

Corner Paul Smith Street and 10th Avenue
Unit 269, Block F, Ravenswood Mews
Boksburg North, 1459
Cell: 072 361 9527
Tel: 011 863 1079
Fax: 086 605 5488

Email Address: mpho@manyabeconsultancy.com



**INTEGRATED WATER AND WASTE MANAGEMENT PLAN FOR THE
CONSOLIDATION AND AMENDMENT OF THE WATER USE LICENSE (WUL)
AND ITS ADDENDUM GRANTED TO SOUTH DEEP JV: SOUTH DEEP GOLD
MINE**

DWS APPLICATION REFERENCE NUMBER: WU31462
WUL REFERENCE NUMBER: 08/C22J/GCEFIJA/8705
MANYABE CONSULTANCY (PTY) LTD PROJECT CODE: 202308

Prepared for:



Old Vereeniging Road, Farm Modderfontein
Westonaria, 1780, South Africa

Prepared by:



Unit 269, Corner Paul Smith Street and 10th Avenue
Ravenswood Mews, Block F, Boksburg North, 1459

Tel: +2711 863 1079

Website: www.manyabeconsultancy.com

Contact Person: Ms. Mpho Manyabe

Date: July 2026

No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, by any individual /company other than the client, without permission in writing from Manyabe Consultancy (Pty) Ltd. Likewise, it may not be lent, resold, hired out or otherwise disposed of by way of trade in any form of binding or cover other than that in which it is published.

© Manyabe Consultancy (Pty) Ltd

**MANAGING DIRECTOR: MPHO MANYABE
COMPANY REG: 2014/063679/07**

DOCUMENT HISTORY – MANYABE CONSULTANCY

Revision	Date	Compiled By	Comments
01	June 2026	Mpho Manyabe	Initial draft for commenting by the client
02	July 2026	Mpho Manyabe	Draft for commenting by the Interested and Affected Parties (I&APs)

APPROVAL FOR RELEASE

Name	Title	Signed
Ms. Mpho Manyabe	Manyabe Consultancy: Managing Director	

**SOUTH DEEP JV: SOUTH DEEP GOLD MINE REPRESENTATIVE
CONTACT DETAILS**

Contact Person:	Ms. Thihanedzwi (Thiara) Ratshibvumo
Email Address:	Thiara.Ratshibvumo@goldfields.com
Telephone Number:	+27(0)11 411 1445

EXECUTIVE SUMMARY

PROJECT INTRODUCTION AND BACKGROUND

Gold Fields Operations Limited (GFO) and GFI Joint Venture Holdings (Pty) Limited (GFI Holdings) acting jointly in their capacities as participants in an unincorporated joint venture (JV) known as South Deep JV: South Deep Gold Mine appointed Manyabe Consultancy (Pty) Ltd (hereinafter referred to as MC), as a Professional Service Provider (PSP) - Environmental Assessment Practitioner (EAP), to consolidate and amend the Water Use License (WUL) and its addendum, granted to South Deep JV: South Deep Gold Mine.

The mine is located in Westonaria, Rand West City Local Municipality (RWCLM), within the West Rand District Municipality (WRDM). South Deep Gold Mine is situated in the magisterial district of Westonaria, approximately 45 km south-west of Johannesburg and 10 km south of Westonaria, in the Gauteng Province. It is accessed via the R28 provincial road between Westonaria and Vereeniging or from the N12 provincial road between Johannesburg and Potchefstroom and is located in the major gold mining region of South Africa, the Witwatersrand Basin.

The main properties on which the mine falls are Doornpoort 347 IQ; and Modderfontein 345 IQ. While the Doornpoort Tailings Storage Facility (TSF) lies outside of the mine lease area, it is located on property that is owned by the mine. The South Deep Gold Mine boundary area comprises of an area of approximately 7 452 hectares. The mine has been operational since the 1970s. The current Life of Mine (LoM) is estimated to be 76 years (2098). Not only will South Deep Gold Mine be a valuable asset to the Gold Fields Group for decades to come, but it is likely to be the last gold mine in South Africa, with most other mines having run out of reserves by then. It is estimated that the South Deep Gold Mine contains more than 80 470 gold bullion bars of golds, which can be mined by means of underground mining methods during the 76 years of current LoM.

South Deep JV: South Deep Gold Mine is the holder of the Mining Right (MR) which was granted by the Department of Mineral and Petroleum Resources (DMPR) in 2010. The MR affords South Deep JV: South Deep Gold Mine the right to mine gold, silver, nickel, uranium, copper and pyrite. The MR was converted in terms of Item 7 of Schedule II of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) in respect of a mining area measuring 4,268 hectares, registered in the Mineral and Petroleum Titles Registration Office and is valid for the period ending 12 July 2040.

South Deep JV: South Deep Gold Mine was originally granted a WUL in terms of Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369). From 2016 to 2017, South Deep JV: South Deep Gold Mine identified some errors on the issued WUL i.e. the amendments to quantities which were contrary to what was applied for. Other amendments included the addition of scavenger boreholes mainly established to control the pollution plume around the TSFs and Return Water Dams (RWDs), for the removal and containment of contamination from the TSFs by abstracting contaminated water from the aquifers. The WUL was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705). The 2018 WUL also had errors. An addendum to the issued WUL was issued on 29 July 2021.

The WUL authorises the following water uses, under Section 21 of the act:

- (a) Taking of water from a water resource.
- (c) Impeding or diverting the flow of water in a watercourse.
- (e) Engaging in a controlled activity.
- (f) Discharging waste or water containing waste into a water resource through a pipe, canal, canal, sewer or other conduit.
- (g) Discharging waste or water containing waste into a water resource.
- (i) Altering the bed, banks course or characteristics of a watercourse.
- (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

South Deep JV: South Deep Gold Mine has been operational for over 50 years and is engaged in underground mining comprising one metallurgical plant and two operating shaft systems: South Shaft complex and Twin

Shaft complex. The South Shaft complex includes a main shaft and three sub-vertical shafts, two of which are operational. The Twin Shaft complex consists of a single-barrel main shaft for hoisting personnel, rock materials and an adjacent bratticed ventilation shaft, used for both drawing used air and hoisting rock. The South Shaft complex operates to a depth of 2 650 metres below surface, and the Twin Shaft complex operates to a depth of 2 995 metres below surface.

South Deep JV: South Deep Gold Mine's workings are at depth and therefore require significant cooling infrastructure. The South Deep JV: South Deep Gold Mine operation has access to the national electricity grid, the mine's Khanyisa solar grid, water and road infrastructure and is located near regional urban centres where it can obtain needed supplies and services.

As part of the Integrated Water Use License Application (IWULA) process, MC compiled the Integrated Water and Waste Management (IWWMP) for the proposed WUL and its addendum amendments, and consolidation project. The IWWMP is part of the application for IWULA for the proposed WUL and its addendum amendments, and consolidation project.

PROJECT LOCATION

The mine is located in Westonaria, RWCLM, within the WRDM. South Deep Gold Mine is situated in the magisterial district of Westonaria, approximately 45 km south-west of Johannesburg and 10 km south of Westonaria, in the Gauteng Province. It is accessed via the R28 provincial road between Westonaria and Vereeniging or from the N12 provincial road between Johannesburg and Potchefstroom and is located in the major gold mining region of South Africa, the Witwatersrand Basin.

OVERVIEW OF THE EXISTING OPERATIONS AND INFRASTRUCTURE

A. Current Activities

South Deep Gold Mine has been operational for over 50 years and is engaged in underground mining comprising one metallurgical plant and two operating shaft systems: South Shaft complex and Twin Shaft complex. The South Shaft complex includes a main shaft and three sub-vertical shafts, two of which are operational. The Twin Shaft complex consists of a single-barrel main shaft for hoisting personnel, rock materials and an adjacent bratticed ventilation shaft, used for both drawing used air and hoisting rock. The South Shaft complex operates to a depth of 2 650 metres below surface, and the Twin Shaft complex operates to a depth of 2 995 metres below surface. The mine's workings are at depth and therefore require significant cooling infrastructure. The mine's operation has access to the national electricity grid, the mine's Khanyisa solar grid, water and road infrastructure and is located near regional urban centres where it can obtain needed supplies and services.

The current South Deep JV: South Deep Gold Mine operations derive from the Barrick Gold - Western Areas Joint Venture which Gold Fields acquired in a series of transactions in the second half of 2007. The Barrick Gold – Western Areas Joint Venture was named the South Deep JV.

It is a long-life (LoM estimated to extend to 2098), deep-level mechanised gold mine operating at between 2 000 and 3 000 meters below surface.

i. Mining Method

South Deep Gold Mine gold reserves are mined through underground operation accessed through South Shaft and Twin Shaft.

The underground mining utilises conventional and trackless mining methods that involve drilling, blasting, loading and hauling of ore and waste. On the other hand, conventional mining (more labour intensive and requires the use of rail infrastructure) is used to extract the Ventersdorp Contact Reef (VCRs) and for destress-stopping. Trackless mining methods involve mechanised bulk mining (makes use of machinery) and takes place in the massive part of the ore body. The main operating levels of the mine are Level 90 and 95, with Level 87

as an inter-level between Level 85 and 90.

ii. Current mine

South Deep Gold Mine utilises a selective access development and Longhole open stoping mining method. Mining is spread across a large area, which was originally mined using conventional tabular mining. Current mine is accessed from three 90, 93 and 95 access levels using both South Shaft and Twin Shaft.

iii. North of Wrench

This area is directly south and down-dip of current mine and is accessed from the Twin Shaft. the mining area consists of six corridors which are separated by regional pillars. This division of the mine is mined using horizontal mechanised destress and longhole stoping methods and is accessed from two active levels and ramp systems.

iv. South of Wrench

This area is directly south and down-dip of North of Wrench and is accessed from Twin Shaft. The bulk mining in the future will occur in this area. The mining will occur once all required infrastructure to exploit the area has been installed.

v. Production Rate

The Gold Plant has a capacity to produce 220 000 tons per month of product.

vi. Gold Recovery Process

The gold recovery process comprises of milling (wet process), concentrating, thickening, leaching, and carbon-in-pulp (CIP) sections. All material in the Gold Plant is potentially gold bearing, and therefore, all spillages are recycled.

Milling

The milling plant consists of a Semi-Autogenous Grinding (SAG) mill and a ball mill. Ore from the stockpile is conveyed to the SAG mill where it is ground using large (100mm) steel balls. The ground material is screened. Oversized material is recycled back to the SAG mill via the ore stockpile while undersized material is fed to a cyclone cluster for classification. The cyclone overflow gravitates to one of three linear screens for woodchip/trash removal. The final milled pulp gravitates into a high-rate thickener (HRT). The underflow from four cyclones is fed to the ball mill for further grinding using smaller (50mm) steel balls. The ground material from the ball mill is screened.

Oversized material is recycled back to the SAG mill while undersized material is fed to a discharge box. Lime is added to the discharge box. From the discharge box, the material is pumped to the cyclone cluster for classification. The cyclone overflow gravitates to one of three linear screens for woodchip/trash removal. The final milled pulp gravitates into a HRT.

Inputs: Large volumes of process water and lime

Concentrating

The underflow from three or four cyclones on the cluster is fed to the Knelson vibrating screen. The oversize is recycled back to the ball mill while the undersize is sent to the Knelson concentrators for the recovery of free gold. Concentrate from the concentrators is fed to a storage tank in the smelt house.

Inputs: Reagents

Thickening

The HRT feed is dosed with flocculant to agglomerate solid particles as they settle to produce pulp. Lime is added, (at the SAG mill discharge box) to regulate the pH. Clear water overflows to the mill circuit water tank while the underflow (pulp) is thickened and pumped to the leach tanks.

Inputs: Flocculants

Leaching

Pulp from the HRT is pumped to the leach section where it is treated in mechanically agitated tanks with sodium cyanide to dissolve the gold. Air is injected to provide the oxygen needed during the leaching process. Lime is added to regulate the pH.

Inputs: Sodium cyanide, Air and Lime

Carbon-in-pulp Process

The CIP circuit consists of 8 mechanically agitated tanks. Carbon (which is porous) is added to each tank to absorb the dissolved gold. Samples are taken in each tank to see the carbon profile and to see how much gold the carbon has absorbed. The loaded carbon is pumped to a screen where it is washed. The underflow is recycled back to the CIP tanks while the overflow is dropped into an elution column. The elution process involves firstly the acid treatment of the carbon to remove impurities before stripping the gold into a solution by the use of a hot cyanide/caustic solution.

The resulting eluate is pumped to a tank at the smelt house area where it is stored until the carbon stripping process is complete. The stripped carbon is then transferred to a screen where the undersize reports to carbon fines circuit. Oversize is fed into a rotary kiln for regeneration. The tails from the CIP tails tank are fed to a screen where the underflow is pumped to the Backfill Plant. The overflow is pumped to the carbon sizing screen as it contains carbon.

Inputs: Carbon, Water, Diluted acid and Caustic soda

Carbon Regeneration

Used carbon is regenerated for use in the CIP section of the gold recovery process. The process of regeneration is used to rid the stripped carbon of organics and other impurities, which decrease the activity of the carbon that is to be used in the CIP process. This is achieved by raising the temperature of the carbon in an electrically fired rotary kiln to 750°C. The steam created during the regeneration process creates a negative atmospheric pressure which prevents the combustion of the carbon.

The regenerated carbon is quenched to cool down and then transferred hydraulically, with water, to the carbon sizing screen. Fine carbon is distributed to two Settlers from where the settled fines (carbon sludge) are recovered in 1-ton bulk bags and sold to a contractor/recycler who will recover the fine gold caught in the fine carbon. The sized carbon is collected in a transfer vessel. Approximately 7 tons of carbon is collected in the transfer vessel before it is returned to the adsorption circuit (CIP circuit). It being a wet process, the kiln feed hopper is fitted with a wire screen in order to drain excess water and some fines (if present). Excess water gravitates to a water tank for re-use.

Smelting

Concentrate from the Knelson concentrators is upgraded using a Gemini (vibrating) table from where it is calcined and smelted. The eluate from the CIP section is pumped to holding tanks and circulated through automatic electrowinning reactors until most of the gold is recovered to a sludge. The reactors are backwashed daily, and the sludge is discharged into holding tanks inside the smelt house. The gold sludge is filtered and dried in the smelt house. The spent electrolyte is recycled back to the leach circuit. Dried sludge is smelted with fluxes in an induction furnace to produce gold bullion and slag.

Gold bullion is sent by helicopter to the Rand Refinery in Germiston (Gauteng) for further processing. Slag is recycled back to the SAG mill. Due to the gold content, all spillage in the section is recycled.

Inputs: Fluxes

B. Extent of Activity

The South Deep Gold Mine boundary area comprises of an area of approximately 7 452 hectares. It is estimated that the South Deep Gold Mine contains more than 80 470 gold bullion bars of golds, which can be mined by means of underground mining methods during the 76 years of current LoM.

The surface area of the mine is located north of Westonaria on landscape dominated by quartzitic ridges of the Gatsrand, trending roughly east-west. The Leeuspruit rises in these ridges and flows southwards, skirting the eastern boundary of the mine. The gentle undulating open terrain within the area is representative of African cycle erosion with deep weathering, leached soils and accumulations of ferricrete that commonly occur.

C. Key Related Activities, Processes and Products

i. Activity Life Description

The South Deep Gold Mine operation extracts the largest gold deposits globally and has a mineral reserve of 32.19 million ounces. The estimated LoM is about 76 years.

ii. Activity Infrastructure Description

The key infrastructure associated with South Deep Gold Mine are summarised below.

- Surfaced roads, haul roads, pipelines and conveyors (±10 ha);
- Main administration offices (including parking facilities) (±3.4 ha) and security facilities;
- Two shaft complexes, namely, South Shaft (±10.7 ha) and Twin Shaft (±40 ha);
 - South Shaft complex comprises a shaft, ventilation shafts, winder houses, Eskom yard, Refrigeration Plant, workshops, wash bay, change house, ablution facilities, offices and clinic;
 - Twin Shaft complex comprises a shaft, ventilation shafts, winder houses, Eskom yard, Refrigeration Plant, workshops and stores, wash bay, diesel station, offices, change house, ablution facilities, lamp and crush building, explosives loading shed, explosives detonation bay and canteen.
- Gold Plants:
 - Backfill Plant at South Shaft, and
 - The Gold Plant in the Twin Shaft area (±35.2 ha) including a substation, compressor house, stores, workshops, wash bay, diesel station, offices, canteen, change house and ablution facilities.
- Mine waste management infrastructure including:
 - South Shaft Waste Rock Dump (WRD) (±15.2 ha) has been decommissioned and rehabilitated;
 - Twin Shaft WRD (±20 ha) (not accepting any waste rock as the mine does not produce waste rock);
 - “Old” TSF 1 and 2 (Phase 1) (±70 ha) (currently being remined);
 - “Old” TSF 3 and 4 (Phase 2) (±100 ha) (progressively being rehabilitated – revegetated);
 - Doornpoort TSF (±260 ha); and
 - Waste transfer station and salvage yard.
- Clean and dirty water management facilities:
 - Pollution Control Dams (PCDs);
 - Cascade Dams;
 - Settlers;
 - Stormwater management infrastructure including RWDs;
 - Reverse Osmosis (RO) Plants 1,2 and 3 (RO 3 is yet to be constructed), and
 - Water storage tanks.
- Wastewater treatment facilities:
 - French drains;
 - Pump stations at Twin Shaft and South Shaft areas, and

- Pipeline between pump stations and Wastewater Treatment Works (WWTW) in South Shaft area (± 1.4 ha).
- Waste Transfer station including:
 - Domestic waste sorting area; and
 - Salvage yard.
- Employee facilities including:
 - Housing;
 - Recreational facilities, and
 - Taxi rank.

APPROVED WATER USES

The table below provides all the water uses that were incorporated into the WUL issued on 19 November 2018.

Water Uses that were Incorporated into the WUL 2018

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
Water Use activities for Section 21(a)			
Water is abstracted from Salvage BH [A1] (A3) to reduce the pollution plume and is disposed to twin shaft PCD.	Portion 39 of Farm Modderfontein 345IQ	154 030	26°25'3.06"S 27°39'50.48"E
Old RWD seepage interception BH (A4) to reduce the pollution plume. The water is disposed (recycled back) to the RWD.	Portion 44 of Farm Modderfontein 345IQ	154 030	26°25'18.03"S 27°40'55.73"E
Abstraction of water from Scavenger BH (A5-1) [to reduce the pollution plume and disposal in Doornpoort RWD] below old TSF to reduce the pollution plume and disposal in old RWD.	Portion 41 of Farm Modderfontein 345IQ	94 900	26°24'45.12"S 27°40'45.85"E
Abstraction of water from Scavenger BH (A5-2) [borehole to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 20 of Farm Modderfontein 345IQ	94 900	26°25'0.49"S 27°40'38.06"E
Abstraction of water from Scavenger BH (A5-3) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3 of Farm Modderfontein 345IQ	94 900	26°25'12.66"S 27°40'51.32"E
Abstraction of water from Scavenger BH (A5-4) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3 of Farm Modderfontein 345IQ	94 900	26°25'21.87"S 27°40'25.25"E
Abstraction of water from Scavenger BH (A5-5) to reduce the pollution plume and disposal in RWD.	Portion 21 of Farm Modderfontein 345IQ	94 900	26°25'7.25"S 27°40'6.35"E
Abstraction of water from Scavenger BH (A5-6) to reduce the pollution plume and disposal in RWD.	Portion 21 of Farm Modderfontein 345IQ	94 900	26°25'7.25"S 27°40'0.35"E
Abstraction of water from Scavenger BH (A6-1) below the Doornpoort TSF to reduce the pollution plume and disposal in RWD.	[Portion 20 of Farm Modderfontein 345IQ] Doornpoort 347IQ	94 900	26°27'49.99"S 27°38'18.73"E
Abstraction of water from Scavenger BH (A6-2) below the old TSF to reduce the pollution plume and disposal in RWD.	[Portion 20 of Farm Modderfontein 345IQ] Doornpoort 347IQ	94 900	26°27'42.49"S 27°38'18.08"E
Abstraction of water from South Shaft borehole for mining purpose	Portion 30 and 65 of Farm Modderfontein 345IQ	273 756	26°24'14.10"S 27°41'7.40"E
Abstraction of water from Leeuspruit for mining purpose	Portion 30 and 65 of Farm Modderfontein 345IQ	729 996	26°24'36.00"S 27°41'22.95"E
BH1	Farm Doornpoort 347IQ	94 900 (2.0L/s)	-26.467033°; 27.636497°
SD31	Farm Doornpoort 347IQ	94 900 (0.25L/s)	-26.471389°; 27.649738°
SD32	Farm Doornpoort 347IQ	94 900 (0.6L/s)	-26.471790°; 27.654380°
SD38	Farm Doornpoort 347IQ	94 900 (1L/s)	-26.468937°;

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
			27.645781°
SD40	Farm Doornpoort 347IQ	94 900 (1.2L/s)	-26.469808°; 27.639373°
SD43	Farm Doornpoort 347IQ	94 900 (1.55L/s)	-26.465064°; 27.640661°
Water Use activities for Section 21(c) and (i)			
Haul Road crossing Leeuspruit River and flow meter -entrance to South Shaft. The road is an existing road with a new meter installation.	Portion 44 of Farm Modderfontein 345IQ	L=55m H=1.0m W=57m	26°24'37.3"S 27°41'64.1"E
Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road.	Portion 12 of Farm Modderfontein 345IQ	L=12m H=2.0m W=100m	26°27'49.27"S 27°38'4.21"E
Road crossing Leeuspruit River diversion-existing road passing over the river diversion.	Portion 20 of Farm Modderfontein 345IQ	L=15m H=2.0m W=35m	26°25'14.17"S 27°41'0.53"E
South shaft stormwater separation system which run through a wetland.	Portion 20 of Farm Modderfontein 345IQ		Start 26°24'30.83"S 27°41'7.53"E End 26°25'0.26"S 27°40'53.30"E
Water Use activities for Section 21(e)			
Irrigation of old TSF with water from RWD 1 and 2 for maintenance of grassed areas.	Farm Modderfontein Portions 3, 20, 21, 40 and 41 of farm Modderfontein	730 000	26°24'52.80"S 27°40'36.14"E
Irrigation of new TSF with water from RWD 3 and 4 for maintenance of grassed areas.	Farm Modderfontein	730 000	26°25'5.08"S 27°40'13.09"E
Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas.	Portion 1,44,45,51,52 and 53 of the farm Doornpoort 347IQ.	730 000	26°27'53.34"S 27°38'48.78"E
Irrigation of shaft areas with water from Twin shaft PCD.	Farm Modderfontein	365 000	26°24'23.5"S 27°41'18.6"E
Irrigation of all TSF with final effluent from WWTW.	Farm Modderfontein and farm Doornpoort 347IQ.	912 500	26°24'23.5"S 27°41'18.6"E 26°24'52.80"S 27°40'36.14"E 26°25'5.08"S 27°40'13.09"E 26°27'53.34"S 27°38'48.78"E
Water Use activities for Section 21(f)			
Discharge of excess underground water.	Portion 44 of Farm Modderfontein 345IQ	1 095 000	26°24'35.59"S 27°41'21.81"E
Water Use activities for Section 21(g)			
Disposing of gold slurry at south shaft.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	1 200 000	26°25'0.02"S 27°40'12.16"E
Disposing waste water from the Doornpoort TSF into the RWD.	Portion 20, 50, 51 Doornpoort 347IQ	1 000 000	26°28'0.05"S 27°39'14.18"E
Twin shaft retention pond.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	62 000	26°25'22.62"S 27°39'56.92"E
Cascade Ponds.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	3 000	26°25'10.27"S 27°40'33.85"E
Upgraded RWD.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	52 487	26°25'12.50"S 27°40'49.12"E
Gold Plant PCD.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 3 500	26°25'15.88"S 27°39'32.57"E
Settlers A&B.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 650	26°25'8.30"S 27°39'50.97"E
Mine Water Tanks.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 2 200	26°24'20.74"S 27°41'15.72"E 26°25'10.27"S 27°40'33.85"E
Old RWD.	Portion 3, 20, 21, 40 and 41 of the farm Modderfontein 345IQ,	150 000	26°25'13.92"S 27°40'52.27"E

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
Water Use activities for Section 21(j)			
Removal of water found underground for the efficient continuation of mine or safety of the people.	Portion 3, 20, 21,40 and 41 of the farm Modderfontein 345IQ	1 824 996	

As part of the WUL Amendment application, South Deep JV: South Deep Gold Mine has been granted an addendum to the WUL 2018 as follows:

Amendment of the Licensee

- The licence is hereby amended a) by substitution of condition 1 of the following:

“South Deep **[Gold Mine]** Joint Venture: South Deep Gold Mine”

Amendment of properties and ownership on which the water use will be exercised

- Properties and ownership on which the water use will be exercised is hereby amended a) by the substitution in properties for Table 1 of the following Table:

Properties where water uses will be exercised

Properties	Water uses	Owner
Portion 3,20,21,30,41,44,39 and 65 of farm Modderfontein 345IQ	Section 21(a)	South Deep Gold Mine
Portion 3 and 52 of the farm Modderfontein 345IQ, Portion 3,12,20,41,44 and 61 of the farm Modderfontein 345IQ	Section 21(c) and (i)	South Deep Gold Mine
Portion 12, 20,21 of farm Modderfontein 345IQ	Section 21(e)	South Deep Gold Mine
Portion 44 of the farm Modderfontein 345IQ	Section 21(f)	South Deep Gold Mine
Portion 1,7,20,43,45,46,50,51,52,53 of the farm Doornpoort 347IQ. Portion 44 of the farm Modderfontein 345IQ	Section 21(g)	South Deep Gold Mine
Portion 30 of the farm Modderfontein 345IQ	Section 21(j)	South Deep Gold Mine

Amendment of the description of the activities

- Description of the activities is hereby amended a) by substitution for the description of the activities of the following description of the activities:

"This license authorises South Deep Gold mine for the following water uses in terms of section 40 for section 21(a),(c),(e),(f),(g),(i) and (j) of the NWA for taking water from the South Shaft boreholes and Leeuspruit river, installation of flow meter at the river, river diversion, pipeline crossing the stream, discharging of waste water into the river, irrigation of TSF with treated effluent, disposing of waste water into containment facilities and removing of water found underground for continuation of mining and safety of the people. The mine falls within the Vaal River WMA, quaternary catchments C22J".

