable vegetative cover.

The objectives for the re-vegetation of reshaped and top-soiled land are to:

- Prevent erosion;
- Re-establish eco-system processes to ensure that a sustainable land use can be established without requiring long-term fertilizer additions; and
- Restore the biodiversity of the area as far as possible.

Climatic Conditions

Planting will be most successful when it is done after the first rains and into freshly prepared fine-tilled seedbeds (provided the soil material is not prone to crusting). Water retention in the seed zone will stimulate germination and can be supported by the application of light vegetation mulches.

Vegetation Conservation

If rare and protected flora species are found on the mining area during construction or operational activities, they should be conserved by removing and relocating them to another section of the project area which is suitable. The rare/protected plants can be kept in a nursery; the plants can then be replanted during rehabilitation of the disturbed areas.

Control and management of alien vegetation will contribute to the conservation of the natural vegetation. The alien species should, therefore, be removed from site and control measures must be implemented to ensure spreading of these species does not occur to other parts of the project area or the surrounding lands.

3. General Monitoring and Maintenance Guidelines

The purpose of monitoring is to ensure that the objectives of rehabilitation are met and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the operational phase as well as during the progress of establishment of desired final ecosystems.

Final Topography

The topography that is achieved during rehabilitation should be monitored and compared to the planned topography. The final profile achieved should be acceptable in terms of the surface water drainage requirements. The survey department should do an assessment of the reshaping carried out on the site and signoff should be obtained from the rehabilitation specialist before the topsoil is replaced.

Depth of Topsoil Stripped and Replaced

A final post-mining rehabilitation performance assessment should be done and information should be adequate for closure applications that involve:

- Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations;
- A post-mining land capability map based on soil thickness and characteristics;
- A proposed post-mining land use map;
- Erosion occurrences;
- Fertility analysis and soil analysis; and
- Representative bulk density analysis.

Chemical, Physical and Biological Status of Replaced Soils

- Erosion
    - Continuous erosion monitoring of rehabilitated areas should be undertaken and zones with excessive erosion should be identified. Erosion can either be quantified or the occurrence there-of simply recorded for the particular location.

Surface Water

- Drainage Systems
    - The functionality of the surface water drainage systems should be assessed on an annual basis. This should preferably be done after the first major rains of the season and then after any major storm. An assessment of these structures will ensure that the drainage on the recreated profile matches the rehabilitation plan as well as to detect early on when any drainage structures are not

functioning efficiently. These structures can then be repaired or replaced before they cause significant erosion damage.

Vegetation Species

Biodiversity assessments and surveys should be undertaken by external experts to establish the full range of plants that have become established. Summer and winter samplings should be done during these assessments.

Alien Invasive Control

The risk of alien invasive species moving into an area and potentially outcompeting other species may need to be managed as there is a risk of alien invasive species occurring at any mine site, which needs to be dealt with in the appropriate manner.

Alien Species Control

Invasive alien plant species are difficult to control. Methods should be used that are appropriate for the species concerned, as well as to the ecosystem in which they occur.

When controlling weeds and invaders, damage to the environment must be limited to a minimum.

There are four basic methods by which encroachers or weeds are controlled:

- Physical (mechanical):
    - Uprooting (hand pulling);
    - Cutting back;
    - Chopping, slashing and felling; and
    - Ring-barking (girdling).
- Chemical:
    - Foliar application;
    - Stem notching and application;
    - Stump treatment; and
    - Soil treatment.
- Biological treatment which involves the use of host-specific natural enemies of weeds or invaders from the plant's country of origin, to either kill or remove the invasive potential of these plants; and
- Use of chemical treatment must be undertaken by a qualified or trained individual and the chemicals used must be approved by authorities.