Amendment of condition I of Appendix II

- Condition 1 of the licence is hereby amended a) by substitution in condition 1 for Table 2 of the following Table:

Water use activities for Section 21(a)

Purpose/ Description	Property	Volume	Co-ordinates
1. Water is abstracted from Salvage BH [A] (A3) to reduce the pollution plume and is disposed to twin shaft PCD.	Portion 39 of Farm Modderfontein 345IQ	154 030 m ³ /a	26°25'3.06"S 27°39'50.48"E
Old RWD seepage interception BH (A4) to reduce the pollution plume. The water is disposed (recycled back) to the RWD.	Portion 44, of farm Modderfontein 345 IQ	154 030 m ³ /a	26°25'18.03"S 27°40'55.73"E

Purpose/ Description	Property	Volume	Co-ordinates
2. Abstraction of water from Scavenger BH (A5-1) [to reduce the pollution plume and disposal in Old RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 41, of farm Modderfontein 345 IQ	94 900 m³/a	26°24'45.12"S 27°40'45.85"E
3. Abstraction of water from Scavenger BH (A5-2) [borehole to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 20, of farm Modderfontein 345 IQ	94 900 m³/a	26°25'0.49"S 27°40'51.32"E
4. Abstraction of water from Scavenger BH (A5-3) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3, of farm Modderfontein 345 IQ	94 900 m³/a	26°25'12.66"S 27°40'38.06"E
5. Abstraction of water from Scavenger BH(A5-4) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3, of farm Modderfontein 345 IQ	94 900 m³/a	[26°25'7.25"S] 26°25'30.70"S 27°40'25.25"E
Abstraction of water from Scavenger BH(A5-5) to reduce the pollution plume and disposal in RWD	Portion 21, of farm Modderfontein 345 IQ	94 900 m³/a	26°25'7.25"S 27°40'6.35"E
Abstraction of water from Scavenger BH(A5-6) to reduce the pollution plume and disposal in RWD	Portion 21, of farm Modderfontein 345 IQ	94 900 m³/a	26°25'7.25"S 27°40'0.35"E
6. Abstraction of water from scavenger BH (A6-1) below the Doornpoort TSF to reduce the pollution plume and disposal in RWD.	[Portion 20, of farm Modderfontein 345] Doornpoort 347 IQ	94 900 m³/a	26°27'49.99"S 27°38'18.73"E
7. Abstraction of water from Scavenger BH (A6-2) below the old TSF to reduce the pollution plume and disposal in RWD.	[Portion 20, of farm Modderfontein 345] Doornpoort 347 IQ	94 900 m³/a	26°27'42.49"S 27°38'18.08"E
Abstraction of water from South Shaft borehole for mining purpose	Portion 30 and 65 of the farm Modderfontein 345IQ	273 756 m³/a	26°24'14.10"S 27°41'7.40"E
Abstraction of water from Leeuspruit for mining purpose	Portion 30 and 65 of the farm Modderfontein 345IQ	729 996 m³/a	26°24'36.00"S 27°41'22.95"E
BH1	Farm Doornpoort 347IQ	94 900 (2.0L/s)	-26.467033° 27.636497°
SD31	Farm Doornpoort 347IQ	94 900 (0.25L/s)	-26.471389°; 27.649738°
SD32	Farm Doornpoort 347IQ	94 900 (0.6L/s)	-26.471790° 27.654380°
SD38	Farm Doornpoort 347IQ	94 900 (1L/s)	-26.468937° 27.645781°
SD40	Farm Doornpoort 347IQ	94 900 (1.2L/s)	-26.469808° 27.639373°
SD43	Farm Doornpoort 347IQ	94 900 (1.55L/s)	-26.465064° 27.640661°

Amendment of condition 3 of Appendix III

5. Condition 3.1.2 of the licence is hereby amended by substitution of condition 3.1.2 for the following condition:

"3.1.2 The Licensee must ensure that clean storm water is discharged (**into bio retention ponds**) outside of the riparian area".

Amendment of condition 1 of Appendix V

Condition 1.1 of the licence is hereby amended by the substitution in condition 1.1 for Table 7 of the following Table:

Water use activity

Description of the activity	Volume (m³/a)	Property	Co-ordinates
Discharge of excess underground water.	1 095 000	Portion 44, of farm Modderfontein 345 IQ	[26°25'35.6"S] 26°24'35.59"S 27°41'.21.81"E

Amendment of condition 3 of Appendix VI

6. Condition 3.1 of the licence is hereby amended a) by substitution of condition 3.1 of the following condition:

"3.1 The Licensee must monitor on a **[monthly]** quarterly basis the water resources at surface water monitoring points and groundwater monitoring points to determine the impact of the facilities and other activities on the water quality by taking samples at the monitoring points as indicated in Tables 10 and 11".

Amendment of condition 1 of Appendix VIII

7. Condition 1 of the license is hereby amended a) by substitution of condition 1 of the following condition:

"1 The Licensee is authorised to remove a maximum volume not exceeding **[seven hundred and twenty-nine thousand nine hundred and ninety-six cubic metres per annum (729 993m³/a)]** one million eight hundred and twenty four thousand nine hundred and ninety six cubic meters per annum (1 824 996 m³/a) of water found underground from portion 3, 20, 21, 40 and 451 of the farm Modderfontein 345IQ for the efficient continuation of mine or safety of the people."

PROPOSED WATER USES

The IWULA process is being conducted in compliance with the WULA and Appeals Regulations published in GNR. 267 dated 24 March 2017.

A pre- application enquiry was submitted to the Department of Water and Sanitation (DWS) on 17 July 2023. A request for a pre-application meeting was received on 11 August 2023. A site visit/ meeting with the DWS officials was convened on 31 August 2023. From the site visit/ meeting, MC was requested by the DWS to submit on behalf of South Deep JV: South Deep Gold Mine, an IWULA for the consolidation and amendment of the WULs granted to South Deep JV: South Deep Gold Mine as well as incorporating new activities proposed to be conducted for future proofing the mining operation. DWS also advised that South Deep JV: South Deep Gold Mine also considers investigating water uses within the entire mine, so that a consolidated application is submitted for the issuance of an amended Integrated Water Use License (IWUL), which would cover all water uses which might not have been authorised.

MC conducted five (5) days of site visits in the presence of the South Deep JV: South Deep Gold Mine team. The site visits were undertaken to understand the receiving environment and the current activities. A screening exercise has been undertaken to determine the applicable activities and the relevant legislation and necessity for application to be lodged with the DWS.

An authority's meeting was convened with the DWS on 09 May 2025 to present the findings of the investigation/ assessment of the water uses within the entire mine. MC was advised to submit the Phase 1 documentation, outlining all the water uses identified (authorised and to be authorised). Phase 1 Application: Application details based on the outcome of the pre-application meeting were uploaded. The documentation was submitted on 06 November 2025.

Another site visit was conducted on 10 February 2026, in the presence of the DWS representatives and South Deep: South Deep Gold Mine representatives. Based on the outcome of the meeting, DWS reopened Phase 1 for submission of additional information; and correction of the water uses being applied for on 13 May 2026.

This Draft IWWMP is being subjected to Public Participation Process (PPP) for commenting and forms part of the application for Phase 3 submission. The report is being made available for a 60-day review and comment period from **Friday, 10 July 2026 to Thursday, 10 September 2026**. The IWWMP will be finalised for submission to DWS as part of the technical documents for decision making.

The proposed WUL and its addendum amendments, and consolidation project requires a Section 21 (a), (b), (c), (e), (f), (g), (i), (j) WULA, for the following water uses:

Water Use activities for Section 21 (a)

Description/ Purpose (Proposed)
SCTS-01 (TS-BH01) Abstraction of water from Twin Shaft SCTS-01 borehole for mining purposes
SCSS-03 (A4) Abstraction of water from old RWD seepage interception borehole SCSS-03 to reduce the pollution plume. The water is disposed (recycled back) to the RWD
SCSS-44 (A5-1) Abstraction of water from Scavenger borehole SCSS-44 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-02 (A5-2) Abstraction of water from old RWD seepage interception SCSS-02 to reduce the pollution plume. The water is disposed (recycled back) to the RWD
SCSS-01 (A5-3) Abstraction of water from Scavenger borehole SCSS-01 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-45 (A5-4) Abstraction of water from Scavenger borehole SCSS-11 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-06 (A5-5) Abstraction of water from Scavenger borehole SCSS-06 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-46 (A5-6) Abstraction of water from Scavenger borehole SCSS-46 to reduce the pollution plume and disposal in RWD
SCSS-08 (A6-1) Abstraction of water from Scavenger borehole SCSS-08 below old TSF to reduce the pollution plume and disposal in RWD
SCDP-20 (A6-2) Abstraction of water from scavenger SCDP-20 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCSS-04 (SDS17) Abstraction of water from Scavenger borehole SCSS-04 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-05 (SDS18) Abstraction of water from Scavenger borehole SCSS-05 below old TSF to reduce the pollution plume and disposal in RW
SCSS-07 (SPD02) Abstraction of water from Scavenger borehole SCSS-07 below old TSF to reduce the pollution plume and disposal in RWD
SCSS-09 (SCSS-09) Abstraction of water from Scavenger borehole SCSS-09 below old TSF to reduce the pollution plume and disposal in RWD
WASS-01 (BH1) Abstraction of water for South Shaft borehole WASS-01 for mining purpose 1
WASS-04 (BH4) Abstraction of water for South Shaft borehole WASS-04 for mining purpose 2
WASS-05 (BH5) Abstraction of water for South Shaft borehole WASS-05 for mining purpose 3
SCDP-11 (BH1) Abstraction of water from Scavenger borehole SCDP-11 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
Abstraction of water from Leeuspruit for mining purposes
SCDP-12 (SC31) Abstraction of water from Scavenger borehole SCDP-12 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-01 (SC43) Abstraction of water from Scavenger borehole SCDP-01 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-02 (SC61) Abstraction of water from Scavenger borehole SCDP-02 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-03 (SC54) Abstraction of water from Scavenger borehole SCDP-03 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-04 (SC84) Abstraction of water from Scavenger borehole SCDP-04 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-05 (82) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-06 (SC38) Abstraction of water from Scavenger borehole SCDP-06 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-07 (SC65) Abstraction of water from Scavenger borehole SCDP-07 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-08 (SC60) Abstraction of water from Scavenger borehole SCDP-08 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-09 (SC59) Abstraction of water from Scavenger borehole SCDP-09 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-10 (SC50) Abstraction of water from Scavenger borehole SCDP-10 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-13 (SC40) Abstraction of water from Scavenger borehole SCDP-13 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-14 (SC46) Abstraction of water from Scavenger borehole SCDP-14 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD

Description/ Purpose (Proposed)
SCDP-15 (SC49) Abstraction of water from Scavenger borehole SCDP-15 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-16 (SC51) Abstraction of water from Scavenger borehole SCDP-16 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-17 (SC54R) Abstraction of water from Scavenger borehole SCDP-17 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-18 (SC67) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-19 (SC45) Abstraction of water from Scavenger borehole SCDP-19 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-21 (EP3) Abstraction of water from Scavenger borehole SCDP-21 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-22 (EP7) Abstraction of water from Scavenger borehole SCDP-22 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
SCDP-23 (EP3-A) Abstraction of water from Scavenger borehole SCDP-23 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD
WADP-01 (WADP-01) Abstraction of water from borehole WADP-01 for domestic use at the Doornpoort offices
WADP-02 (WADP-02) Abstraction of water from borehole WADP-02 for domestic use at the Doornpoort offices
DP-Sump 1 (Sump 1) for collection of stormwater from the Doornpoort TSF for disposal into the RWD
DP-Sump 2 (Sump 2) for collection of stormwater from the Doornpoort TSF for disposal into the RWD
DP-Sump 3 (Sump 3) for collection of stormwater from the Doornpoort TSF for disposal into the RWD
DP-Sump 4 (Sump 4) for collection of stormwater from the Doornpoort TSF for disposal into the RWD

Water Use activities for Section 21(b)

Description/ Purpose (Proposed)
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 1
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 2
Storage of Potable Water - South Shaft 35m Potable Water Reservoir

Water Use activities for Section 21(c and i)

Description/ Purpose (Proposed)
Haul Road and flow meter installation (crossing Kariegaspruit)
Existing river diversion of Leeuspruit and flow meter installation in the diversion
Pipeline Crossing - Kariegaspruit
Haul Road crossing Leeuspruit River and flow meter -old entrance to South Shaft. The road is an existing road with a new meter installation
Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road
South shaft storm water separation system which runs through a wetland
Topsoil Stockpile
Wetland Rehabilitation
Old RWD Decommissioning and Wetland Rehabilitation
WWTW within 500m radius from the edge of the wetland
RWD upgrade
Backfill Plant Area (x5 Mine Water Tanks)
Discharge of treated water from the RO Plants
South Shaft: 2x pipes (to transport water to the Twin and the South Shaft)
Khanyisa Solar Plant
Twin Shaft and associated infrastructure
South Shaft and Associated Infrastructure

Water Use activities for Section 21(e)

Description/ Purpose (Proposed)
Irrigation of old TSFs (Phase 1) with water from the RWD for maintenance of grassed areas (730 000m ³ /a) – area of 240ha
Irrigation of old TSFs (Phase 2) with water from RWD for maintenance of grassed areas (730 000m ³ /a) – area of 240ha
Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas (730 000m ³ /a) – area of 240ha
Irrigation of shaft areas with water from Twin shaft PCD (365 000m ³ /a) – area of 240ha
Irrigation of all TSFs with final effluent from WWTW (912 500m ³ /a) – area of 960ha

Water Use activities for Section 21(f)

Description/ Purpose (Proposed)
Discharging water into the Leeuspruit (730 000 m ³ /a) of purified sewage effluent, based on maximum quantity of 2 500m ³ /day) into Leeuspruit.
Discharge of excess underground water (1 095 000m ³ /a).
Discharge of treated water from the RO Plants

Water Use activities for Section 21(g)

Description/ Purpose (Proposed)
Disposing 1 560 000 tonnes of gold slurry as backfill into the mined-out workings underground.
Disposing 20 400 sewage sludge into the drying beds.
Disposing a maximum quantity of 584 000 tonnes of waste rock into the WRD.
Disposing quantity of 1000 000 of waste water from the Doornpoort TSF into the RWD.
Twin Shaft PCD at 62 400m ³ /a
Cascade Dams (16x3 000m ³ /a) (12 unlined and 4 PVC lined).
South Shaft RWD to be decommissioned and rehabilitated (52 487m ³ /a)
Settlers A & B (2 x 650m ³ /a)
Mine Water Tanks (2 x 2 200m ³ /a)
Condenser Dams at the Refrigeration Plant for condensation (200m ³ /a)
Thickeners at old Gold Plant area (5 x 3 500 m ³ /a)
Upgraded South Shaft RWD (150 624m ³ /a)
Gold Plant PCD (2 x 3 500m ³ /a)
Refrigeration Dams (4 x 2 800)
Refrigeration Dam (1 x 2 800)
Dust suppression with waste water from upgraded RWD on all haul roads (365 000m ³ /a) over 3 566ha.
Backfill Plant Area (x5 Mine Water Tanks)
Cascade Dams (South of TSF 3 and 4)
Disposing 1 200 000 tonnes per annum of gold slurry at Doornpoort TSF

Water Use activities for Section 21(i)

Description/ Purpose (Proposed)
Removing a volume not exceeding 1 824 996 m ³ /a of groundwater for efficient continuation of mine or safety of people, for use in the process.

IMPACTS AND MANAGEMENT OF WATER USES

Potential impacts and mitigation measures have been identified, management objectives, strategy and operational action plan has been developed based on the Best Practice Guidelines (BPGs) for mining, applicable commitments and specialists' reports recommendations.

The table below represents a summary of the significance of impacts identified during the project lifetime. The table only highlights the impacts that are water related.

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Significance After Mitigation
CONSTRUCTION PHASE					
Section 21 (c) and (i)	- The activities are located within the regulated area of two (2) watercourses, namely UVB01 and CVB01. - No construction/ rehabilitation activities are expected to take place within CVB01. - Construction/ rehabilitation	Direct disturbance of aquatic habitat and ecological structure within the catchment area of the at-risk watercourses associated with the proposed activities.	Aquatic Habitat and Ecological Connectivity	• Moderate	• Low

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Significance After Mitigation
	activities within UVB01 will likely disturb the current habitat structure and functionality and may result in the proliferation of Alien Invasive Plant Species (AIPS) encroaching into the disturbed area if not managed appropriately, which presents a risk of reduced biodiversity and ecosystem functionality.				
Section 21 (c) and (i)	- Excess bare soil and sedimentation created from construction/ rehabilitation activities may enter the adjacent watercourses and deteriorate the water quality in comparison to the baseline conditions presented herein. - The introduction of hydrocarbon sources and concrete mix poses a risk of contamination occurring if mitigation measures are not implemented.	Indirect alteration of the water quality within the at-risk and downstream watercourses.	Water Quality	Moderate	Low
Section 21 (c) and (i) Section 21 (f)	- The hardened surfaces created by the construction/ rehabilitation of the proposed activities will reduce the area of vegetation and infiltration surface, as well as alter the current hydrological flow regime within the catchment area. - This could lead to erosion features developing downslope of the structures if adequate flow management systems are not integrated into the overall design of the proposed activities.	Direct alteration of the catchment landscape and hydrological flows.	Catchment Landscape and Hydrological Flows	Moderate	Low
Section 21 (c) and (i)	The disturbance of freshwater ecosystems as a result of construction/ rehabilitation activities and associated infrastructure may alter the ability of the freshwater ecosystems to provide valuable regulating and supporting, as well as cultural and provisioning, benefits to the surrounding anthropogenic and natural environments.	Indirect alteration of the ecosystem services provided by freshwater ecosystems within the study area.	Ecosystem Service Provision	Low	Low
Section 21 (c) and (i) Section 21 (f)	Discharging activities.	- Impacts on Hillslopes - Soil erosion and bank instability due to increase in water	Hydropedological Cycle	Low	Low

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Significance After Mitigation
		flow. • Contamination of soil and water due to leaks from the infrastructure and from water being discharged.			
OPERATIONAL PHASE					
Section 21 (f)	• The discharge of treated wastewater into the receiving watercourse may result in deteriorated water quality if appropriate mitigation and monitoring measures are not implemented.	• Direct alteration of the water quality within the at-risk and downstream watercourses.	• Water Quality	• Moderate	• Low
Section 21 (c) and (i) Section 21 (f) Section 21 (g)	• The hardened surfaces created by the proposed activities may result in altered land cover and the discharge of treated wastewater may result in additional alteration of the hydrological regime.	• Direct alteration of the catchment landscape and hydrological flows.	• Catchment Landscape and Hydrological Flows	• Moderate	• Moderate
Section 21 (a) Section 21 (c) and (i) Section 21 (f) Section 21 (g) Section 21 (j)	• Underground fissure water and scavenger well abstraction poses no tangible impact on either the Leeuspruit system. This is evident from long term water level monitoring data, and from current and previous modelling studies indicating no loss of the baseflow component. ✓ Dewatering from the underground does not extend to surface, with deeper aquifer dewatering limited to fissure water that does not extend to the baseflow component of the regolith (unsaturated) and weathered aquifer. ✓ Scavenger well abstraction cones of depression are limited to within 100 m of the positions of these wells, and do not extend to beyond the mining rights (	• Loss of flow to aquatic systems due to dewatering, and potential contaminant contributions.	• Aquatic biodiversity of the Leeuspruit.	• Low	• Low
Section 21 (a) Section 21 (c) and (i) Section 21 (e) Section 21 (f) Section 21 (g) Section 21 (j)	• As in the case of aquatic systems, dewatering and scavenger wells has no tangible impact on privately used boreholes. This is evident from long-term water level monitoring data, and from current and		• Privately boreholes used for potable, livestock, and irrigation usage.	• Low	• Low

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Significance After Mitigation
	previous modelling studies. ✓ Dewatering from the underground does not extend to surface, with deeper aquifer dewatering limited to fissure water that does not extend to the baseflow component of the regolith (unsaturated) and weathered aquifer. ✓ Scavenger well abstraction cones of depression are limited to within 100 m of the positions of these wells, and do not extend to beyond the mining rights				
REHABILITATION PHASE					
Section 21 (c) and (i)	• Subsequent to the end of the construction/ rehabilitation phase, the disturbed areas around the proposed activities footprint will be rehabilitated to pre-construction/ rehabilitation (or better) conditions. • This may result in an improvement of the condition of the downstream watercourses if all mitigation measures presented herein are strictly implemented and subsequently monitored.	• Improvement of the aquatic habitat and ecosystem structure adjacent to the proposed activities site.	• Aquatic Habitat and Ecological Structure	• Low	• Low

CONCLUSION

South Deep JV: South Deep Gold Mine was originally granted a WUL in terms of Chapter 4 of the NWA on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369). From 2016 to 2017, South Deep JV: South Deep Gold Mine identified some errors on the issued WUL i.e. the amendments to quantities which were contrary to what was applied for. Other amendments included the addition of scavenger boreholes mainly established to control the pollution plume around the TSFs and RWDs, for the removal and containment of contamination from the TSFs by abstracting contaminated water from the aquifers. The WUL was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705). The 2018 WUL also had errors. An addendum to the issued WUL was issued on 29 July 2021.

South Deep JV: South Deep Gold Mine is required to compile and submit for approval, an IWULA for the following NWA Section 21 water uses: Section 21 (a), (b), (c), (e), (f), (g), (i), (j).

A pre- application enquiry was submitted on 17 July 2023. A request for a pre-application meeting was received on 11 August 2023. A site visit/ meeting with the DWS officials was convened on 31 August 2023. From the site visit/ meeting, MC was requested by the DWS to submit on behalf of South Deep JV: South Deep Gold Mine, a IWULA for the consolidation and amendment of the WULs granted to South Deep JV: South Deep Gold Mine as well as incorporating new activities proposed to be conducted for future proofing the mining operation. DWS also advised that South Deep JV: South Deep Gold Mine also considers investigating water uses within the

entire mine, so that a consolidated application is submitted for the issuance of an amended WUL, which would cover all water uses which might not have been authorised.

MC conducted five (5) days of site visits in the presence of the South Deep JV: South Deep Gold Mine team. The site visits were undertaken to understand the receiving environment and the current activities. A screening exercise has been undertaken to determine the applicable activities and the relevant legislation and necessity for application to be lodged with the DWS.

An authority's meeting was convened with the DWS on 09 May 2025 to present the findings of the investigation/assessment of the water uses within the entire mine. MC was advised to submit the Phase 1 documentation, outlining all the water uses identified (authorised and to be authorised). Phase 1 Application: Application details based on the outcome of the pre-application meeting were uploaded. The documentation was submitted on 06 November 2025.

Another site visit was conducted on 10 February 2026, in the presence of the DWS representatives and South Deep: South Deep Gold Mine representatives. DWS are yet to reopen Phase 1 for submission of additional information; and correction of the water uses being applied for.

The IWWMP is a living document that will be revised and updated throughout the life of the operations of the proposed WUL and its addendum amendments, and consolidation project and its associated infrastructure, to accommodate additional information and improved technologies. This will ensure that water and waste management is continually optimised and adapted to the changing needs of the proposed project at West Mine and the WMA.

TABLE OF CONTENTS

SECTION 1: PROJECT INTRODUCTION AND BACKGROUND	1
1-1 Details of the Environmental Assessment Practitioner	2
1-2 South Deep JV: South Deep Gold Mine Details	3
1-3 Regional setting and location of activity	3
1-4 Property Description	3
1-5 Objectives/ Purpose of the IWWMP	4
SECTION 2: DESCRIPTION OF THE SCOPE OF THE ACTIVITY	10
2-1 Approved Water Uses	10
2-2 Water Uses TO BE consolidated	15
SECTION 3: DESCRIPTION OF CURRENT AND PROPOSED ACTIVITIES	21
3-1 Current Activities	21
3-2 Extent of activity	24
3-3 Key related Activities, processes and products	26
3-4 Key water uses applied for	27
3-5 Key Water Uses and Waste Streams	54
3-6 Organisational structure of activity	55
SECTION 4: POLICY AND LEGAL CONTEXT	60
4-1 Summary of all water uses	62
4-2 Existing lawful water uses	63
4-3 Generally authorised water uses	66
SECTION 5: SPECIFIC BASELINE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITE	68
5-1 Geology	68
5-2 Topography and Drainage	68
5-3 Hydrogeology	68
5-4 Climate	73
5-5 Terrain	76
5-6 Soils and Hydropedology	78
5-7 Terrestrial Ecology (Flora and Fauna)	86
5-8 Aquatic Ecology	91
5-9 Surface Hydrology	97
5-10 Soils, Vegetation and Land Cover	99
5-11 Ground Water	103
5-12 Aquatic Biomonitoring and Toxicity testing	113
5-13 Socio-economic environment	116
SECTION 6: ANALYSES AND CHARACTERISATION OF ACTIVITY	120
6-1 Site delineation for characteriSation	120
6-2 Storm water	126
6-3 Water balance	132
6-4 Groundwater Model	146
6-5 Waste	155
6-6 Organisational structure	160
6-7 Resources and competence	160
6-8 Education and training	160
6-9 Internal and external communication	161
6-10 Awareness raising	161
6-11 Monitoring and control	162
6-12 Risk Assessment/Best Practice Assessment	168
6-13 Issues and responses from public consultation processes	177
6-14 Matters requiring attention/Nproblem statement	179
6-15 Assessment of level of information and confidence of information	184
SECTION 7: WATER AND WASTE MANAGEMENT	187

7-1	Water and Waste Management Philosophy	187
7-2	Strategies	187
7-3	Performance objectives/goals.....	189
7-4	Measures to achieve and sustain performance objectives.....	189
7-5	OPTION ANALYSIS AND MOTIVATION FOR THE IMPLEMENTATION OF PREFERRED OPTIONS	190
7-6	Integrated Water and Waste Management Plan action plan	204
7-7	Control and monitoring.....	209
7-8	monitoring programme and audit plan.....	209
7-9	Monitoring of change in baseline information	211
7-10	Audit report on performance measures	211
7-11	Audit and report on relevance of IWWMP action plan.....	211
SECTION 8:	CONCLUSION.....	213
SECTION 9:	REFERENCES	214

LIST OF TABLES

Table 1: Water Uses that were Incorporated into the WUL 2018.....	10
Table 2: Water Use activities for Section 21(a)	15
Table 3: Water Use activities for Section 21(b)	17
Table 4: Water Use activities for Section 21(c and i)	17
Table 5: Water Use activities for Section 21(e)	18
Table 6: Water Use activities for Section 21(f)	19
Table 7: Water Use activities for Section 21(g)	19
Table 8: Water Use activities for Section 21(j)	20
Table 9: Water Use activities for Section 21 (a).....	27
Table 10: Water Use activities for Section 21(b)	37
Table 11: Water Use activities for Section 21(c and i)	38
Table 12: Water Use activities for Section 21(e)	43
Table 13: Water Use activities for Section 21(f)	46
Table 14: Water Use activities for Section 21(g)	47
Table 15: Water Use activities for Section 21(j)	53
Table 16: Identified waste streams at South Deep JV: South Deep Gold Mine.....	55
Table 17: Water and waste management legal and regulatory framework requirements.....	60
Table 18: South Deep JV: South Deep Gold Mine IWULs	63
Table 19: Government Notice 704 Assessment (DWS, 2010).....	65
Table 20: Average Monthly Rainfall Distribution (mm).....	73
Table 21: DRESSA 24-hour rainfall depth.....	74
Table 22: Monthly A-Pan Equivalent Potential Evaporation.....	74
Table 23: Fb5 terrain units (ARC, 2006).....	79
Table 24: Ba1 terrain units (ARC, 2006)	79
Table 25: Soils identified on-site.....	80
Table 26: Hydropedological soil groups present on site.....	85
Table 27: Aquifer Vulnerability Rating	103
Table 28: Ratings – Aquifer System Management and Second Variable Classifications	104
Table 29: Ratings - Groundwater Quality Management Classification System.....	104
Table 30: GQM Index for the Study Area	105
Table 31: Hydrochemistry Results for boreholes tested at Gold Fields	107
Table 32: Estimated Recharge Calculation Summary.....	109
Table 33: Groundwater Abstraction Summary	109
Table 34: Water Balance Summary.....	110
Table 35: Project Area Water Balance Summary.....	110

Table 36: Categories of Abstraction	110
Table 37: Summarised Conceptual Site Model (CSM).....	112
Table 38: Biomonitoring Testing Points	113
Table 39: Population by sex	116
Table 40: Population by age band	116
Table 41: Population group	116
Table 42: Population by language most spoken at home	117
Table 43: Population by highest education level	117
Table 44: Population by main dwelling type	118
Table 45: Population by Source of water.....	118
Table 46: Population by type of toilet facilities	118
Table 47: Population by Refuse (rubbish) service.....	119
Table 48: Summary of the Wastewater Treatment Specifications	120
Table 49: South Deep JV: South Deep Gold Mine Process and Potable Water.....	122
Table 50: Summary Water Balance for the Underground Workings (Period January 2022 to September 2024)	133
Table 51: Summary Water Balance for Refrigeration Plant and Mine Water Tank (Period January 2022 to September 2024)	133
Table 52: Summary water balance for remining (Period January 2022 to September 2024)	136
Table 53: Summary of Gold Plant water balance (Period January 2022 to September 2024)	137
Table 54: Summary of Gold Plant PCD Water Balance (Period January 2022 to September 2024)	138
Table 55: Summary of calibration results on Twin Shaft PCD (Period January 2022 to September 2024)....	139
Table 56: Summary of Twin Shaft PCD water balance (Period January 2022 to September 2024)	140
Table 57: Summary Water Balance for SCT plant (Period January 2022 to September 2024).....	140
Table 58: Summary Water Balance for Backfill RO plant (Period January 2022 to September 2024).....	142
Table 59: Summary of Doornpoort TSF and RWD Water Balance (Period January 2022 to September 2024)	143
Table 60: Summary of TSF 3 and 4 as well as TSF 1 and 2 water balance (Period January 2022 to September 2024).....	144
Table 61: Types of domestic and industrial waste generated by South Deep Gold Mine.....	157
Table 62: Surface Water Quality Monitoring Location.....	162
Table 63: Water quality parameters relevant for sampling.....	162
Table 64: Quality of wastewater to be discharged	163
Table 65: Current Groundwater monitoring points for South Deep Gold Mine	163
Table 66: Proposed Additional boreholes to be included in the groundwater monitoring programme	164
Table 67: BPGs applicable to this IWWMP	168
Table 68: Summary of Project Activities.....	169
Table 69: Likelihood descriptors and definitions	170
Table 70: Residual risk categories	170
Table 71: Levels of Risk	170
Table 72: Listing of descriptors and associated definitions to determine the extent of an impact.	171
Table 73: Listing of descriptors and associated definitions to determine the duration of an impact.	172
Table 74: Summary of impacts and mitigation measures	173
Table 75: Observations and photographic references at Discharge Point (Option 1) - preferred option	190
Table 76: Observations and photographic references at Discharge Point (Option 2).....	191
Table 77: Observations and photographic references at Doornpoort discharge point.....	192
Table 78: Proposed ecological engineering strategies for optimising the Leeuspruit wetland area at SDGM	199
Table 79: IWWMP Action Plan	205
Table 80: Proposed Monitoring Programme and Audit Plan	210

LIST OF FIGURES

Figure 1: Project Locality Map	6
--------------------------------------	---

Figure 2: Mine Layout Plan.....	7
Figure 3: South Deep JV: South Deep Gold Mine Freehold areas	8
Figure 4: Land Tenure Map	9
Figure 5: Three-dimensional cross-section of South Deep Gold Mine.....	22
Figure 6: South Deep Gold Mine Flow Process	25
Figure 7: South Deep JV: South Deep Gold Mine Organogram Business and Corporate Policies	56
Figure 8: Topography and drainage	70
Figure 9: Geological map of the study area.....	71
Figure 10: Hydrogeological classification map (Vegter, 1995).....	72
Figure 11: Average Monthly Climate for the site	73
Figure 12: Weather Stations and Mean Annual Precipitation.....	75
Figure 13: Terrain and Hydrology	77
Figure 14: Terrain Morphological Units (LTSS, 1972 – 2006).....	78
Figure 15: Fb5 land type (ARC, 2006).....	78
Figure 16: Ba1 land type (ARC, 2006)	79
Figure 17: Red apedal B horizon.....	81
Figure 18: Yellow-brown B horizon.....	81
Figure 19: Shallow, rocky soils	82
Figure 20: Lithic material in the subsoil horizon.	82
Figure 21: Soil forms and families present on site	83
Figure 22: Hydopedological soil groups present on site	84
Figure 23: Gauteng Biodiversity Conservation Plan units relevant to the study area	88
Figure 24: Threatened Ecosystems and Protected Areas within and surrounding the study area	89
Figure 25: Terrestrial vegetation types situated within the study area	90
Figure 26: NFEPA wetlands and rivers relevant to the study area	92
Figure 27: NFEPA wetlands and rivers and National Wetland Map 5 relevant to the study area	93
Figure 28: Wetland vegetation types situated within the study area	94
Figure 29: Map illustrating the overall watercourse delineation for the study area	96
Figure 30: Hydrological Map.....	100
Figure 31: Vegetation and Soil Runoff Potential	101
Figure 32: Land Cover	102
Figure 33: Map indicating the sulphate (SO ₄) distribution.	108
Figure 34: Biomonitoring Points Map	115
Figure 35: South Deep Mine delineation map	125
Figure 36: Dirty and Clean Water Areas.....	127
Figure 37: Typical berm and channel for stormwater diversion system	128
Figure 38: Stormwater Management Plan (South Shaft)	129
Figure 39: Stormwater Management Plan (Twin Shaft and Doornpoort).....	130
Figure 40: Schematic Water Reticulation/ Water Balance	135
Figure 41: Comparison of simulated and measured volumes in Gold Plant PCD.....	137
Figure 42: Comparison of simulated and measured volumes in Gold Plant PCD.....	138
Figure 43: Plot of Backfill RO plant supply, potable product and brine volumes.....	142
Figure 44: Plot of simulated and measured volumes in the Doornpoort RWD.....	143
Figure 45: Plot comparing measured and simulated water volumes stored in the upgraded RWD.....	145
Figure 46: Summary water balance for the upgraded RWD (Period January 2022 to September 2024).....	146
Figure 47: Dewatering scenario (Existing scavenger wells).....	148
Figure 48: Dewatering scenario (Existing + Future scavenger wells)	149
Figure 49: Unmitigated plume – 10 years.....	150
Figure 50: Unmitigated plume – 25 years.....	151
Figure 51: Unmitigated plume – 50 years.....	152
Figure 52: Mitigated plumes after 10 years with scavenger wells.....	153
Figure 53: Mitigated plumes after 10 years with scavenger wells.....	154
Figure 54: Surface Water Monitoring Localities	165

Figure 55: Locality of Ground Water Monitoring boreholes at South Deep Gold Mine	166
Figure 56: Additional Ground Water Monitoring Boreholes consolidation for WUL amendment	167
Figure 57: Proposed discharge direction and spread.....	195
Figure 58: Typical chute design (Russel, 2009).	196
Figure 59: Leeuspruit Wetland Area to be rehabilitated with the TSF complex circled in red.....	197

LIST OF APPENDICES

Appendix A:	EAP's Details
Appendix B:	WUL granted on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369); amended WUL issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705); and an addendum to the issued WUL which was issued on 29 July 2021
Appendix C:	Infrastructure Layout Plan
Appendix D:	Engineering Design Reports
Appendix E:	Flood Hydrological Assessment and Conceptual Stormwater Management Plan
Appendix F:	Hydrogeological Assessment Report
Appendix G:	Groundwater Assessment and Numerical Groundwater Flow Model Report
Appendix H:	Aquatic Biodiversity Assessment Report
Appendix I:	Rehabilitation and Plant Species Plan
Appendix J:	DWS Correspondence
Appendix K:	South Deep JV: South Deep Gold Mine GN 704 Exemptions
Appendix L:	South Deep JV: South Deep Gold Mine Certificate of Registration (CoR-18) issued by the NNR for their South Deep Gold Mine operations
Appendix M:	Continuous Transport Permit No. CPT 204313, issued by South African Police Services (SAPS)
Appendix N:	Detailed Surface Water Quality Results
Appendix O:	Public Participation Process Information
Appendix P:	Motivation in terms of Section 27(1) of the NWA

LIST OF ABBREVIATIONS

ABET	Adult Basic Education and Training
AHR	Area of Hydrological Relevance
AIPs	Alien Invasive Plant species
ARD	Acid Rock Drainage
AOI	Area Of Interest
ASPT	Average Score Per Taxon
BBBEE	Broad Based Black Economic Empowerment
BIDs	Background Information Documents
BPGs	Best Practice Guidelines
CBA	Critical Biodiversity Area
CEO	Chief Executive Officer
CER	Contractor's Environmental Representative
CIP	Carbon-in-pulp
CMA	Catchment Management Agencies
CMS	Catchment Management Strategy
COD	Chemical Oxygen Demand
CR	Critically Endangered
CRR	Comments and Responses Report
CSM	Conceptual Site Model
CV	Curriculum Vitae
CVB	Channelled Valley Bottom
DFFE	Department of Forestry, Fisheries and the Environment

DMPR	Department of Mineral and Petroleum Resources
DO	Dissolved Oxygen
DRESSA	Design Rainfall Estimation Software for South Africa
DSM	Digital Surface Model
DTM	Digital Terrain Model
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
EC	Electrical Conductivity
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ELU	Existing Lawful Use
EMPr	Environmental Management Programme
EMS	Environmental Management System
EPL	Environmental Pollution Laboratory
ESAs	Ecological Support Areas
FRAI	Fish Response Assessment Index
FSL	Full Supply Level
FTWs	Floating Treatment Wetlands
GA	General Authorisation
GFI Holdings	GFI Joint Venture Holdings (Pty) Limited
GFO	Gold Fields Operations Limited
GDEnv	Gauteng Department of Environment
GIS	Geographic information system
GPS	Global Positioning System
GQM	Groundwater Quality Management
GR	Groundwater Reserve
GRAII	South African Groundwater Resource Assessment Ver. 2
GRD	Groundwater Reserve Determination
HGM	Hydro-Geomorphic Unit
HRT	High-rate thickener
HRUs	Hydrological Response Units
HSEC	Health, Safety, Environment and Community
HSTs	hydrological soil types
ICMM	International Council on Mining and Metals
IUCN	International Union for Conservation of Nature
IHAS	Integrated Habitat Assessment
IWRM	Integrated Water Resources Management
IWWMP	Integrated Water and Waste Management Plan
IWUL	Integrated Water Use Licence
IWULA	Integrated Water Use Licence Application
IHI	Index of Habitat Integrity
I&APs	Interested and Affected Parties
JV	Joint Venture
LPG	Liquefied Petroleum Gas
LSUs	Landscape units
LiDAR	Light Detection and Ranging
LoM	Life of Mine
LX	Lixisols
mamsl	meters above mean sea level
MAP	Mean annual precipitation
mbgl	meters below ground level
MC	Manyabe Consultancy (Pty) Ltd
MEC	Member of the Executive Committee

MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MR	Mining Right
Necsa	South African Nuclear Energy Corporation
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geospatial Institute
NIWIS	National Integrated Water Information System
NNR	National Nuclear Regulator
NNRA	National Nuclear Regulator Act, 1999 (Act No. 47 of 1999)
NORM	Naturally Occurring Radioactive Material
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWRS	National Water Resource Strategy
OHSA	Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
PAG	Potentially Acid Generating
PAs	Protected Areas
PCD	Pollution Control Dam
PES	Present Ecological State
POPI	Personal Information Act, 2013 (Act No. 4 of 2013)
PPP	Public Participation Process
PRPP	Public Radiation Protection Programme
PSP	Professional Service Provider
RAM	Risk Assessment Matrix
RHP	River Health Programme
RI	Recurrence Interval
RMOs	Recommended Management Objectives
RO	Reverse Osmosis
RQOs	Resource Quality Objectives
RWCLM	Rand West City Local Municipality
RWDs	Return Water Dams
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professions
SAG	Semi-Autogenous Grinding
SANAS	South African National Accreditation System National
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAPS	South African Police Services
SAR	Sodium Absorption Ratio
SASS5	South African Scoring System Version 5
SAWAQ	South African Water Quality
SAWS	South African Weather Services
SCT	Semi-classified tailings
SFCW	Surface Flow Constructed Wetland
SHE	Safety, Health and Environmental
SSFCW	Subsurface Flow Constructed Wetland
Stats SA	Statistics South Africa
SWMP	Stormwater Management Plan
TDS	Total Dissolved Solids
TMU	Terrain Morphological Unit
TOPS	Threatened and/or Protected Species
TSF	Tailings Storage Facility
TUT	Tshwane University of Technology
TWQR	Target Water Quality Range
UFS	University of Free State
UN	United Nations
UNISA	University of Southern Africa
UVB	Unchannelled Valley Bottom

VCRs	Ventersdorp Contact Reef
WARMS	Water Authorisation and Registration Management System
WMA	Water Management Area
WRB	World Reference Base
WRC	Water Research Commission
WRD	Waste Rock Dump
WRDM	West Rand District Municipality
WUL	Water Use License
WULA	Water Use License Application
WWTW	Waste Water Treatment Works

SECTION 1: PROJECT INTRODUCTION AND BACKGROUND

Gold Fields Operations Limited (GFO) and GFI Joint Venture Holdings (Pty) Limited (GFI Holdings) acting jointly in their capacities as participants in an unincorporated joint venture (JV) known as South Deep JV: South Deep Gold Mine appointed Manyabe Consultancy (Pty) Ltd (hereinafter referred to as MC), as a Professional Service Provider (PSP) - Environmental Assessment Practitioner (EAP), to consolidate and amend the Water Use License (WUL) and its addendum, granted to South Deep JV: South Deep Gold Mine.

The mine is located in Westonaria, Rand West City Local Municipality (RWCLM), within the West Rand District Municipality (WRDM). South Deep Gold Mine is situated in the magisterial district of Westonaria, approximately 45 km south-west of Johannesburg and 10 km south of Westonaria, in the Gauteng Province as indicated in Figure 1. It is accessed via the R28 provincial road between Westonaria and Vereeniging or from the N12 provincial road between Johannesburg and Potchefstroom and is located in the major gold mining region of South Africa, the Witwatersrand Basin.

The main properties on which the mine falls are Doornpoort 347 IQ; and Modderfontein 345 IQ. The mine lease area is shown in Figure 2. While the Doornpoort Tailings Storage Facility (TSF) lies outside of the mine lease area, it is located on property that is owned by the mine as indicated in the Freehold areas in Figure 3. The South Deep Gold Mine boundary area comprises of an area of approximately 7 452 hectares. The mine has been operational since the 1970s. The current Life of Mine (LoM) is estimated to be 76 years (2098). Not only will South Deep Gold Mine be a valuable asset to the Gold Fields Group for decades to come, but it is likely to be the last gold mine in South Africa, with most other mines having run out of reserves by then. It is estimated that the South Deep Gold Mine contains more than 80 470 gold bullion bars of golds, which can be mined by means of underground mining methods during the 76 years of current LoM. The extent of mine activity is depicted in Figure 1.

South Deep JV: South Deep Gold Mine is the holder of the Mining Right (MR) which was granted by the Department of Mineral and Petroleum Resources (DMPR) in 2010. The MR affords South Deep JV: South Deep Gold Mine the right to mine gold, silver, nickel, uranium, copper and pyrite. The MR was converted in terms of Item 7 of Schedule II of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) in respect of a mining area measuring 4,268 hectares, registered in the Mineral and Petroleum Titles Registration Office and is valid for the period ending 12 July 2040.

South Deep JV: South Deep Gold Mine was originally granted a WUL in terms of Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369). From 2016 to 2017, South Deep JV: South Deep Gold Mine identified some errors on the issued WUL i.e. the amendments to quantities which were contrary to what was applied for. Other amendments included the addition of scavenger boreholes mainly established to control the pollution plume around the TSFs and Return Water Dams (RWDs), for the removal and containment of contamination from the TSFs by abstracting contaminated water from the aquifers. The WUL was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705). The 2018 WUL also had errors. An addendum to the issued WUL was issued on 29 July 2021 (Refer to Appendix B for WULs and Addendum).

The WUL authorises the following water uses, under Section 21 of the act:

- (a) Taking of water from a water resource.
- (c) Impeding or diverting the flow of water in a watercourse.
- (e) Engaging in a controlled activity.
- (f) Discharging waste or water containing waste into a water resource through a pipe, canal, canal, sewer or other conduit.
- (g) Discharging waste or water containing waste into a water resource.
- (i) Altering the bed, banks course or characteristics of a watercourse.
- (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

South Deep JV: South Deep Gold Mine has been operational for over 50 years and is engaged in underground mining comprising one metallurgical plant and two operating shaft systems: South Shaft complex and Twin Shaft complex. The South Shaft complex includes a main shaft and three sub-vertical shafts, two of which are operational. The Twin Shaft complex consists of a single-barrel main shaft for hoisting personnel, rock materials and an adjacent bratticed ventilation shaft, used for both drawing used air and hoisting rock. The South Shaft complex operates to a depth of 2 650 metres below surface, and the Twin Shaft complex operates to a depth of 2 995 metres below surface.

South Deep JV: South Deep Gold Mine's workings are at depth and therefore require significant cooling infrastructure. The South Deep JV: South Deep Gold Mine operation has access to the national electricity grid, the mine's Khanyisa solar grid, water and road infrastructure and is located near regional urban centres where it can obtain needed supplies and services.

As part of the Integrated Water Use License Application (IWULA) process, MC compiled the Integrated Water and Waste Management (IWWMP) for the proposed WUL and its addendum amendments, and consolidation project. The IWWMP is part of the application for IWULA for the proposed WUL and its addendum amendments, and consolidation project.

1-1 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Below are the details of the appointed independent EAP by South Deep JV: South Deep Gold Mine. For the expertise of the EAP, please refer to Appendix A for a Curriculum Vitae (CV).

EAP Company Name:	Manyabe Consultancy (Pty) Ltd
Registration Number:	2014/063679/07
Contact Person:	Mpho Manyabe
Telephone Number:	011 863 1079
Email Address:	mpho@manyabeconsultancy.com
Postal Address:	7682 I-Nkwaza Street, Vosloorus, 1475
Physical Address:	Corner Paul Smith Street and 10 th Avenue , Unit 269, Block F, Ravenswood Mews, Boksburg North, 1459

1-1.1 Qualifications and Experience of the EAP

Qualifications
BSc.Honours in Environmental Management, UNISA, 2016. National Diploma Environmental Sciences, TUT, 2008 SACNASP Registered Scientist: Reg No. 117719 Environmental Assessment Practitioners Association of South Africa (EAPASA) Registered EAP: Reg No. 2019/700

1-1.2 Summary of the EAP's Experience

MC is a 100% black female owned entity which offers sustainable development solutions to both public and private sectors, including parastatals. The company was founded in 2014 by the Managing Director, Mpho Manyabe. MC seeks to maintain its strategic position in the Environmental Management Services sector by providing service of excellence to its clients. This is achieved by providing: a professional and efficient service; the highest possible level of customer care; the highest ethical and moral principles in our actions, words and thoughts; and the highest possible level of integrity.

The objective of MC is to create an environment in which enthusiastic, highly skilled and motivated professionals seek professional opinions for contribution to the environmental, social and economic development in South Africa. MC currently has a turnover of less than R10 million rand and is a Level 1 contributor with 135% Broad Based Black Economic Empowerment (BBBEE) procurement.

Mpho Manyabe: BSc Honours in Environmental Management, University of South Africa (UNISA), 2016; National Diploma Environmental Sciences, Tshwane University of Technology (TUT), 2008

Mpho Manyabe currently holds a BSc Honours Degree in Environmental Management from UNISA; and National Diploma in Environmental Sciences, from TUT, 2008. She has eighteen (18) years of work experience in the field of Environmental Management from different consulting companies.

She was previously nominated to be in the Gauteng Department of Environment (GDEnv) Environmental Impact Assessment (EIA) EAP committee which was launched on 31 March 2015 comprising of EAPs and GDEnv officials to provide quarterly reports to the Executive Authority (Member of the Executive Committee (MEC)) on issues identified as blockages to the improved efficiencies the department seeks to achieve.

She was also a member of the Academic Advisory Committee for the Environmental Science programme in the Department of Environmental, Water and Earth Sciences in the Faculty of Science at the TUT, to serve for a period of three (3) years, where she assisted with preparation and provision of relevant, high quality teaching and learning content for students. She was identified based on her expertise in the field of Environmental Sciences/ Management to make a positive contribution to what TUT was offering students in terms of course content and on how to better run programs to the benefit of students.

She is registered with South African Council for Natural Scientific Professions (SACNASP) as a Professional Natural Scientist, and she is also a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA).

She is the Lead EAP on the project.

1-2 SOUTH DEEP JV: SOUTH DEEP GOLD MINE DETAILS

Contact Person:	Ms. Thihanedzwi (Thiara) Ratshibvumo
Designation:	Manager Environment
Email Address:	Thiara.Ratshibvumo@goldfields.com
Telephone Number:	+27(0)11 411 1445
South Deep JV: South Deep Gold Mine Physical Address:	Farm Modderfontein, Old Vereeniging Road, 1779, South Africa
South Deep JV: South Deep Gold Mine Postal Address:	PO Box 776, Westonaria, 1780

1-3 REGIONAL SETTING AND LOCATION OF ACTIVITY

The mine is located in Westonaria, RWCLM, within the WRDM. South Deep Gold Mine is situated in the magisterial district of Westonaria, approximately 45 km south-west of Johannesburg and 10 km south of Westonaria, in the Gauteng Province as indicated in Figure 1. It is accessed via the R28 provincial road between Westonaria and Vereeniging or from the N12 provincial road between Johannesburg and Potchefstroom and is located in the major gold mining region of South Africa, the Witwatersrand Basin.

1-4 PROPERTY DESCRIPTION

South Deep JV: South Deep Gold Mine is the holder of the MR for the properties within the South Deep Gold Mine boundary area, which are presented in Figure 4 below. Below is a list of farms owned by South Deep JV: South Deep Gold Mine, within which the authorised and proposed water uses exist.

- Portion 3 of Farm Modderfontein 345IQ
- Portion 10 of Farm Modderfontein 345IQ
- Portion 12 of Farm Modderfontein 345IQ
- Portion 20 of Farm Modderfontein 345IQ
- Portion 21 of Farm Modderfontein 345IQ

- Portion 29 of Farm Modderfontein 345IQ
- Portion 30 of Farm Modderfontein 345IQ
- Portion 41 of Farm Modderfontein 345IQ
- Portion 44 of Farm Modderfontein 345IQ
- Portion 52 of Farm Modderfontein 345IQ
- Portion 65 of Farm Modderfontein 345IQ
- Portion 70 of Farm Modderfontein 345IQ
- Portion 1 of Farm Doornpoort 347IQ
- Portion 7 of Farm Doornpoort 347IQ
- Portion 20 of Farm Doornpoort 347IQ
- Portion 21 of Farm Doornpoort 347IQ
- Portion 34 of Farm Doornpoort 347IQ
- Portion 39 of Farm Doornpoort 347IQ
- Portion 45 of Farm Doornpoort 347IQ
- Portion 51 of Farm Doornpoort 347IQ
- Portion 50 of Farm Doornpoort 347IQ
- Portion 52 of Farm Doornpoort 347IQ

1-5 OBJECTIVES/ PURPOSE OF THE IWWMP

Section 40 of the NWA requires that all water uses defined by Section 21 of the Act are authorised. In support of any IWULA, a technical supporting document is required in the form of an IWWMP.

In terms of section 50 and 52 of the NWA South Deep Gold Mine is making an amendment application for an Integrated Water Use Licence (IWUL) for the various Section 21 water uses related to the mine which were not included in the 2018 WUL and its addendum issued in 2021. The IWULA is also being submitted for correction of administrative errors or water uses which have subsequently changed, for example in volumes abstracted etc. In order to support the IWUL amendment application, an IWWMP is required.

An IWWMP considers the principles of Integrated Water Resources Management (IWRM) and is linked to the Catchment Management Strategy (CMS) or IWRM strategy for the catchment under consideration. An IWWMP is therefore a simple, feasible, implementable plan for the mine; taking into account the National Water Resource Strategy (NWRS), the CMS for the catchment in question, Resource Quality Objectives (RQOs); and sensitivity of the receiving water resource. It also considers up- and downstream cumulative impacts of water use activities. The plan is based on site specific programmes that will be implemented over time and is a living document that should be updated as the mine activities change.

The purpose/ objectives of the IWWMP are outlined as follows:

- Compilation of a site specific, implementable, management plan addressing all the identified water use and waste management related aspects of a specific activity, in order to meet set goals and objectives in accordance with IWRM principles;
- Provision of a management plan to guide the water user regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term;
- Documentation of all the relevant information, as specified in the IWWMP Guideline as compiled by the Department of Water and Sanitation (DWS), to enable DWS to make a decision regarding the authorisation of a water use;
- Clarification of the content of the IWWMP for DWS officials and the water users, as the various regional offices of DWS might have different interpretations regarding the contents of the IWWMP;
- Standardisation of the format of supporting documentation required by DWS during the submission of IWULA;

- Provision of guidance on the content of information required in an IWWMP as part of the water use authorisation process and level of detail that DWS requires to evaluate the supporting documentation, facilitating decision on authorising a water use; and
- Ensuring that a consistent approach is adopted by DWS and the various Regional Offices and Catchment Management Agencies (CMA) with regards to IWWMPs.

This IWWMP contains information on the proposed activities that will be undertaken, with emphasis on proposed management measures for water and waste. The IWWMP can be considered a living document that will continue to be revised and updated annually in terms of the IWUL to be issued requirements, throughout the life of the proposed operations, to accommodate additional information and improved technology to ensure that water and waste management is continually optimised and adapted to the changing needs of the Water Management Area (WMA) thereby reducing the risks of the operation to the environment and humans.

DWS require that a water user needs to compile an IWWMP for any one of the following purposes:

- As the supporting technical documentation for any IWULA;
- When converting Existing Lawful Use (ELU) to licensed water use; and
- In order to comply with the conditions of an existing WUL.

This IWWMP has been compiled as per the requirements of the following legal pieces:

- DWS Operational Guideline: IWWMP (2010);
- Best Practice Guideline (BPG) H1 (Integrated Mine Water Management (2008); and
- Regulations regarding the procedural arrangements for WULAs and appeals (GNR. 267, Gazette No. 40713, 24 March 2017).

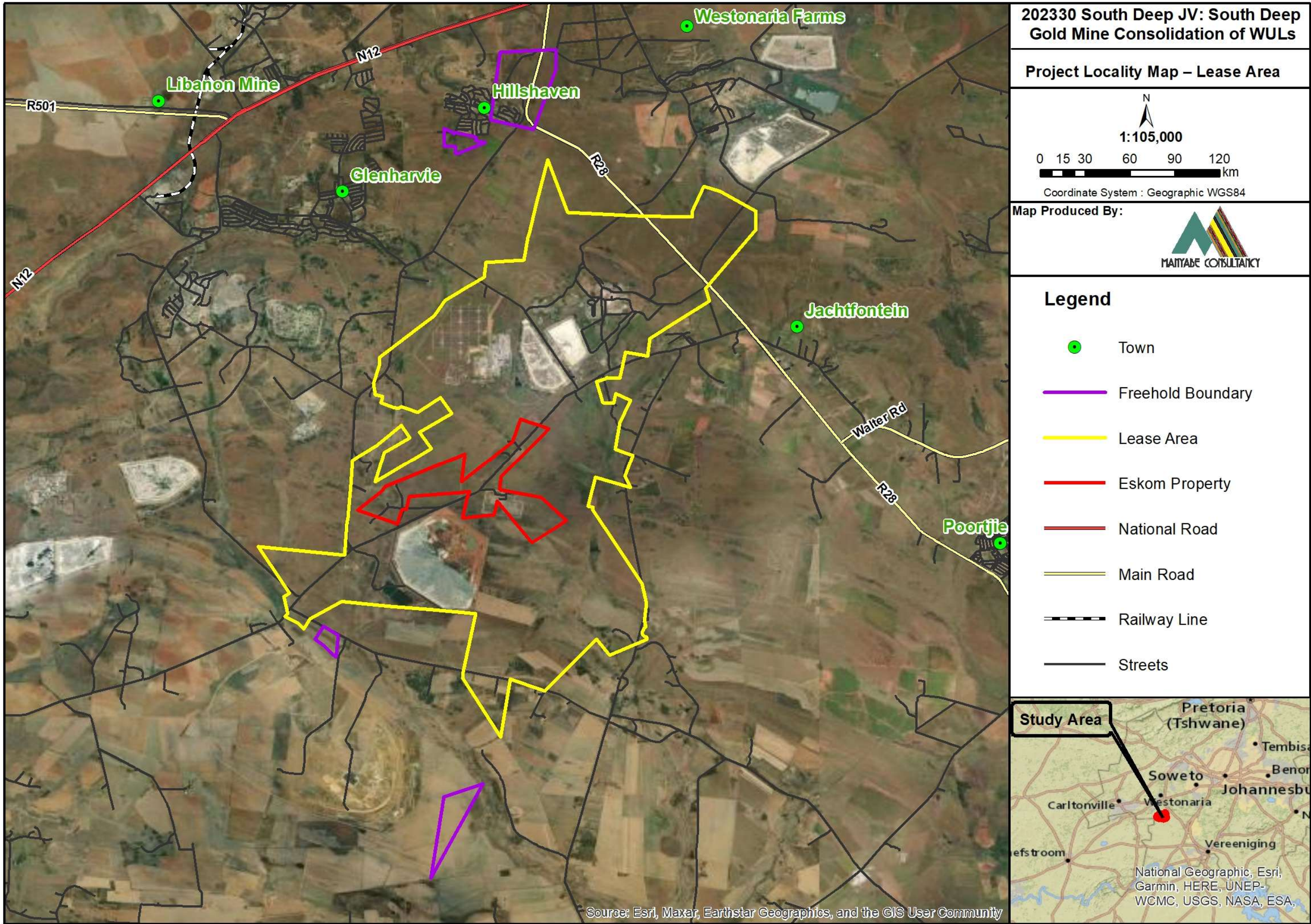


Figure 1: Project Locality Map



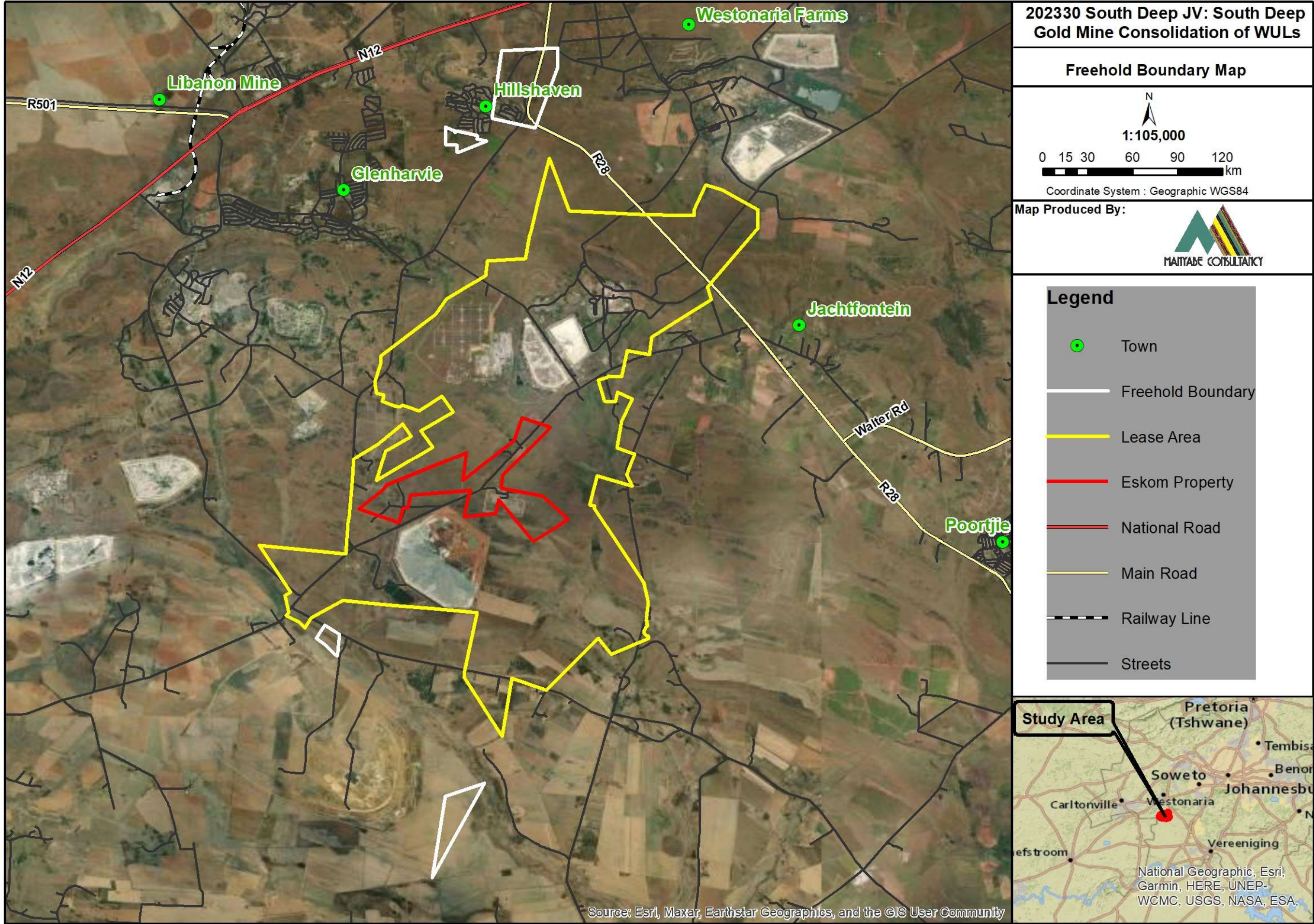


Figure 3: South Deep JV: South Deep Gold Mine Freehold areas



SECTION 2: DESCRIPTION OF THE SCOPE OF THE ACTIVITY

A plan drawn to a scale i.e. 1: 50 000 that shows the location, and area (hectares) of the proposed WUL and its addendum amendments, and consolidation project has been compiled. Refer to Figure 1 above. The mine's infrastructure layout plan is provided in Appendix C and Figure 2.

2-1 APPROVED WATER USES

Table 1 provides all the water uses that were incorporated into the WUL issued on 19 November 2018.

Table 1: Water Uses that were Incorporated into the WUL 2018

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
Water Use activities for Section 21(a)			
Water is abstracted from Salvage BH [A1] (A3) to reduce the pollution plume and is disposed to twin shaft PCD.	Portion 39 of Farm Modderfontein 345IQ	154 030	26°25'3.06"S 27°39'50.48"E
Old RWD seepage interception BH (A4) to reduce the pollution plume. The water is disposed (recycled back) to the RWD.	Portion 44 of Farm Modderfontein 345IQ	154 030	26°25'18.03"S 27°40'55.73"E
Abstraction of water from Scavenger BH (A5-1) [to reduce the pollution plume and disposal in Doornpoort RWD] below old TSF to reduce the pollution plume and disposal in old RWD.	Portion 41 of Farm Modderfontein 345IQ	94 900	26°24'45.12"S 27°40'45.85"E
Abstraction of water from Scavenger BH (A5-2) [borehole to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 20 of Farm Modderfontein 345IQ	94 900	26°25'0.49"S 27°40'38.06"E
Abstraction of water from Scavenger BH (A5-3) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3 of Farm Modderfontein 345IQ	94 900	26°25'12.66"S 27°40'51.32"E
Abstraction of water from Scavenger BH (A5-4) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3 of Farm Modderfontein 345IQ	94 900	26°25'21.87"S 27°40'25.25"E
Abstraction of water from Scavenger BH (A5-5) to reduce the pollution plume and disposal in RWD.	Portion 21 of Farm Modderfontein 345IQ	94 900	26°25'7.25"S 27°40'6.35"E
Abstraction of water from Scavenger BH (A5-6) to reduce the pollution plume and disposal in RWD.	Portion 21 of Farm Modderfontein 345IQ	94 900	26°25'7.25"S 27°40'0.35"E
Abstraction of water from Scavenger BH (A6-1) below the Doornpoort TSF to reduce the pollution plume and disposal in RWD.	[Portion 20 of Farm Modderfontein 345IQ] <u>Doornpoort 347IQ</u>	94 900	26°27'49.99"S 27°38'18.73"E
Abstraction of water from Scavenger BH (A6-2) below the old TSF to reduce the pollution plume and disposal in RWD.	[Portion 20 of Farm Modderfontein 345IQ] <u>Doornpoort 347IQ</u>	94 900	26°27'42.49"S 27°38'18.08"E
Abstraction of water from South Shaft borehole for mining purpose	Portion 30 and 65 of Farm Modderfontein 345IQ	273 756	26°24'14.10"S 27°41'7.40"E
Abstraction of water from Leeuspruit for mining purpose	Portion 30 and 65 of Farm Modderfontein 345IQ	729 996	26°24'36.00"S 27°41'22.95"E
BH1	Farm Doornpoort 347IQ	94 900 (2.0L/s)	-26.467033°; 27.636497°
SD31	Farm Doornpoort 347IQ	94 900 (0.25L/s)	-26.471389°; 27.649738°
SD32	Farm Doornpoort 347IQ	94 900 (0.6L/s)	-26.471790°; 27.654380°
SD38	Farm Doornpoort 347IQ	94 900 (1L/s)	-26.468937°; 27.645781°
SD40	Farm Doornpoort 347IQ	94 900 (1.2L/s)	-26.469808°; 27.639373°

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
SD43	Farm Doornpoort 347IQ	94 900 (1.55L/s)	-26.465064°; 27.640661°
Water Use activities for Section 21(c) and (i)			
Haul Road crossing Leeuspruit River and flow meter -entrance to South Shaft. The road is an existing road with a new meter installation.	Portion 44 of Farm Modderfontein 345IQ	L=55m H=1.0m W=57m	26°24'37.3"S 27°41'64.1"E
Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road.	Portion 12 of Farm Modderfontein 345IQ	L=12m H=2.0m W=100m	26°27'49.27"S 27°38'4.21"E
Road crossing Leeuspruit River diversion-existing road passing over the river diversion.	Portion 20 of Farm Modderfontein 345IQ	L=15m H=2.0m W=35m	26°25'14.17"S 27°41'0.53"E
South shaft stormwater separation system which run through a wetland.	Portion 20 of Farm Modderfontein 345IQ		Start 26°24'30.83"S 27°41'7.53"E End 26°25'0.26"S 27°40'53.30"E
Water Use activities for Section 21(e)			
Irrigation of old TSF with water from RWD 1 and 2 for maintenance of grassed areas.	Farm Modderfontein Portions 3, 20, 21, 40 and 41 of farm Modderfontein	730 000	26°24'52.80"S 27°40'36.14"E
Irrigation of new TSF with water from RWD 3 and 4 for maintenance of grassed areas.	Farm Modderfontein	730 000	26°25'5.08"S 27°40'13.09"E
Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas.	Portion 1,44,45,51,52 and 53 of the farm Doornpoort 347IQ.	730 000	26°27'53.34"S 27°38'48.78"E
Irrigation of shaft areas with water from Twin shaft PCD.	Farm Modderfontein	365 000	26°24'23.5"S 27°41'18.6"E
Irrigation of all TSF with final effluent from Wastewater Treatment Works (WWTW).	Farm Modderfontein and farm Doornpoort 347IQ.	912 500	26°24'23.5"S 27°41'18.6"E 26°24'52.80"S 27°40'36.14"E 26°25'5.08"S 27°40'13.09"E 26°27'53.34"S 27°38'48.78"E
Water Use activities for Section 21(f)			
Discharge of excess underground water.	Portion 44 of Farm Modderfontein 345IQ	1 095 000	26°24'35.59"S 27°41'21.81"E
Water Use activities for Section 21(g)			
Disposing of gold slurry at south shaft.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	1 200 000	26°25'0.02"S 27°40'12.16"E
Disposing waste water from the Doornpoort TSF into the RWD.	Portion 20, 50, 51 Doornpoort 347IQ	1 000 000	26°28'0.05"S 27°39'14.18"E
Twin shaft retention pond.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	62 000	26°25'22.62"S 27°39'56.92"E
Cascade Ponds.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	3 000	26°25'10.27"S 27°40'33.85"E
Upgraded RWD.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	52 487	26°25'12.50"S 27°40'49.12"E
Gold Plant PCD.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 3 500	26°25'15.88"S 27°39'32.57"E
Settlers A&B.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 650	26°25'8.30"S 27°39'50.97"E
Mine Water Tanks.	Portion 3,20,21,40 and 41 of farm Modderfontein 345IQ	2 X 2 200	26°24'20.74"S 27°41'15.72"E 26°25'10.27"S 27°40'33.85"E
Old RWD.	Portion 3, 20, 21, 40 and 41 of the farm Modderfontein 345IQ,	150 000	26°25'13.92"S 27°40'52.27"E

Description/ Purpose	Properties	Volume (m ³ / annum)	Co-ordinates
Water Use activities for Section 21(j)			
Removal of water found underground for the efficient continuation of mine or safety of the people.	Portion 3, 20, 21,40 and 41 of the farm Modderfontein 345IQ	1 824 996	

As part of the WUL Amendment application, South Deep JV: South Deep Gold Mine has been granted an addendum to the WUL 2018 as follows:

Amendment of the Licensee

8. The licence is hereby amended a) by substitution of condition 1 of the following:

“South Deep **[Gold Mine]** Joint Venture: South Deep Gold Mine”

Amendment of properties and ownership on which the water use will be exercised

9. Properties and ownership on which the water use will be exercised is hereby amended a) by the substitution in properties for Table 1 of the following Table:

Table 1: Properties where water uses will be exercised

Properties	Water uses	Owner
Portion 3,20,21,30,41,44,39 and 65 of farm Modderfontein 345IQ	Section 21(a)	South Deep Gold Mine
Portion 3 and 52 of the farm Modderfontein 345IQ, Portion 3,12,20,41,44 and 61 of the farm Modderfontein 345IQ	Section 21(c) and (i)	South Deep Gold Mine
Portion 12, 20,21 of farm Modderfontein 345IQ	Section 21(e)	South Deep Gold Mine
Portion 44 of the farm Modderfontein 345IQ	Section 21(f)	South Deep Gold Mine
Portion 1,7,20,43,45,46,50,51,52,53 of the farm Doornpoort 347IQ. Portion 44 of the farm Modderfontein 345IQ	Section 21(g)	South Deep Gold Mine
Portion 30 of the farm Modderfontein 345IQ	Section 21(j)	South Deep Gold Mine

Amendment of the description of the activities

10. Description of the activities is hereby amended a) by substitution for the description of the activities of the following description of the activities:

"This license authorises South Deep Gold mine for the following water uses in terms of section 40 for section 21(a),(c),(e),(f),(g),(i) and (j) of the NWA for taking water from the South Shaft boreholes and Leeuspruit river, installation of flow meter at the river, river diversion, pipeline crossing the stream, discharging of waste water into the river, irrigation of TSF with treated effluent, disposing of waste water into containment facilities and removing of water found underground for continuation of mining and safety of the people. The mine falls within the Vaal River WMA, quaternary catchments C22J".

Amendment of condition I of Appendix II

11. Condition 1 of the licence is hereby amended a) by substitution in condition 1 for Table 2 of the following Table:

Table 2: Water use activities for Section 21(a)

Purpose/ Description	Property	Volume	Co-ordinates
1. Water is abstracted from Salvage BH [A] (A3) to reduce the pollution plume and is disposed to twin shaft PCD.	Portion 39 of Farm Modderfontein 345IQ	154 030 m ³ /a	26°25'3.06"S 27°39'50.48"E
Old RWD seepage interception BH (A4) to reduce the pollution plume. The water is disposed (recycled back) to the RWD.	Portion 44, of farm Modderfontein 345 IQ	154 030 m ³ /a	26°25'18.03"S 27°40'55.73"E

Purpose/ Description	Property	Volume	Co-ordinates
2. Abstraction of water from Scavenger BH (A5-1) [to reduce the pollution plume and disposal in Old RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 41, of farm Modderfontein 345 IQ	94 900 m ³ /a	26°24'45.12"S 27°40'45.85"E
3. Abstraction of water from Scavenger BH (A5-2) [borehole to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 20, of farm Modderfontein 345 IQ	94 900 m ³ /a	26°25'0.49"S 27°40'51.32"E
4. Abstraction of water from Scavenger BH (A5-3) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3, of farm Modderfontein 345 IQ	94 900 m ³ /a	26°25'12.66"S 27°40'38.06"E
5. Abstraction of water from Scavenger BH(A5-4) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	Portion 3, of farm Modderfontein 345 IQ	94 900 m ³ /a	[26°25'7.25"S] 26°25'30.70"S 27°40'25.25"E
Abstraction of water from Scavenger BH(A5-5) to reduce the pollution plume and disposal in RWD	Portion 21, of farm Modderfontein 345 IQ	94 900 m ³ /a	26°25'7.25"S 27°40'6.35"E
Abstraction of water from Scavenger BH(A5-6) to reduce the pollution plume and disposal in RWD	Portion 21, of farm Modderfontein 345 IQ	94 900 m ³ /a	26°25'7.25"S 27°40'0.35"E
6. Abstraction of water from scavenger BH (A6-1) below the Doornpoort TSF to reduce the pollution plume and disposal in RWD.	[Portion 20, of farm Modderfontein 345] Doornpoort 347 IQ	94 900 m ³ /a	26°27'49.99"S 27°38'18.73"E
7. Abstraction of water from Scavenger BH (A6-2) below the old TSF to reduce the pollution plume and disposal in RWD.	[Portion 20, of farm Modderfontein 345] Doornpoort 347 IQ	94 900 m ³ /a	26°27'42.49"S 27°38'18.08"E
Abstraction of water from South Shaft borehole for mining purpose	Portion 30 and 65 of the farm Modderfontein 345IQ	273 756 m ³ /a	26°24'14.10"S 27°41'7.40"E
Abstraction of water from Leeuspruit for mining purpose	Portion 30 and 65 of the farm Modderfontein 345IQ	729 996 m ³ /a	26°24'36.00"S 27°41'22.95"E
BH1	Farm Doornpoort 347IQ	94 900 (2.0L/s)	-26.467033° 27.636497°
SD31	Farm Doornpoort 347IQ	94 900 (0.25L/s)	-26.471389°; 27.649738°
SD32	Farm Doornpoort 347IQ	94 900 (0.6L/s)	-26.471790° 27.654380°
SD38	Farm Doornpoort 347IQ	94 900 (1L/s)	-26.468937° 27.645781°
SD40	Farm Doornpoort 347IQ	94 900 (1.2L/s)	-26.469808° 27.639373°
SD43	Farm Doornpoort 347IQ	94 900 (1.55L/s)	-26.465064° 27.640661°

Amendment of condition 3 of Appendix III

12. Condition 3.1.2 of the licence is hereby amended by substitution of condition 3.1.2 for the following condition:

"3.1.2 The Licensee must ensure that clean storm water is discharged **(into bio retention ponds)** outside of the riparian area".

Amendment of condition 1 of Appendix V

Condition 1.1 of the licence is hereby amended by the substitution in condition 1.1 for Table 7 of the following Table:

Table 7: Water use activity

Description of the activity	Volume (m ³ /a)	Property	Co-ordinates
Discharge of excess underground water.	1 095 000	Portion 44, of farm Modderfontein 345 IQ	[26°25'35.6"S] 26°24'35.59"S 27°41'.21.81"E

Amendment of condition 3 of Appendix VI

13. Condition 3.1 of the licence is hereby amended a) by substitution of condition 3.1 of the following condition:

"3.1 The Licensee must monitor on a **[monthly]** quarterly basis the water resources at surface water monitoring points and groundwater monitoring points to determine the impact of the facilities and other activities on the water quality by taking samples at the monitoring points as indicated in Tables 10 and 11".

Amendment of condition 1 of Appendix VIII

14. Condition 1 of the license is hereby amended a) by substitution of condition 1 of the following condition:

"1 The Licensee is authorised to remove a maximum volume not exceeding **[seven hundred and twenty-nine thousand nine hundred and ninety-six cubic metres per annum (729 993m³/a)]** one million eight hundred and twenty four thousand nine hundred and ninety six cubic meters per annum (1 824 996 m³/a) of water found underground from portion 3, 20, 21, 40 and 451 of the farm Modderfontein 345IQ for the efficient continuation of mine or safety of the people."

2-2 WATER USES TO BE CONSOLIDATED

Table 2: Water Use activities for Section 21(a)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Water is abstracted from Salvage BH [A] (A3) to reduce the pollution plume and is disposed to twin shaft PCD.	SCTS-01 (TS-BH01) Abstraction of water from Twin Shaft SCTS-01 borehole for mining purposes	Portion 39 of Farm Modderfontein 345IQ	Portion 39 of Farm Modderfontein 345IQ	154 030	10 800	26°25'3.06"S 27°39'50.48"E	26°25'1.92"S 27°39'47.99"E
Old RWD seepage interception BH (A4) to reduce the pollution plume. The water is disposed (recycled back) to the RWD.	SCSS-03 (A4) Abstraction of water from upgraded RWD seepage interception borehole SCSS-03 to reduce the pollution plume. The water is disposed (recycled back) to the RWD	Portion 44 of Farm Modderfontein 345IQ	Portion 52 of Farm Modderfontein 345IQ	154 030	207 000	26°25'18.03"S 27°40'55.73"E	26°25'20.35"S 27°40'48.28"E
Abstraction of water from Scavenger BH (A5-1) [to reduce the pollution plume and disposal in Doornpoort RWD] below old TSF to reduce the pollution plume and disposal in old RWD.	SCSS-44 (A5-1) Abstraction of water from Scavenger borehole SCSS-44 below old TSF to reduce the pollution plume and disposal in RWD	Portion 41 of Farm Modderfontein 345IQ	Portion 41 of Farm Modderfontein 345IQ	94 900	94 900	26°24'45.12"S 27°40'45.85"E	26°24'45.12"S 27°40'45.85"E
Abstraction of water from Scavenger BH (A5-2) [borehole to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	SCSS-02 (A5-2) Abstraction of water from upgraded RWD seepage interception SCSS-02 to reduce the pollution plume. The water is disposed (recycled back) to the RWD	Portion 20 of Farm Modderfontein 345IQ	Portion 44 of Farm Modderfontein 345IQ	94 900	334 800	26°25'0.49"S 27°40'51.32"E	26°25'0.49"S 27°40'51.32"E
Abstraction of water from Scavenger BH (A5-3) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	SCSS-01 (A5-3) Abstraction of water from Scavenger borehole SCSS-01 below old TSF to reduce the pollution plume and disposal in RWD	Portion 3 of Farm Modderfontein 345IQ	Portion 41 of Farm Modderfontein 345IQ	94 900	230 400	26°25'12.66"S 27°40'38.06"E	26°25'12.66"S 27°40'38.06"E
Abstraction of water from Scavenger BH (A5-4) [to reduce the pollution plume and disposal in RWD] below old TSF to reduce the pollution plume and disposal in RWD.	SCSS-45 (A5-4) Abstraction of water from Scavenger borehole SCSS-11 below old TSF to reduce the pollution plume and disposal in RWD	Portion 3 of Farm Modderfontein 345IQ	Portion 52 of Farm Modderfontein 345IQ	94 900	94 900	26°25'30.70"S 27°40'25.25"E	26°25'30.70"S 27°40'25.25"E
Abstraction of water from Scavenger BH (A5-5) to reduce the pollution plume and disposal in RWD.	SCSS-06 (A5-5) Abstraction of water from Scavenger borehole SCSS-06 below old TSF to reduce the pollution plume and disposal in RWD	Portion 21 of Farm Modderfontein 345IQ	Portion 41 of Farm Modderfontein 345IQ	94 900	255 600	26°25'7.25"S 27°40'6.35"E	26°25'7.25"S 27°40'6.35"E
Abstraction of water from Scavenger BH (A5-6) to reduce the pollution plume and disposal in RWD.	SCSS-46 (A5-6) Abstraction of water from Scavenger borehole SCSS-46 to reduce the pollution plume and disposal in RWD	Portion 21 of Farm Modderfontein 345IQ	Portion 70 of Farm Modderfontein 345IQ	94 900	94 900	26°25'7.25"S 27°40'0.35"E	26°25'7.25"S 27°40'0.35"E
Abstraction of water from Scavenger BH (A6-1) below the Doornpoort TSF to reduce the pollution plume and disposal in RWD.	SCSS-08 (A6-1) Abstraction of water from Scavenger borehole SCSS-08 below old TSF to reduce the pollution plume and disposal in RWD	Portion 20 of Farm Modderfontein 345IQ	Portion 20 of Farm Modderfontein 345IQ	94 900	223 200	26°27'49.99"S 27°38'18.73"E	26°27'49.99"S 27°38'18.73"E
Abstraction of water from Scavenger BH (A6-2) below the old TSF to reduce the pollution plume and disposal in RWD.	SCDP-20 (A6-2) Abstraction of water from scavenger SCDP-20 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	Portion 20 of Farm Modderfontein 345IQ	Portion 20 of Farm Doornpoort 347IQ	94 900	46 800	26°27'42.49"S 27°38'18.08"E	26°27'42.49"S 27°38'18.08"E
NEW BOREHOLES TO BE REGISTERED	SCSS-04 (SDS17) Abstraction of water from Scavenger borehole SCSS-04 below old TSF to reduce the pollution plume and disposal in RWD	NEW BOREHOLES TO BE REGISTERED	Portion 52 of Farm Modderfontein 345IQ	NEW BOREHOLES TO BE REGISTERED	115 200	NEW BOREHOLES TO BE REGISTERED	26°28'3.94"S 27°38'12.49"E
	SCSS-05 (SDS18) Abstraction of water from Scavenger borehole SCSS-05 below old TSF to reduce the pollution plume and disposal in RW		Portion 12 of Farm Modderfontein 345IQ		111 600		26°25'46.67"S 27°40'31.73"E
	SCSS-07 (SPD02) Abstraction of water from Scavenger borehole SCSS-07 below old TSF to reduce the pollution plume and disposal in RWD		Portion 44 of Farm Modderfontein 345IQ		133 200		26°25'1.04"S 27°41'14.84"E
	SCSS-09 (SCSS-09) Abstraction of water from Scavenger borehole SCSS-09 below old TSF to reduce the pollution plume and disposal in RWD		Portion 3 of Farm Modderfontein 345IQ		93 240		26°25'12.55"S 27°40'39.17"E
Abstraction of water from South Shaft borehole for mining purpose	WASS-01 (BH1) Abstraction of water for South Shaft borehole WASS-01 for mining purpose 1	Portion 30 and 65 of Farm Modderfontein 345IQ	Portion 30 of Farm Modderfontein 345IQ	273 756	91 252	26°24'15.72"S 27°41'8.57"E	26°24'15.72"S 27°41'8.57"E
	WASS-04 (BH4) Abstraction of water for South Shaft borehole WASS-04 for mining purpose 2	Portion 30 and 65 of Farm Modderfontein 345IQ	Portion 29 of Farm Modderfontein 345IQ	NEW BOREHOLES TO BE REGISTERED	91 252	26°24'15.71"S 27°41'8.07"E	26°24'15.72"S 27°41'8.07"E
	WASS-05 (BH5) Abstraction of water for South Shaft	Portion 30 and 65 of	Portion 29 of Farm		91 252	26°24'15.77"S	26°24'15.72"S

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
	borehole WASS-05 for mining purpose 3	Farm Modderfontein 345IQ	Modderfontein 345IQ			27°41'7.49"E	27°41'7.49"E
BH1	SCDP-11 (BH1) Abstraction of water from Scavenger borehole SCDP-11 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	Farm Doornpoort 347IQ	Portion 21 of Farm Doornpoort 347IQ	94 900	10 800	26°28'0.90"S 27°38'10.35"E	26°28'0.90"S 27°38'10.35"E
Abstraction of water from Leeuspruit for mining purpose	Abstraction of water from Leeuspruit for mining purposes	Portion 30 and 65 of Farm Modderfontein 345IQ	Portion 10 of Farm Modderfontein 345IQ	729 996	729 996	26°24'36.00"S 27°41'22.95"E	26°24'36.00"S 27°41'22.95"E
NEW BOREHOLES TO BE REGISTERED	SCDP-12 (SC31) Abstraction of water from Scavenger borehole SCDP-12 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	NEW BOREHOLES TO BE REGISTERED	Portion 52 of Farm Doornpoort 347IQ	NEW BOREHOLES TO BE REGISTERED	10 800	NEW BOREHOLES TO BE REGISTERED	26°28'17.07"S 27°38'59.29"E
SD31	THE WATER USES ARE NO LONGER APPLICABLE. THE BOREHOLES ARE FOR MONITORING PURPOSES	Farm Doornpoort 347IQ	THE WATER USES ARE NO LONGER APPLICABLE. THE BOREHOLES ARE FOR MONITORING PURPOSES	94 900	THE WATER USES ARE NO LONGER APPLICABLE	26°28'17,00" 27°38'59,46"	THE WATER USES ARE NO LONGER APPLICABLE
SD38		Farm Doornpoort 347IQ		94 900		26°28'7,86" 27°38'44,23"	
SD40		Farm Doornpoort 347IQ		94 900		26°28'9,98" 27°38'20,22"	
SD43		Farm Doornpoort 347IQ		94 900		26°27'54,86" 27°38'26,70"	
WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	SCDP-01 (SC43) Abstraction of water from Scavenger borehole SCDP-01 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	Portion 50 of Farm Doornpoort 347IQ	WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	208 800	WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	26°27'54.78"S 27°38'26.92"E
	SCDP-02 (SC61) Abstraction of water from Scavenger borehole SCDP-02 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 45 of Farm Doornpoort 347IQ		181 440		26°27'56.44"S 27°38'28.24"E
	SCDP-03 (SC54) Abstraction of water from Scavenger borehole SCDP-03 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 20 of Farm Doornpoort 347IQ		180 000		26°27'51.90"S 27°38'25.56"E
	SCDP-04 (SC84) Abstraction of water from Scavenger borehole SCDP-04 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		111 600		26°28'9.03"S 27°38'39.73"E
	SCDP-05 (82) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		187 200		26°28'11.19"S 27°38'37.75"E
	SCDP-06 (SC38) Abstraction of water from Scavenger borehole SCDP-06 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		120 600		26°28'7.72"S 27°38'44.39"E
	SCDP-07 (SC65) Abstraction of water from Scavenger borehole SCDP-07 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		60 480		26°28'9.11"S 27°38'42.15"E
	SCDP-08 (SC60) Abstraction of water from Scavenger borehole SCDP-08 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		37 800		26°28'0.73"S 27°38'33.72"E
	SCDP-09 (SC59) Abstraction of water from Scavenger borehole SCDP-09 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		43 920		26°28'3.21"S 27°38'37.47"E
	SCDP-10 (SC50) Abstraction of water from Scavenger borehole SCDP-10 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		23 040		26°28'10.38"S 27°38'48.45"E
	SCDP-13 (SC40) Abstraction of water from Scavenger borehole SCDP-13 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 50 of Farm Doornpoort 347IQ		72 000		26°28'11.31"S 27°38'21.87"E
	SCDP-14 (SC46) Abstraction of water from Scavenger borehole SCDP-14 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		48 600		26°28'6.77"S 27°38'37.96"E
	SCDP-15 (SC49) Abstraction of water from Scavenger borehole SCDP-15 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		43 200		26°28'5.51"S 27°38'41.05"E
WATER USES WHICH WERE OMITTED	SCDP-16 (SC51) Abstraction of water from Scavenger	WATER USES WHICH	Portion 20 of Farm	WATER USES WHICH	28 800	WATER USES WHICH WERE	26°27'48.88"S

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	borehole SCDP-16 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	Doornpoort 347IQ	WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)		OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	27°38'23.62"E
	SCDP-17 (SC54R) Abstraction of water from Scavenger borehole SCDP-17 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 20 of Farm Doornpoort 347IQ		72 000		26°27'51.90"S 27°38'25.37"E
	SCDP-18 (SC67) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		5 400		26°28'14.22"S 27°38'28.96"E
	SCDP-19 (SC45) Abstraction of water from Scavenger borehole SCDP-19 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 51 of Farm Doornpoort 347IQ		41 400		26°28'1.39"S 27°38'32.07"E
	SCDP-21 (EP3) Abstraction of water from Scavenger borehole SCDP-21 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 20 of Farm Doornpoort 347IQ		46 800		26°27'55.87"S 27°38'10.46"E
	SCDP-22 (EP7) Abstraction of water from Scavenger borehole SCDP-22 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 20 of Farm Doornpoort 347IQ		31 104		26°27'53.14"S 27°38'23.01"E
	SCDP-23 (EP3-A) Abstraction of water from Scavenger borehole SCDP-23 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD		Portion 20 of Farm Doornpoort 347IQ		93 240		26°27'47.50"S 27°38'9.24"E
	WADP-01 (WADP-01) Abstraction of water from borehole WADP-01 for domestic use at the Doornpoort offices		Portion 20 of Farm Doornpoort 347IQ		31 104		26°27'44.20"S 27°37'51.59"E
	WADP-02 (WADP-02) Abstraction of water from borehole WADP-02 for domestic use at the Doornpoort offices		Portion 1 of Farm Doornpoort 347IQ		31 104		26°27'35.23"S 27°37'53.61"E
WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	DP-Sump 1 (Sump 1) for collection of stormwater from the Doornpoort TSF for disposal into the RWD	WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (SUMPS)	Portion 50 of Farm Doornpoort 347IQ	10 800	10 800	WATER USES WHICH WERE OMITTED FROM THE WUL AND ITS ADDENDUM (DOORNPOORT TSF SCAVENGER BOREHOLES)	26°28'14.11"S 27°38'27.69"E
	DP-Sump 2 (Sump 2) for collection of stormwater from the Doornpoort TSF for disposal into the RWD		Portion 50 of Farm Doornpoort 347IQ	10 800	10 800		26°28'7.74"S 27°38'17.26"E
	DP-Sump 3 (Sump 3) for collection of stormwater from the Doornpoort TSF for disposal into the RWD		Portion 51 of Farm Doornpoort 347IQ	10 800	10 800		26°28'10.77"S 27°38'38.85"E
	DP-Sump 4 (Sump 4) for collection of stormwater from the Doornpoort TSF for disposal into the RWD		Portion 51 of Farm Doornpoort 347IQ	10 800	10 800		26°28'8.85"S 27°38'45.95"E

Table 3: Water Use activities for Section 21(b)

Description/ Purpose (Proposed)	Properties to be authorised	Volume (m³)	Co-ordinates
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 1	Portion 25 of Farm Modderfontein 345IQ	1 963.5	26°23'54.33"S 27°41'11.11"E
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 2	Portion 25 of Farm Modderfontein 345IQ	1 963.5	26°23'54.79"S 27°41'11.92"E
Storage of Potable Water - South Shaft 35m Potable Water Reservoir	Portion 25 of Farm Modderfontein 345IQ	2 919.4	26°23'53.54"S 27°41'10.00"E

Table 4: Water Use activities for Section 21(c and i)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Capacity/ Volume/ dimensions (m³, tonnes and/or m³/annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL						
Haul road and flow metre installation	Haul Road and flow meter installation (crossing Kariegaspruit)	Portions 3, 41 and 61, Modderfontein 345IQ	Portion 52 of Farm Modderfontein 345IQ	NOT INDICATED	26°25'37.88"S 29°23'93.6"E	Start Point: 26°25'44.44"S; 27°40'2.65"E End Point: 26°25'24.89"S; 27°40'39.83"E
River diversion and flow metre Installation	Existing river diversion of Leeuspruit and flow meter installation in the diversion	Portion 41 and 61 of Farm, Modderfontein 345IQ	Portion 44 of Farm, Modderfontein 345IQ	L=15m H=2.0m W=35m	Start: 26°25'9.37"S; 27°40'58.94"E End: 26°25'16.90"S; 27°40'16.37"E	Start: 26°25'9.37"S; 27°40'58.94"E End: 26°25'16.90"S; 27°40'16.37"E
Pipeline Crossing	Pipeline Crossing - Kariegaspruit	Portion 51 of Farm Doornpoort 347IQ	Portion 52 of Farm Modderfontein 345IQ	NOT INDICATED	26°25'35.06"S 27°40'16.37"E	Start: 26°25'35.06"S; 27°40'16.37"E End: 26°25'35.16"S;

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Capacity/ Volume/ dimensions (m³, tonnes and/or m³/annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL						
						27°40'15.69"E
Approved in the 2018 WUL						
Haul Road crossing Leeuspruit River and flow meter –OLD entrance to South Shaft. The road is an existing road with a new meter installation.	Haul Road crossing Leeuspruit River and flow meter -old entrance to South Shaft. The road is an existing road with a new meter installation	Portion 44 of Farm, Modderfontein 345IQ	Portion 30 of Farm, Modderfontein 345IQ	L=55m H=1.0m W=57m	26°24'37.3"S 27°41'64.1"E	Start: 26°24'22.55"S; 27°41'39.78"E End: 26°24'21.66"S; 27°41'38.00"E
Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road	Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road	Portion 12 of Farm, Modderfontein 345IQ	Portion 1 of Farm Doornpoort 347IQ	L=12m H=2.0m W=100m	26°27'49.27"S 27°38'4.21"E	Start: 26°27'47.72"S; 27°38'0.57"E End: 26°27'50.49"S; 27°38'6.90"E
Road crossing Leeuspruit River diversion-existing road passing over the river diversion (It was previously "Existing River diversion of Leeuspruit and flow metre installation in the diversion, located on Portion 51, Doornpoort 347IQ)".	Existing river diversion of Leeuspruit and flow meter installation in the diversion	Portion 20 of Farm, Modderfontein 345IQ	Portion 44 of Farm, Modderfontein 345IQ	L=15m H=2.0m W=35m	26°25'14.17"S 27°41'0.53"E	Start: 26°25'14.17"S; 27°41'0.53"E End: 26°25'24.50"S; 27°40'40.66"E
South Shaft stormwater separation system which runs through a wetland.	South shaft storm water separation system which runs through a wetland	Portion 20 of Farm, Modderfontein 345IQ	Portion 41 of Farm, Modderfontein 345IQ	NOT INDICATED	Start: 26°24'30.83"S; 27°41'7.53"E End: 26°25'0.26"S; 27°40'53.30"E	Start: 26°24'30.83"S; 27°41'7.53"E End: 26°25'0.26"S; 27°40'53.30"E
New water uses to be approved						
NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	Topsoil Stockpile	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	Portion 1 of Farm Doornpoort 347IQ	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	26°27'35.68"S 27°38'1.44"E
	Wetland Rehabilitation		Portion 44 of Farm, Modderfontein 345IQ			26°24'49.30"S 27°41'12.29"E
	Old RWD Decommissioning and Wetland Rehabilitation		Portion 3 of Farm, Modderfontein 345IQ			26°25'15.31"S 27°40'50.05"E
	WWTW within 500m radius from the edge of the wetland		Portion 44 of Farm, Modderfontein 345IQ			26°25'6.98"S 27°41'12.85"E
	RWD upgrade		Portion 3 of Farm, Modderfontein 345IQ			26°25'11.22"S 27°40'43.94"E
	Backfill Plant Area (x5 Mine Water Tanks)		Portion 10 of Farm, Modderfontein 345IQ			26°24'28.04"S 27°41'18.38"E
	Discharge of treated water from the RO Plants		Portion 10 of Farm, Modderfontein 345IQ			26°24'35.59"S 27°41'21.82"E
	Pipeline transporting water to the reservoirs		Portion 65 of Farm, Modderfontein 345IQ			26°24'29.05"S 27°41'12.99"E
	South Shaft: 2x pipes (to transport water to the Twin and the South Shaft)		Portion 29 of Farm, Modderfontein 345IQ			Start: 26°24'36.12"S; 27°39'57.38"E End: 26°24'37.02"S; 27°39'55.26"E
	Khanyisa Solar Plant		Portion 34 of Farm Doornpoort 347IQ			26°24'33.51"S 27°39'16.17"E
	Twin Shaft and associated infrastructure		Portion 7 of Farm Doornpoort 347IQ			26°24'53.29"S 27°39'42.91"E
	South Shaft and Associated Infrastructure		Portion 10 of Farm, Modderfontein 345IQ			26°24'25.55"S 27°40'58.93"E

Table 5: Water Use activities for Section 21(e)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum) and area	Proposed Volume (m³/ annum) and area	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2018 WUL							
Irrigation of old TSF with water from RWD 1 and 2 for maintenance of grassed areas (730 000m³/a) – area of 240ha	Irrigation of old TSFs (Phase 1) with water from the RWD for maintenance of grassed areas (730 000m³/a) – area of 240ha	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 20 of Farm Modderfontein 345IQ	730 000m³/a – area of 240ha	730 000m³/a – area of 240ha	26°24'52.80"S 27°40'36.14"E	26°24'52.80"S 27°40'36.14"E
Irrigation of new TSF with water	Irrigation of old TSFs (Phase 2) with water from	Farm Modderfontein	Portion 21 of Farm	730 000m³/a – area of	730 000m³/a – area	26°25'5.08"S	26°25'5.08"S

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum) and area	Proposed Volume (m³/ annum) and area	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2018 WUL							
from RWD 3 and 4 for maintenance of grassed areas (730 000m³/a) – area of 240ha	RWD for maintenance of grassed areas (730 000m³/a) – area of 240ha		Modderfontein 345IQ	240ha	of 240ha	27°40'13.09"E	27°40'13.09"E
Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas (730 000m³/a) – area of 240ha	Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas (730 000m³/a) – area of 240ha	Portion 1, 44, 45, 51, 52 and 53 of Farm Doornpoort 347IQ	Portion 45 of Farm Doornpoort 347IQ	730 000m³/a – area of 240ha	730 000m³/a – area of 240ha	26°27'53.34"S 27°38'48.78"E	26°27'53.34"S 27°38'48.78"E
Irrigation of shaft areas with water from Twin shaft PCD (365 000m³/a) – area of 240ha	Irrigation of shaft areas with water from Twin shaft PCD (365 000m³/a) – area of 240ha	Farm Doornpoort 347IQ	Portion 45 of Farm Modderfontein 345IQ	365 000m³/a – area of 240ha	365 000m³/a – area of 240ha	26°24'23.50"S 27°41'18.60"E	26°24'23.50"S 27°41'18.60"E
Irrigation of all TSFs and shaft areas with final effluent from WWTW (912 500m³/a) – area of 960ha	Irrigation of all TSFs with final effluent from WWTW (912 500m³/a) – area of 960ha	Farm Modderfontein 345IQ and Farm Doornpoort 347IQ	Portions 20, 21, 45 and 65 of Farm Modderfontein 345IQ	912 500m³/a – area of 960ha	912 500m³/a – area of 960ha	26°24'23.50"S 27°41'18.60"E 26°24'52.80"S 27°40'36.14"E 26°25'5.08"S 27°40'13.09"E 26°27'53.34"S 27°38'48.78"E	26°24'23.50"S 27°41'18.60"E 26°24'52.80"S 27°40'36.14"E 26°25'5.08"S 27°40'13.09"E 26°27'53.34"S 27°38'48.78"E

Table 6: Water Use activities for Section 21(f)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL							
Discharging water into the Leeuspruit (730 000 m³/a) of purified sewage effluent, based on maximum quantity of 2 500m³/day) into Leeuspruit.	Discharging water into the Leeuspruit (730 000 m³/a) of purified sewage effluent, based on maximum quantity of 2 500m³/day) into Leeuspruit.	Portion 44, Modderfontein345IQ	Portion 3, Modderfontein345IQ	730 000 m³/a based on maximum quantity of 2 500m³/day)	730 000 m³/a based on maximum quantity of 2 500m³/day)	26°25'7.25"S 27°41'13.31"E	26°25'17.69"S 27°40'53.43"E
Approved in the 2018 WUL							
Discharge of excess underground water (1 095 000m³/a).	Discharge of excess underground water (1 095 000m³/a).	Portion 44, Modderfontein 345IQ	Portion 3, Modderfontein 345IQ	1 095 000m³/a	1 095 000m³/a	26°25'35.6"S 27°41'21.81"E	26°25'17.63"S 27°40'53.45"E
Additional New water uses to be approved							
NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	Discharge of treated water from the RO Plants	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	1 000 000 m³/a	NEW WATER USES WHICH WERE NEVER APPROVED. THEY WERE INTRODUCED TO SUPPORT THE MINE OPERATIONS	26°24'35.59"S 27°41'21.82"E

Table 7: Water Use activities for Section 21(g)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL							
Disposing 1 200 000 tonnes per annum of gold slurry at South Shaft into the TSFs	Disposing 1 200 000 tonnes per annum of gold slurry at South Shaft into the TSFs	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	1 200 000	THE WATER USE IS NO LONGER APPLICABLE, AS ALL THE MINE'S TAILINGS ARE CURRENTLY BEING DISPOSED OF AT THE DOORNSPOORT TSF.	26°25'0.02"S 27°40'12.16"E	THE WATER USE IS NO LONGER APPLICABLE, AS ALL THE MINE'S TAILINGS ARE CURRENTLY BEING DISPOSED OF AT THE DOORNSPOORT TSF.
Disposing 1 560 000 tonnes of gold slurry as backfill into the mined-out workings underground.	Disposing 1 560 000 tonnes of gold slurry as backfill into the mined-out workings underground.	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	1 560 000	1 560 000	26°24'14.94"S 27°41'8.26"E	26°24'14.94"S 27°41'8.26"E
Disposing 20 400 sewage sludge into the drying beds.	Disposing 20 400 sewage sludge into the drying beds.	Portion 44, Modderfontein 345IQ	Portion 44, Modderfontein 345IQ	20 400	20 400	26°25'6.49"S 27°41'14.85"E	26°25'6.49"S 27°41'14.85"E
Disposing a maximum quantity of	Disposing a maximum quantity of 584 000 tonnes of	Portion 7 of Farm Doornpoort	Portion 7 of Farm	584 000	584 000	26°25'16.38"S	26°25'16.38"S

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL							
584 000 tonnes of waste rock into the Waste Rock Dump (WRD).	waste rock into the WRD.	347 IQ	Doornpoort 347 IQ			27°39'14.02"E	27°39'14.02"E
Disposing quantity of 1000 000 of waste water from the Doornpoort TSF into the RWD.	Disposing quantity of 1000 000 of waste water from the Doornpoort TSF into the RWD.	Portion 20, 50, 51 of Doornpoort 347IQ	Portion 50 of Farm Doornpoort 347IQ	1 000 000	1 000 000	26°28'0.05"S 27°39'14.18"E	26°28'2.42"S 27°38'23.87"E
Twin Shaft retention pond at 62 400m³/a)	Twin Shaft PCD at 62 400m³/a	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 70 of Farm Doornpoort 347IQ	62 400	62 400	26°25'22.62"S 27°39'56.92"E	26°25'22.62"S 27°39'56.92"E
Cascade Dams (16 x 3 000m³/a) (12 unlined and 4 PVC lined).	Cascade Dams (16x3 000m³/a) (12 unlined and 4 PVC lined).	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 3 of Farm Modderfontein 345IQ	16 x 3 000	16 x 3 000	26°25'10.27"S 27°40'33.85"E	26°25'10.27"S 27°40'33.85"E
Upgraded RWD (52 487m³/a)	South Shaft RWD to be decommissioned and rehabilitated (52 487m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 3 of Farm Modderfontein 345IQ	52 487	52 487	26°25'12.50"S 27°40'49.12"E	26°25'15.31"S 27°40'50.05"E
Settlers A & B (2 x 650m³/a)	Settlers A & B (2 x 650m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 39 of Farm Doornpoort 347IQ	2 x 650	2 x 650	26°25'8.15"S 27°39'50.81"E	26°25'8.15"S 27°39'50.81"E
Mine Water Dams (2 x 2 200m³/a)	Mine Water Tanks (2 x 2 200m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 30 of Farm Modderfontein 345IQ	2 x 2 200	2 x 2 200	26°24'20.74"S 27°41'15.72"E	26°24'20.74"S 27°41'15.72"E
Condenser Dam (200m³/a)	Condenser Dams at the Refrigeration Plant for condensation (200m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 30 of Farm Modderfontein 345IQ	200	200	26°24'13.04"S 27°41'15.69"E	26°24'13.04"S 27°41'15.69"E
Thickeners at old Gold Plant area (5 x 3 500 m³/a)	Thickeners at old Gold Plant area (5 x 3 500 m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 7 of Farm Doornpoort 347IQ	5 x 3 500	5 x 3 500	26°25'10.02"S 27°39'29.76"E	26°25'10.02"S 27°39'29.76"E
Amended in the 2018 WUL							
Old RWD (150 000m³/a)	Upgraded South Shaft RWD (150 624m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 3 of Farm Modderfontein 345IQ	150 000	150 624	26°25'10.27"S 27°40'33.85"E	26°25'12.23"S 27°40'45.72"E
Gold Plant PCD (2 x 3 500m³/a)	Gold Plant PCD (2 x 3 500m³/a)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 39 of Farm Doornpoort 347IQ	2x3 500	2x3 500	26°25'11.52"S 27°40'34.81"E	26°25'15.78"S 27°39'32.43"E
Refrigeration Dams (5 x 2 800)	Refrigeration Dams (4 x 2 800)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 29 of Farm Modderfontein 345IQ	5 x 2 800	4 x 2 800	26°24'9.96"S 27°41'16.19"E	26°24'9.96"S 27°41'16.19"E
	Refrigeration Dam (1 x 2 800)	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 29 of Farm Modderfontein 345IQ	5 x 2 800	1 x 2 800	26°24'2.16"S 27°41'17.16"E	26°24'2.16"S 27°41'17.16"E
Dust suppression with waste water from Old RWD on all haul roads (365 000m³/a) over 3 566ha.	Dust suppression with waste water from upgraded RWD on all haul roads (365 000m³/a) over 3 566ha.	N/A	N/A	365 000	365 000	N/A	N/A
New water uses to be approved							
NEW WATER USES WHICH WERE NEVER APPROVED.	Backfill Plant Area (x5 Mine Water Tanks)	NEW WATER USES WHICH WERE NEVER APPROVED.	NEW WATER USES WHICH WERE NEVER APPROVED.	NEW WATER USES WHICH WERE NEVER APPROVED.	5 x 2 200	NEW WATER USES WHICH WERE NEVER APPROVED.	26°24'28.04"S 27°41'18.38"E
	Cascade Dams (South of TSF 3 and 4)				62 400		26°25'31.14"S 27°40'18.60"E
	Disposing 1 200 000 tonnes per annum of gold slurry at Doornpoort TSF				1 200 000		26°27'40.05"S 27°38'55.75"E

Table 8: Water Use activities for Section 21(j)

Description/ Purpose (Approved)	Description/ Purpose (Proposed)	Approved Properties	Corrected Properties to be authorised	Approved Volume (m³/ annum)	Proposed Volume (m³/ annum)	Approved Co-ordinates	Corrected Co-ordinates to be approved
Approved in the 2011 WUL and amended in 2021 addendum							
Removing a volume not exceeding 1 824 996 m³/a of groundwater for efficient continuation of mine or safety of people, for use in the process.	Removing a volume not exceeding 1 824 996 m³/a of groundwater for efficient continuation of mine or safety of people, for use in the process.	Portions 3; 20; 21; 40 and 41 of Farm Modderfontein 345IQ	Portion 29 of Farm Modderfontein 345IQ	1 824 996	1 824 996	26°24'14.10"S 27°41'7.40"E	26°24'14.10"S 27°41'7.40"E

SECTION 3: DESCRIPTION OF CURRENT AND PROPOSED ACTIVITIES

This section provides a description of the method/ technology currently being employed during mining.

3-1 CURRENT ACTIVITIES

South Deep Gold Mine has been operational for over 50 years and is engaged in underground mining comprising one metallurgical plant and two operating shaft systems: South Shaft complex and Twin Shaft complex. The South Shaft complex includes a main shaft and three sub-vertical shafts, two of which are operational. The Twin Shaft complex consists of a single-barrel main shaft for hoisting personnel, rock materials and an adjacent bratticed ventilation shaft, used for both drawing used air and hoisting rock. The South Shaft complex operates to a depth of 2 650 metres below surface, and the Twin Shaft complex operates to a depth of 2 995 metres below surface. The mine's workings are at depth and therefore require significant cooling infrastructure. The mine's operation has access to the national electricity grid, the mine's Khanyisa solar grid, water and road infrastructure and is located near regional urban centres where it can obtain needed supplies and services.

The current South Deep JV: South Deep Gold Mine operations derive from the Barrick Gold - Western Areas Joint Venture which Gold Fields acquired in a series of transactions in the second half of 2007. The Barrick Gold – Western Areas Joint Venture was named the South Deep JV.

It is a long-life (LoM estimated to extend to 2098), deep-level mechanised gold mine operating at between 2 000 and 3 000 meters below surface.

3-1.1 Mining Method

South Deep Gold Mine gold reserves are mined through underground operation accessed through South Shaft and Twin Shaft. Figure 5 depicts the 3D isometric view of South Deep Gold Mine access to its commodity.

The underground mining utilises conventional and trackless mining methods that involve drilling, blasting, loading and hauling of ore and waste. On the other hand, conventional mining (more labour intensive and requires the use of rail infrastructure) is used to extract the Ventersdorp Contact Reef (VCRs) and for distress-stoping. Trackless mining methods involve mechanised bulk mining (makes use of machinery) and takes place in the massive part of the ore body. The main operating levels of the mine are Level 90 and 95, with Level 87 as an inter-level between Level 85 and 90.

3-1.2 Current mine

South Deep Gold Mine utilises a selective access development and Longhole open stoping mining method. Mining is spread across a large area, which was originally mined using conventional tabular mining. Current mine is accessed from three 90, 93 and 95 access levels using both South Shaft and Twin Shaft.

3-1.3 North of Wrench

This area is directly south and down-dip of current mine and is accessed from the Twin Shaft. the mining area consists of six corridors which are separated by regional pillars. This division of the mine is mined using horizontal mechanised distress and longhole stoping methods and is accessed from two active levels and ramp systems.

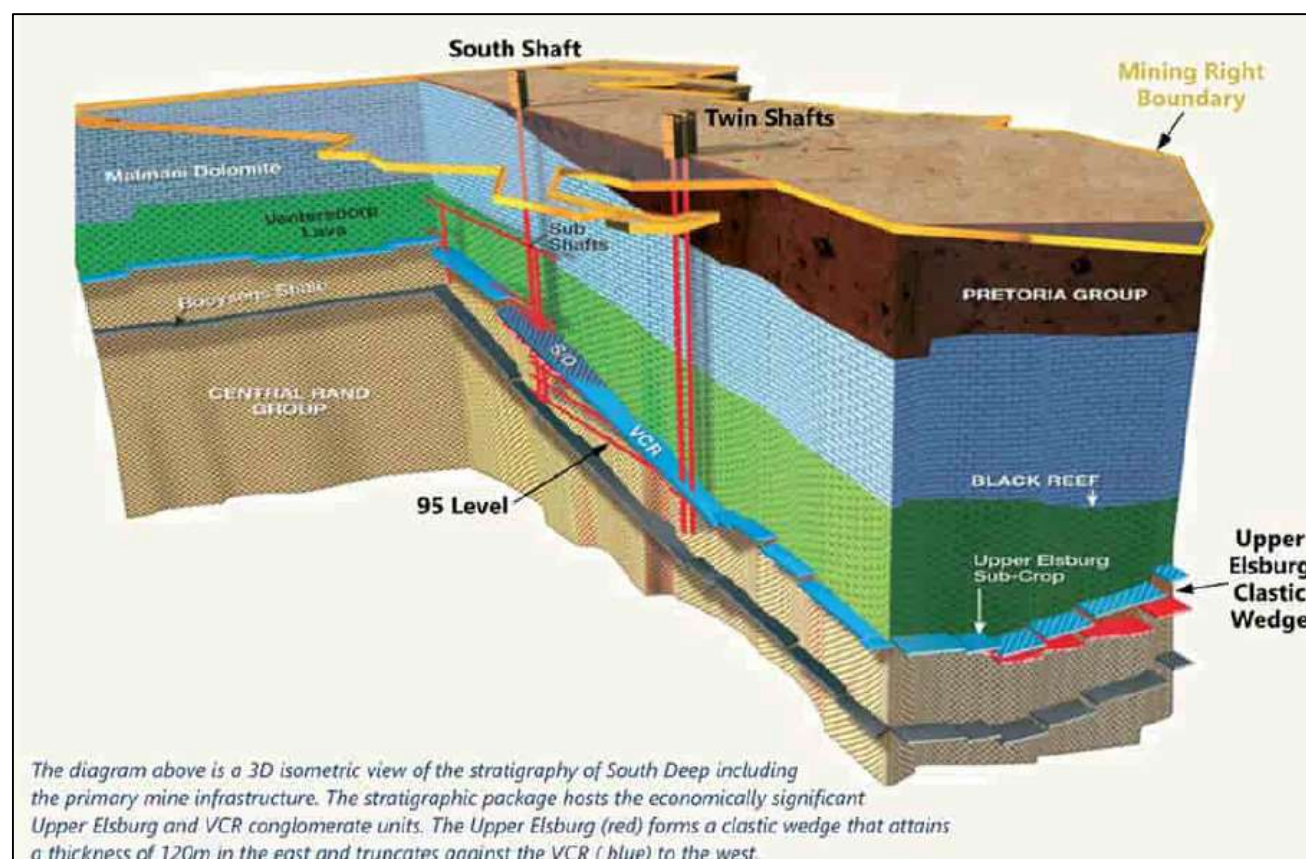


Figure 5: Three-dimensional cross-section of South Deep Gold Mine

3-1.4 South of Wrench

This area is directly south and down-dip of North of Wrench and is accessed from Twin Shaft. The bulk mining in the future will occur in this area. The mining will occur once all required infrastructure to exploit the area has been installed.

3-1.5 Production Rate

The Gold Plant has a capacity to produce 220 000 tons per month of product.

3-1.6 Gold Recovery Process

The gold recovery process comprises of milling (wet process), concentrating, thickening, leaching, and carbon-in-pulp (CIP) sections. All material in the Gold Plant is potentially gold bearing, and therefore, all spillages are recycled. This process is indicated in Figure 6.

3-1.6.1 Milling

The milling plant consists of a Semi-Autogenous Grinding (SAG) mill and a ball mill. Ore from the stockpile is conveyed to the SAG mill where it is ground using large (100mm) steel balls. The ground material is screened. Oversized material is recycled back to the SAG mill via the ore stockpile while undersized material is fed to a cyclone cluster for classification. The cyclone overflow gravitates to one of three linear screens for woodchip/trash removal. The final milled pulp gravitates into a high-rate thickener (HRT). The underflow from four cyclones is fed to the ball mill for further grinding using smaller (50mm) steel balls. The ground material from the ball mill is screened.

Oversized material is recycled back to the SAG mill while undersized material is fed to a discharge box. Lime is added to the discharge box. From the discharge box, the material is pumped to the cyclone cluster for

classification. The cyclone overflow gravitates to one of three linear screens for woodchip/trash removal. The final milled pulp gravitates into a HRT.

Inputs: Large volumes of process water and lime

3-1.6.2 Concentrating

The underflow from three or four cyclones on the cluster is fed to the Knelson vibrating screen. The oversize is recycled back to the ball mill while the undersize is sent to the Knelson concentrators for the recovery of free gold. Concentrate from the concentrators is fed to a storage tank in the smelt house.

Inputs: Reagents

3-1.6.3 Thickening

The HRT feed is dosed with flocculant to agglomerate solid particles as they settle to produce pulp. Lime is added, (at the SAG mill discharge box) to regulate the pH. Clear water overflows to the mill circuit water tank while the underflow (pulp) is thickened and pumped to the leach tanks.

Inputs: Flocculants

3-1.6.4 Leaching

Pulp from the HRT is pumped to the leach section where it is treated in mechanically agitated tanks with sodium cyanide to dissolve the gold. Air is injected to provide the oxygen needed during the leaching process. Lime is added to regulate the pH.

Inputs: Sodium cyanide, Air and Lime

3-1.6.5 Carbon-in-pulp Process

The CIP circuit consists of 8 mechanically agitated tanks. Carbon (which is porous) is added to each tank to absorb the dissolved gold. Samples are taken in each tank to see the carbon profile and to see how much gold the carbon has absorbed. The loaded carbon is pumped to a screen where it is washed. The underflow is recycled back to the CIP tanks while the overflow is dropped into an elution column. The elution process involves firstly the acid treatment of the carbon to remove impurities before stripping the gold into a solution by the use of a hot cyanide/caustic solution.

The resulting eluate is pumped to a tank at the smelt house area where it is stored until the carbon stripping process is complete. The stripped carbon is then transferred to a screen where the undersize reports to carbon fines circuit. Oversize is fed into a rotary kiln for regeneration. The tails from the CIP tails tank are fed to a screen where the underflow is pumped to the Backfill Plant. The overflow is pumped to the carbon sizing screen as it contains carbon.

Inputs: Carbon, Water, Diluted acid and Caustic soda

3-1.6.6 Carbon Regeneration

Used carbon is regenerated for use in the CIP section of the gold recovery process. The process of regeneration is used to rid the stripped carbon of organics and other impurities, which decrease the activity of the carbon that is to be used in the CIP process. This is achieved by raising the temperature of the carbon in an electrically fired rotary kiln to 750°C. The steam created during the regeneration process creates a negative atmospheric pressure which prevents the combustion of the carbon.

The regenerated carbon is quenched to cool down and then transferred hydraulically, with water, to the carbon sizing screen. Fine carbon is distributed to two Settlers from where the settled fines (carbon sludge) are recovered in 1-ton bulk bags and sold to a contractor/recycler who will recover the fine gold caught in the fine carbon. The sized carbon is collected in a transfer vessel. Approximately 7 tons of carbon is collected in the transfer vessel before it is returned to the adsorption circuit (CIP circuit). It being a wet process, the kiln feed hopper is fitted with a wire screen in order to drain excess water and some fines (if present). Excess water gravitates to a water tank for re-use.

3-1.6.7 Smelting

Concentrate from the Knelson concentrators is upgraded using a Gemini (vibrating) table from where it is calcined and smelted. The eluate from the CIP section is pumped to holding tanks and circulated through automatic electrowinning reactors until most of the gold is recovered to a sludge. The reactors are backwashed daily, and the sludge is discharged into holding tanks inside the smelt house. The gold sludge is filtered and dried in the smelt house. The spent electrolyte is recycled back to the leach circuit. Dried sludge is smelted with fluxes in an induction furnace to produce gold bullion and slag.

Gold bullion is sent by helicopter to the Rand Refinery in Germiston (Gauteng) for further processing. Slag is recycled back to the SAG mill. Due to the gold content, all spillage in the section is recycled.

Inputs: Fluxes

3-2 EXTENT OF ACTIVITY

The South Deep Gold Mine boundary area comprises of an area of approximately 7 452 hectares. It is estimated that the South Deep Gold Mine contains more than 80 470 gold bullion bars of golds, which can be mined by means of underground mining methods during the 76 years of current LoM. The extent of mine activity is depicted in Figure 5.

The surface area of the mine is located north of Westonaria on landscape dominated by quartzitic ridges of the Gatsrand, trending roughly east-west. The Leeuspruit rises in these ridges and flows southwards, skirting the eastern boundary of the mine. The gentle undulating open terrain within the area is representative of African cycle erosion with deep weathering, leached soils and accumulations of ferricrete that commonly occur.

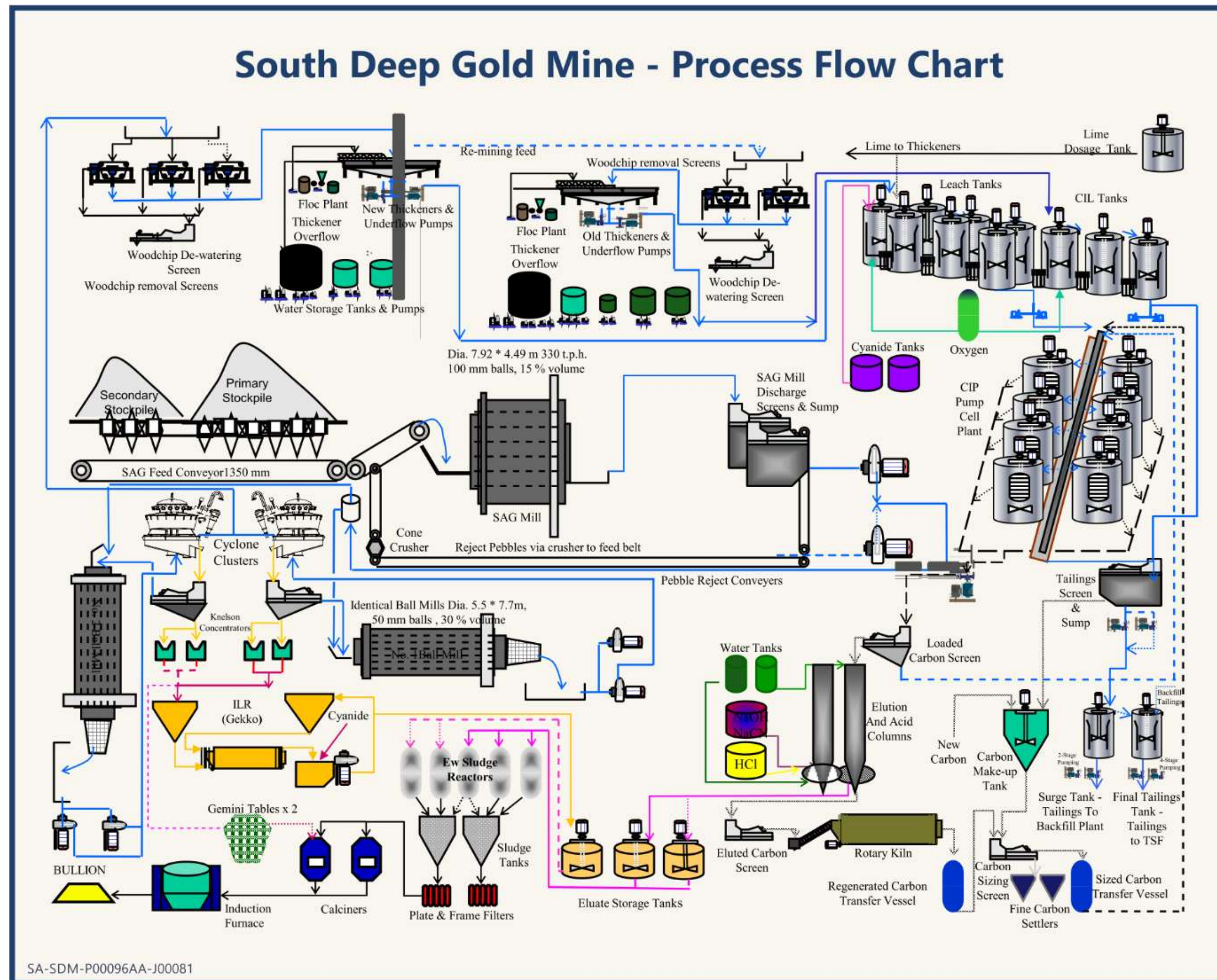


Figure 6: South Deep Gold Mine Flow Process

3-3 KEY RELATED ACTIVITIES, PROCESSES AND PRODUCTS

3-3.1 Activity Life Description

The South Deep Gold Mine operation extracts the largest gold deposits globally and has a mineral reserve of 32.19 million ounces. The estimated LoM is about 76 years.

3-3.2 Activity Infrastructure Description

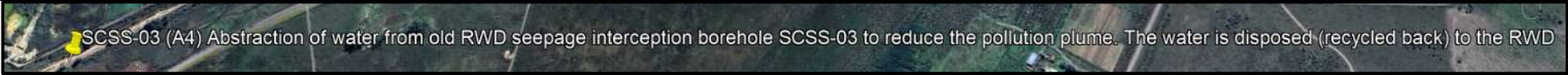
The key infrastructure associated with South Deep Gold Mine are summarised below.

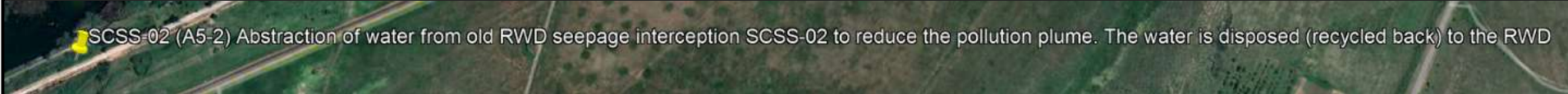
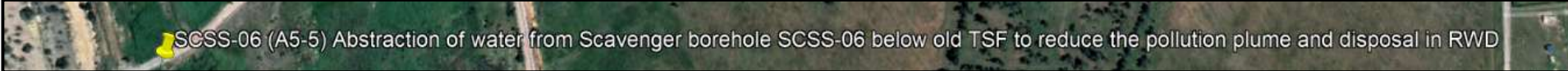
- Surfaced roads, haul roads, pipelines and conveyors (± 10 ha);
- Main administration offices (including parking facilities) (± 3.4 ha) and security facilities;
- Two shaft complexes, namely, South Shaft (± 10.7 ha) and Twin Shaft (± 40 ha);
 - South Shaft complex comprises a shaft, ventilation shafts, winder houses, Eskom yard, Refrigeration Plant, workshops, wash bay, change house, ablution facilities, offices and clinic;
 - Twin Shaft complex comprises a shaft, ventilation shafts, winder houses, Eskom yard, Refrigeration Plant, workshops and stores, wash bay, diesel station, offices, change house, ablution facilities, lamp and crush building, explosives loading shed, explosives detonation bay and canteen.
- Gold Plants:
 - Backfill Plant at South Shaft, and
 - The Gold Plant in the Twin Shaft area (± 35.2 ha) including a substation, compressor house, stores, workshops, wash bay, diesel station, offices, canteen, change house and ablution facilities.
- Mine waste management infrastructure including:
 - South Shaft Waste Rock Dump (WRD) (± 15.2 ha) has been decommissioned and rehabilitated;
 - Twin Shaft WRD (± 20 ha) (not accepting any waste rock as the mine does not produce waste rock);
 - “Old” TSF 1 and 2 (Phase 1) (± 70 ha) (currently being remined);
 - “Old” TSF 3 and 4 (Phase 2) (± 100 ha) (progressively being rehabilitated – revegetated);
 - Doornpoort TSF (± 260 ha); and
 - Waste transfer station and salvage yard.
- Clean and dirty water management facilities:
 - Pollution Control Dams (PCDs);
 - Cascade Dams;
 - Settlers;
 - Stormwater management infrastructure including RWDs;
 - Reverse Osmosis (RO) Plants 1,2 and 3 (RO 3 is yet to be constructed), and
 - Water storage tanks.
- Wastewater treatment facilities:
 - French drains;
 - Pump stations at Twin Shaft and South Shaft areas, and
 - Pipeline between pump stations and WWTW in South Shaft area (± 1.4 ha).
- Waste Transfer station including:
 - Domestic waste sorting area; and
 - Salvage yard.
- Employee facilities including:
 - Housing;
 - Recreational facilities, and
 - Taxi rank.

3-4 KEY WATER USES APPLIED FOR

The proposed WUL and its addendum amendments, and consolidation project requires Section 21 (a) (Table 2), (b) (Table 3), (c and i) (Table 4), (e) (Table 5), (f) (Table 6), (g) (Table 7) (j) (Table 8) IWULA.

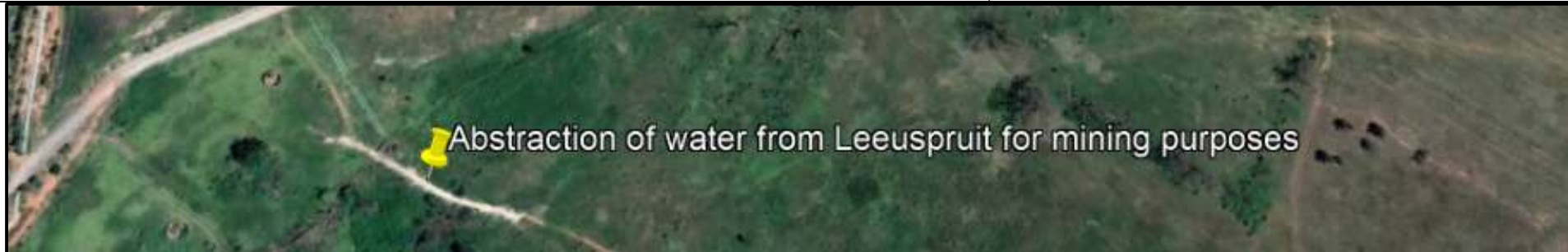
Table 9: Water Use activities for Section 21 (a)

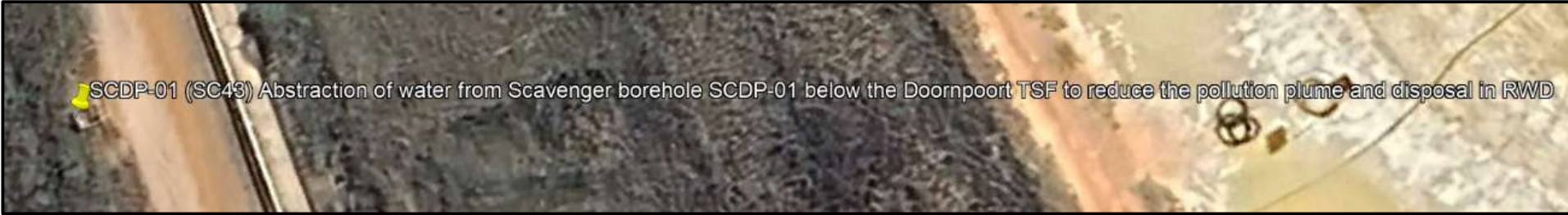
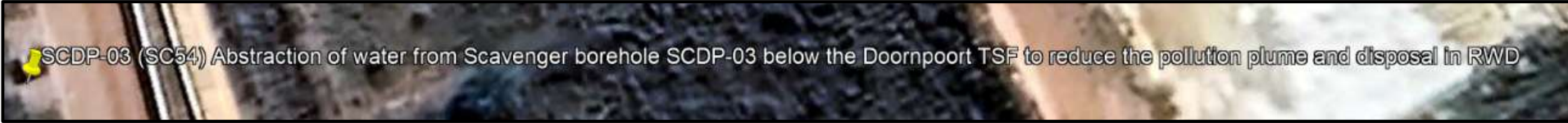
Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
SCTS-01 (TS-BH01) Abstraction of water from Twin Shaft SCTS-01 borehole for mining purposes	26°25'1.92"S 27°39'47.99"E
	
SCSS-03 (A4) Abstraction of water from old RWD seepage interception borehole SCSS-03 to reduce the pollution plume. The water is disposed (recycled back) to the RWD	26°25'20.35"S 27°40'48.28"E
	
SCSS-44 (A5-1) Abstraction of water from Scavenger borehole SCSS-44 below old TSF to reduce the pollution plume and disposal in RWD	26°24'45.12"S 27°40'45.85"E
	
SCSS-02 (A5-2) Abstraction of water from old RWD seepage interception SCSS-02 to reduce the pollution plume. The water is disposed (recycled back) to the RWD	26°25'16.12"S 27°40'55.38"E

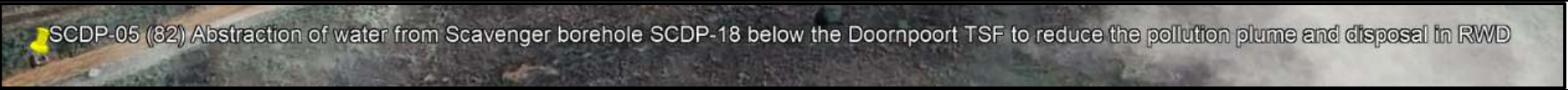
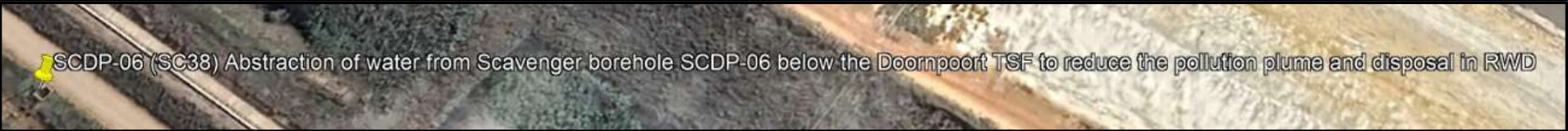
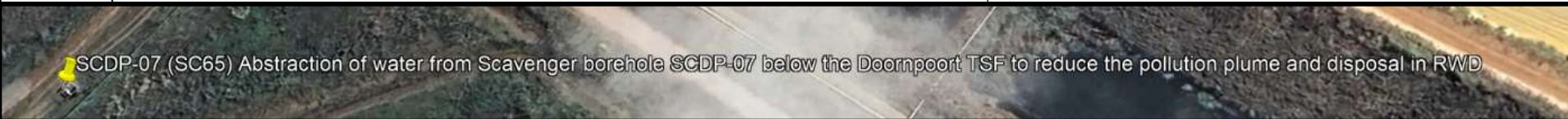
Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
	
SCSS-01 (A5-3) Abstraction of water from Scavenger borehole SCSS-01 below old TSF to reduce the pollution plume and disposal in RWD	26°25'13.40"S 27°41'1.62"E
	
SCSS-45 (A5-4) Abstraction of water from Scavenger borehole SCSS-11 below old TSF to reduce the pollution plume and disposal in RWD	26°25'30.70"S 27°40'25.25"E
	
SCSS-06 (A5-5) Abstraction of water from Scavenger borehole SCSS-06 below old TSF to reduce the pollution plume and disposal in RWD	26°25'0.00"S 27°40'53.90"E
	
SCSS-46 (A5-6) Abstraction of water from Scavenger borehole SCSS-46 to reduce the pollution plume and disposal in RWD	26°25'7.25"S 27°40'0.35"E
	
SCSS-08 (A6-1) Abstraction of water from Scavenger borehole SCSS-08 below old TSF to reduce the pollution plume and disposal in RWD	26°25'7.60"S 27°40'45.50"E

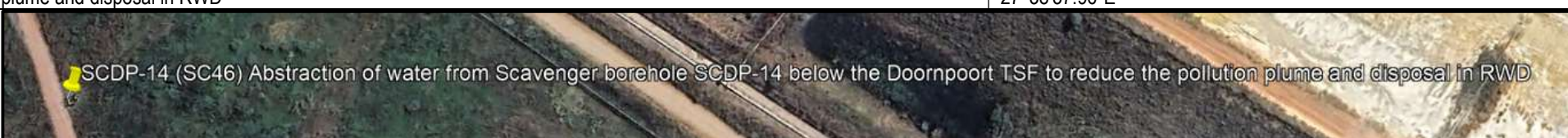
Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
 SCSS-08 (A6-1) Abstraction of water from Scavenger borehole SCSS-08 below old TSF to reduce the pollution plume and disposal in RWD	
SCDP-20 (A6-2) Abstraction of water from scavenger SCDP-20 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'43.84"S 27°38'17.65"E
 SCDP-20 (A6-2) Abstraction of water from scavenger SCDP-20 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCSS-04 (SDS17) Abstraction of water from Scavenger borehole SCSS-04 below old TSF to reduce the pollution plume and disposal in RWD	26°25'40.12"S 27°40'38.03"E
 SCSS-04 (SDS17) Abstraction of water from Scavenger borehole SCSS-04 below old TSF to reduce the pollution plume and disposal in RWD	
SCSS-05 (SDS18) Abstraction of water from Scavenger borehole SCSS-05 below old TSF to reduce the pollution plume and disposal in RW	26°25'46.67"S 27°40'31.73"E
 SCSS-05 (SDS18) Abstraction of water from Scavenger borehole SCSS-05 below old TSF to reduce the pollution plume and disposal in RW	
SCSS-07 (SPD02) Abstraction of water from Scavenger borehole SCSS-07 below old TSF to reduce the pollution plume and disposal in RWD	26°25'1.04"S 27°41'14.84"E

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
 SCSS-07 (SPD02) Abstraction of water from Scavenger borehole SCSS-07 below old TSF to reduce the pollution plume and disposal in RWD	
SCSS-09 (SCSS-09) Abstraction of water from Scavenger borehole SCSS-09 below old TSF to reduce the pollution plume and disposal in RWD	26°25'12.55"S 27°40'39.17"E
 SCSS-09 (SCSS-09) Abstraction of water from Scavenger borehole SCSS-09 below old TSF to reduce the pollution plume and disposal in RWD	
WASS-01 (BH1) Abstraction of water for South Shaft borehole WASS-01 for mining purpose 1	26°24'15.72" 27°41'8.57"E
 WASS-01 (BH1) Abstraction of water for South Shaft borehole WASS-01 for mining purpose 1	
WASS-04 (BH4) Abstraction of water for South Shaft borehole WASS-04 for mining purpose 2	26°24'15.72"S 27°41'8.07"E

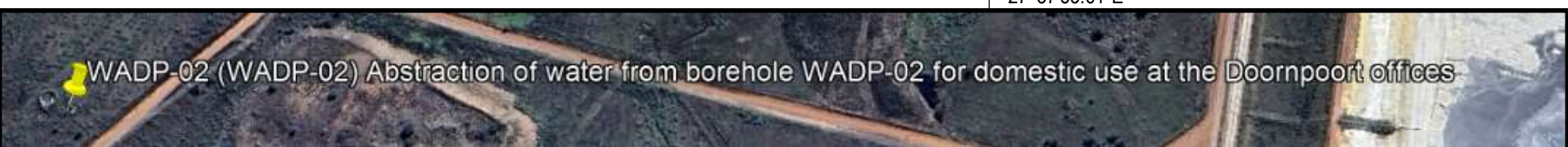
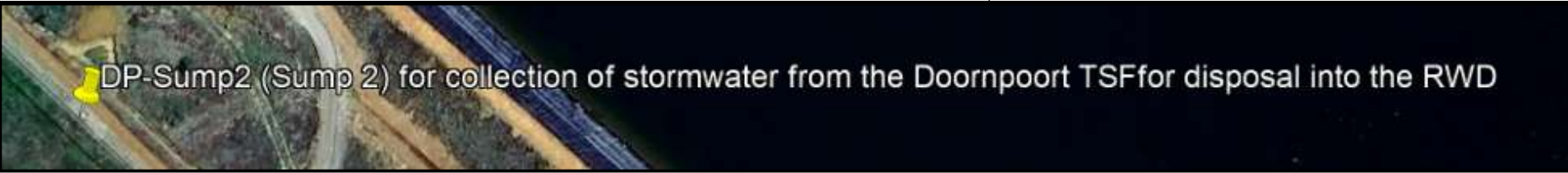
Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
	
WASS-05 (BH5) Abstraction of water for South Shaft borehole WASS-05 for mining purpose 3	26°24'15.72"S 27°41'7.49"E
	
SCDP-11 (BH1) Abstraction of water from Scavenger borehole SCDP-11 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'0.90"S 27°38'10.35"E
	
Abstraction of water from Leeuspruit for mining purposes	26°24'36.04"S 27°41'22.94"E
	
SCDP-12 (SC31) Abstraction of water from Scavenger borehole SCDP-12 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
 SCDP-12 (SC31) Abstraction of water from Scavenger borehole SCDP-12 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-01 (SC43) Abstraction of water from Scavenger borehole SCDP-01 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'54.78"S 27°38'26.92"E
 SCDP-01 (SC43) Abstraction of water from Scavenger borehole SCDP-01 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-02 (SC61) Abstraction of water from Scavenger borehole SCDP-02 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'56.44"S 27°38'28.24"E
 SCDP-02 (SC61) Abstraction of water from Scavenger borehole SCDP-02 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-03 (SC54) Abstraction of water from Scavenger borehole SCDP-03 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'51.90"S 27°38'25.56"E
 SCDP-03 (SC54) Abstraction of water from Scavenger borehole SCDP-03 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-04 (SC84) Abstraction of water from Scavenger borehole SCDP-04 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'9.03"S 27°38'39.73"E

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
 SCDP-04 (SC84) Abstraction of water from Scavenger borehole SCDP-04 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-05 (82) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'11.19"S 27°38'37.75"E
 SCDP-05 (82) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-06 (SC38) Abstraction of water from Scavenger borehole SCDP-06 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'7.72"S 27°38'44.39"E
 SCDP-06 (SC38) Abstraction of water from Scavenger borehole SCDP-06 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-07 (SC65) Abstraction of water from Scavenger borehole SCDP-07 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'9.11"S 27°38'42.15"E
 SCDP-07 (SC65) Abstraction of water from Scavenger borehole SCDP-07 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-08 (SC60) Abstraction of water from Scavenger borehole SCDP-08 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'0.73"S 27°38'33.72"E
 SCDP-08 (SC60) Abstraction of water from Scavenger borehole SCDP-08 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	
SCDP-09 (SC59) Abstraction of water from Scavenger borehole SCDP-09 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'3.21"S 27°38'37.47"E
 SCDP-09 (SC59) Abstraction of water from Scavenger borehole SCDP-09 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
SCDP-10 (SC50) Abstraction of water from Scavenger borehole SCDP-10 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'10.38"S 27°38'48.45"E
	
SCDP-13 (SC40) Abstraction of water from Scavenger borehole SCDP-13 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'11.31"S 27°38'21.87"E
	
SCDP-14 (SC46) Abstraction of water from Scavenger borehole SCDP-14 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'6.77"S 27°38'37.96"E
	
SCDP-15 (SC49) Abstraction of water from Scavenger borehole SCDP-15 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'5.51"S 27°38'41.05"E
	
SCDP-16 (SC51) Abstraction of water from Scavenger borehole SCDP-16 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'48.88"S 27°38'23.62"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
SCDP-17 (SC54R) Abstraction of water from Scavenger borehole SCDP-17 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'51.90"S 27°38'25.37"E
	
SCDP-18 (SC67) Abstraction of water from Scavenger borehole SCDP-18 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'14.22"S 27°38'28.96"E
	
SCDP-19 (SC45) Abstraction of water from Scavenger borehole SCDP-19 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°28'1.39"S 27°38'32.07"E
	
SCDP-21 (EP3) Abstraction of water from Scavenger borehole SCDP-21 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'55.87"S 27°38'10.46"E
	
SCDP-22 (EP7) Abstraction of water from Scavenger borehole SCDP-22 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'53.14"S 27°38'23.01"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
SCDP-23 (EP3-A) Abstraction of water from Scavenger borehole SCDP-23 below the Doornpoort TSF to reduce the pollution plume and disposal in RWD	26°27'47.50"S 27°38'9.24"E
	
WADP-01 (WADP-01) Abstraction of water from borehole WADP-01 for domestic use at the Doornpoort offices	26°27'44.20"S 27°37'51.59"E
	
WADP-02 (WADP-02) Abstraction of water from borehole WADP-02 for domestic use at the Doornpoort offices	26°27'35.23"S 27°37'53.61"E
	
DP-Sump 1 (Sump 1) for collection of stormwater from the Doornpoort TSF for disposal into the RWD	26°28'14.11"S 27°38'27.69"E
	
DP-Sump 2 (Sump 2) for collection of stormwater from the Doornpoort TSF for disposal into the RWD	26°28'7.74"S 27°38'17.26"E
	

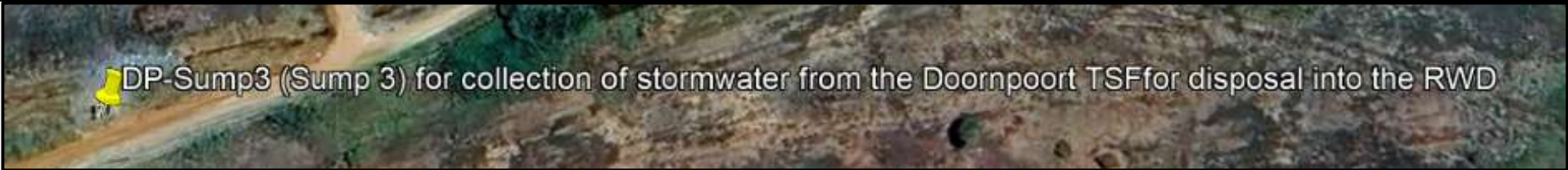
Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
DP-Sump 3 (Sump 3) for collection of stormwater from the Doornpoort TSF for disposal into the RWD	26°28'10.77"S 27°38'38.85"E
	
DP-Sump 4 (Sump 4) for collection of stormwater from the Doornpoort TSF for disposal into the RWD	26°28'8.85"S 27°38'45.95"E
	

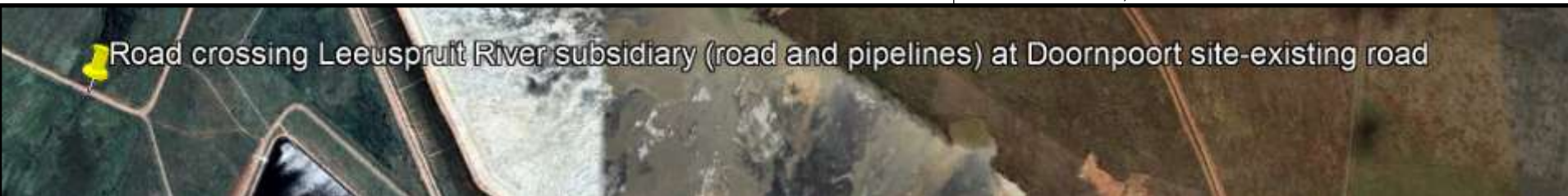
Table 10: Water Use activities for Section 21(b)

Description/ Purpose (Proposed)	Co-ordinates
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 1	26°23'54.33"S 27°41'11.11"E
Storage of Potable Water - South Shaft 25m Potable Water Reservoir 2	26°23'54.33"S 27°41'11.11"E
Storage of Potable Water - South Shaft 35m Potable Water Reservoir	26°23'54.33"S 27°41'11.11"E

Description/ Purpose (Proposed)	Co-ordinates
	

Table 11: Water Use activities for Section 21(c and i)

Description/ Purpose (Proposed)	Co-ordinates
Haul Road and flow meter installation (crossing Kariegaspruit)	Start Point: 26°25'44.44"S; 27°40'2.65"E End Point: 26°25'24.89"S; 27°40'39.83"E
	
Existing river diversion of Leeuspruit and flow meter installation in the diversion	Start: 26°25'9.37"S; 27°40'58.94"E End: 26°25'16.90"S; 27°40'16.37"E
	

Description/ Purpose (Proposed)	Co-ordinates
Pipeline Crossing - Kariegaspruit	Start: 26°25'35.06"S; 27°40'16.37"E End: 26°25'35.16"S; 27°40'15.69"E
 CORRECTED: Pipeline Crossing - Kariegaspruit	
Haul Road crossing Leeuspruit River and flow meter -old entrance to South Shaft. The road is an existing road with a new meter installation	Start: 26°24'22.55"S; 27°41'39.78"E End: 26°24'21.66"S; 27°41'38.00"E
 Haul Road crossing Leeuspruit River and flow meter -old entrance to South Shaft. The road is an existing road with a new meter installation	
Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road	Start: 26°27'47.72"S; 27°38'0.57"E End: 26°27'50.49"S; 27°38'6.90"E
 Road crossing Leeuspruit River subsidiary (road and pipelines) at Doornpoort site-existing road	
South shaft storm water separation system which runs through a wetland	Start: 26°24'30.83"S; 27°41'7.53"E End: 26°25'0.26"S; 27°40'53.30"E
 South shaft storm water separation system which run through a wetland - Start Point South shaft storm water separation system which run through a wetland - End Point	

Description/ Purpose (Proposed)	Co-ordinates
Topsoil Stockpile	26°27'35.68"S 27°38'1.44"E
	
Wetland Rehabilitation	26°24'49.30"S 27°41'12.29"E
	
Old RWD Decommissioning and Wetland Rehabilitation	26°25'15.31"S 27°40'50.05"E
	

Description/ Purpose (Proposed)	Co-ordinates
WWTW within 500m radius from the edge of the wetland	26°25'6.98"S 27°41'12.85"E
 NEW: STP within 500m radius from the edge of the wetland	
RWD upgrade	26°25'11.22"S 27°40'43.94"E
 New: RWD upgrade	
Backfill Plant Area (x5 Mine Water Tanks)	26°24'28.04"S 27°41'18.38"E
 South Shaft Associated Infrastructure, including Backfill Plant Area, RO plants, hostels and x5 Mine Water Tanks	

Description/ Purpose (Proposed)	Co-ordinates
Discharge of treated water from the RO Plants	26°24'35.59"S 27°41'21.82"E
	
South Shaft: 2x pipes (to transport water to the Twin and the South Shaft)	26°24'29.05"S 27°41'12.99"E
	
Khanyisa Solar Plant	26°24'33.51"S 27°39'16.17"E
	

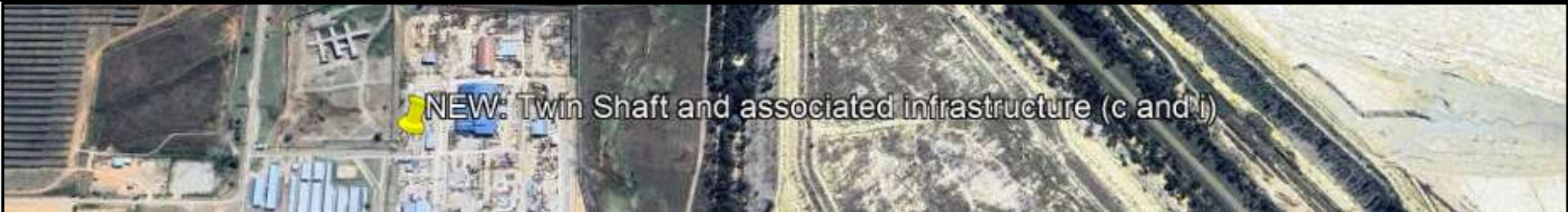
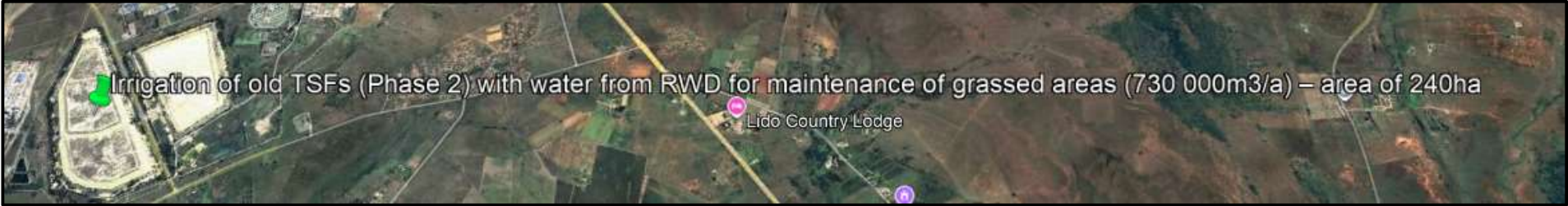
Description/ Purpose (Proposed)	Co-ordinates
Twin Shaft and associated infrastructure	26°24'53.29"S 27°39'42.91"E
	
South Shaft and Associated Infrastructure	26°24'25.55"S 27°40'58.93"E
	

Table 12: Water Use activities for Section 21(e)

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Irrigation of old TSFs (Phase 1) with water from the RWD for maintenance of grassed areas (730 000m ³ /a) – area of 240ha	26°24'52.80"S 27°40'36.14"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Irrigation of old TSFs (Phase 2) with water from RWD for maintenance of grassed areas (730 000m ³ /a) – area of 240ha	26°25'5.08"S 27°40'13.09"E
	
Irrigation of Doornpoort TSF with water from RWDs for maintenance of grassed areas (730 000m ³ /a) – area of 240ha	26°27'53.34"S 27°38'48.78"E
	
Irrigation of shaft areas with water from Twin shaft PCD (365 000m ³ /a) – area of 240ha	26°24'23.50"S 27°41'18.60"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Irrigation of all TSFs with final effluent from WWTW (912 500m³/a) – area of 960ha	26°24'23.50"S 27°41'18.60"E 26°24'52.80"S 27°40'36.14"E 26°25'5.08"S 27°40'13.09"E 26°27'53.34"S 27°38'48.78"E

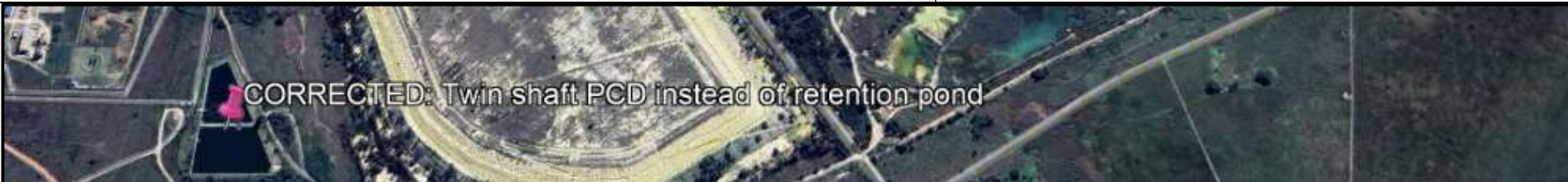


Table 13: Water Use activities for Section 21(f)

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Discharging water into the Leeuspruit (730 000 m ³ /a) of purified sewage effluent, based on maximum quantity of 2 500m ³ /day) into Leeuspruit.	26°25'17.69"S 27°40'53.43"E
	
Discharge of excess underground water (1 095 000m ³ /a).	26°25'17.63"S 27°40'53.45"E
	
Discharge of treated water from the RO Plants	26°24'35.59"S 27°41'21.82"E
	

Table 14: Water Use activities for Section 21(g)

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Disposing 1 560 000 tonnes of gold slurry as backfill into the mined-out workings underground.	26°24'14.94"S 27°41'8.26"E
	
Disposing 20 400 sewage sludge into the drying beds.	26°25'6.49"S 27°41'14.85"E
	
Disposing a maximum quantity of 584 000 tonnes of waste rock into the WRD.	26°25'16.38"S 27°39'14.02"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Disposing quantity of 1000 000 of waste water from the Doornpoort TSF into the RWD.	26°28'2.42"S 27°38'23.87"E
	
Twin Shaft PCD at 62 400m³/a	26°25'22.62"S 27°39'56.92"E
	
Cascade Dams (16x3 000m³/a) (12 unlined and 4 PVC lined).	26°25'10.27"S 27°40'33.85"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
South Shaft RWD to be decommissioned and rehabilitated (52 487m³/a)	26°25'15.31"S 27°40'50.05"E
	
Settlers A & B (2 x 650m³/a)	26°25'8.15"S 27°39'50.81"E
	
Mine Water Tanks (2 x 2 200m³/a)	26°24'20.74"S 27°41'15.72"E

Description/ Purpose (Proposed)		Corrected Co-ordinates to be approved	
 An aerial photograph showing two large, circular, green-roofed water tanks situated in an industrial area. The tanks are labeled "Mine Water Tanks x2". The surrounding area includes various industrial buildings, roads, and some vegetation.			
Condenser Dams at the Refrigeration Plant for condensation (200m³/a)		26°24'13.04"S 27°41'15.69"E	
 An aerial photograph showing several large, circular, brown-roofed condenser dams. The area is labeled "South Deep Gold Mine" and "Condenser Dams at the refrigeration plant for condensation". The surrounding area includes industrial buildings, roads, and some vegetation.			
Thickeners at old Gold Plant area (5 x 3 500 m³/a)		26°25'10.02"S 27°39'29.76"E	
 An aerial photograph showing several large, circular, brown-roofed thickeners. The area is labeled "Thickeners at Gold Plant Area (5x3 500m³)". The surrounding area includes industrial buildings, roads, and some vegetation.			

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Upgraded South Shaft RWD (150 624m³/a)	26°25'12.23"S 27°40'45.72"E
 Old Return Water Dam	
Gold Plant PCD (2 x 3 500m³/a)	26°25'15.78"S 27°39'32.43"E
 Gold Plant Pollution Control Dam	
Refrigeration Dams (4 x 2 800)	26°24'9.96"S 27°41'16.19"E
 Refrigeration Dams (x4) Deep Gold Mine	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Refrigeration Dam (1 x 2 800)	26°24'2.16"S 27°41'17.16"E
	
Dust suppression with waste water from upgraded RWD on all haul roads (365 000m³/a) over 3 566ha.	N/A
	
Backfill Plant Area (x5 Mine Water Tanks)	26°24'28.04"S 27°41'18.38"E
	

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Cascade Dams (South of TSF 3 and 4)	26°25'31.14"S 27°40'18.60"E
 NEW: Cascade Dams (South of TSF 3 and 4)	
Disposing 1 200 000 tonnes per annum of gold slurry at Doornpoort TSF	26°27'40.05"S 27°38'55.75"E
 Disposing 1 200 000 tonnes per annum of gold slurry at Doornpoort TSF South Deep Doornpoort TSF	

Table 15: Water Use activities for Section 21(j)

Description/ Purpose (Proposed)	Corrected Co-ordinates to be approved
Removing a volume not exceeding 1 824 996 m ³ /a of groundwater for efficient continuation of mine or safety of people, for use in the process.	26°24'14.10"S 27°41'7.40"E
 Removing water found underground	

The IWULA process is being conducted in compliance with the WULA and Appeals Regulations published in GNR. 267 dated 24 March 2017.

A pre- application enquiry was submitted to the DWS on 17 July 2023. A request for a pre-application meeting was received on 11 August 2023. A site visit/ meeting with the DWS officials was convened on 31 August 2023. From the site visit/ meeting, MC was requested by the DWS to submit on behalf of South Deep JV: South Deep Gold Mine, an IWULA for the consolidation and amendment of the WULs granted to South Deep JV: South Deep Gold Mine as well as incorporating new activities proposed to be conducted for future proofing the mining operation. DWS also advised that South Deep JV: South Deep Gold Mine also considers investigating water uses within the entire mine, so that a consolidated application is submitted for the issuance of an amended IWUL, which would cover all water uses which might not have been authorised.

MC conducted five (5) days of site visits in the presence of the South Deep JV: South Deep Gold Mine team. The site visits were undertaken to understand the receiving environment and the current activities. A screening exercise has been undertaken to determine the applicable activities and the relevant legislation and necessity for application to be lodged with the DWS.

An authority's meeting was convened with the DWS on 09 May 2025 to present the findings of the investigation/ assessment of the water uses within the entire mine. MC was advised to submit the Phase 1 documentation, outlining all the water uses identified (authorised and to be authorised). Phase 1 Application: Application details based on the outcome of the pre-application meeting were uploaded. The documentation was submitted on 06 November 2025.

Another site visit was conducted on 10 February 2026, in the presence of the DWS representatives and South Deep: South Deep Gold Mine representatives. Based on the outcome of the meeting, DWS reopened Phase 1 for submission of additional information; and correction of the water uses being applied for on 13 May 2026.

Refer to Appendix J for all meetings/ site visits discussions minutes.

This Draft IWWMP is being subjected to Public Participation Process (PPP) for commenting and forms part of the application for Phase 3 submission. The report is being made available for a 60-day review and comment period from **Friday, 10 July 2026 to Thursday, 10 September 2026** (refer to Appendix O Public Participation Process Information). The IWWMP will be finalised for submission to DWS as part of the technical documents for decision making.

3-5 KEY WATER USES AND WASTE STREAMS

3-5.1 Key Water Uses

In terms of Section 40 NWA, South Deep JV: South Deep Gold Mine is authorised to engage in the following water uses:

- Section 21 (a): For the abstraction of water to reduce the pollution plume; and for mining purposes.
- Section 21 (c) and (i): For roads and pipelines crossings, river diversion and for stormwater separation system.
- Section 21 (e): For irrigation of TSFs and shaft areas with water from RWDs, PCDs and WWTW.
- Section 21 (f): For discharge of excess underground water.
- Section 21 (g): For disposal of gold slurry, waste water from the TSFs into RWDs, PCDs, Cascade Dams, RWDs, Settlers, and Mine Water Tanks.
- Section 21 (j): For the removal of water found underground for the efficient continuation of mine or safety of the people.

3-5.2 Waste Streams

The waste streams generated by South Deep JV: South Deep Gold Mine include general and hazardous waste as described in Table 3

Table 16: Identified waste streams at South Deep JV: South Deep Gold Mine

Process	Waste stream	Storage / disposal
Gold Plant	Tailings	Doornpoort TSF
	Tailings used as back-fill	Underground in mined workings
Other wastes	General domestic waste	Temporarily stored on-site before disposal at a waste disposal facility (off-site)
	Industrial waste (hazardous and non-hazardous)	Off-site disposal at Holfontein (hazardous waste) or Westonaria Industrial waste disposal facility (non-hazardous waste) and Doornpoort TSF.

3-6 ORGANISATIONAL STRUCTURE OF ACTIVITY

The organisational structure that will implement the IWWMP is in accordance with the management plan set out in Figure 7. The implementation of the IWWMP will require the continued involvement of several key managers as well as requiring the co-operation of all mine employees and contractors.

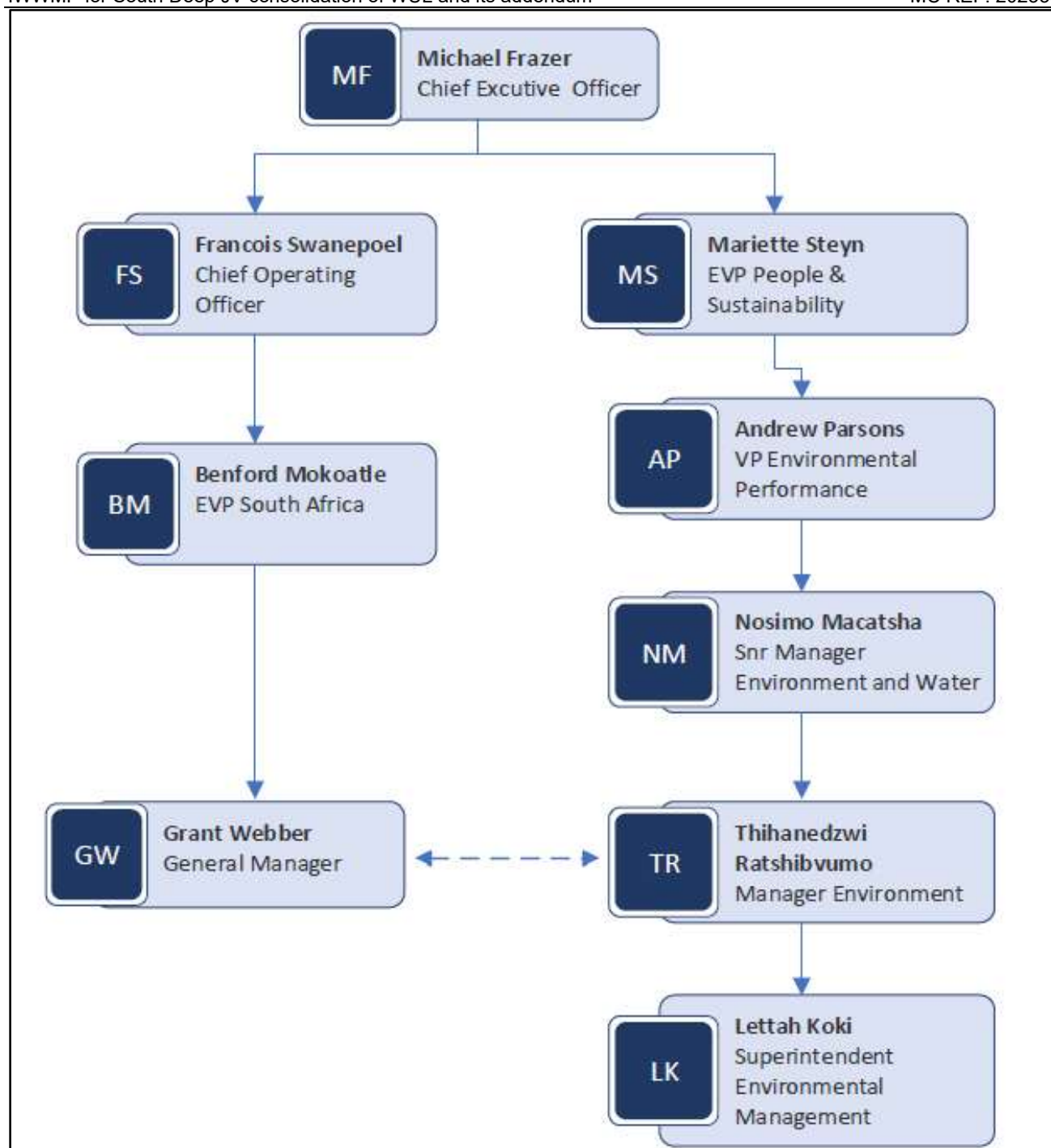


Figure 7: South Deep JV: South Deep Gold Mine Organogram Business and Corporate Policies

3-6.1 Climate Change

Climate change and environmental governance are fundamental to the way Gold Fields addresses the impacts of climate change and ensures that the company remains a responsible steward of the natural environment. The Climate Change and Environment Governance Framework (2024) illustrates how Gold Fields integrate leadership, management, operational implementation and execution, both from a top-down Group perspective and a bottom-up asset-based perspective.

During the year (2024), Gold Fields made a significant strategic shift from a regional three-layered (Group, regions, operations) structure to a function-led, two-layered (Group, operations) organisational structure. This redesigned structure is also reflected in Gold Fields' Climate Change and Environment Governance Framework.

The mining activities often impact host communities and the environment in which they live. Successfully embedding sustainability considerations and practices into the business, to both manage these impacts and drive positive outcomes, is intrinsic to Gold Fields' long-term performance and success. Responsible mining is embedded in pillar 2 of Gold Fields' strategy to deliver positive social and environmental impact. This is supported by the mine's 2030 targets, which include three social and three environmental priority areas. The primary environmental commitment to communities is to ensure that Gold Fields upholds the highest standards of environmental stewardship – a commitment that has been successfully achieved for almost a decade by having zero serious environmental incidents. This is further supported by the 2030 targets related to climate change, water stewardship and tailings management to ensure Gold Fields responsibly manage its natural resources and mitigate impact on the environment (Gold Fields Limited Climate Change and Environment Report, 2024).

Gold Fields' decarbonisation journey, which commenced in 2016, was driven by the need to secure the mine's operations' electricity supply and mitigate rapidly rising energy costs. Gold Fields' investment in renewable energy microgrids is proving to be a valuable business solution while, at the same time, addressing one of the most critical challenges facing society: climate change. Applying a commercial lens has always been critical and Gold Fields' decarbonisation work prioritises energy resilience and cost-effective reduction in emissions while optimising operational efficiency and maintaining business sustainability. At the same time, Gold Fields has adopted a portfolio-based view of its decarbonisation efforts, critically assessing where the greatest opportunities lie to enhance operational flexibility and energy security and meet its carbon reduction priorities (Gold Fields Limited Climate Change and Environment Report, 2024).

Gold Fields' two largest investments in renewables are South Deep JV: South Deep Gold Mine's Khanyisa solar plant, commissioned in late 2022, and the St Ives renewable energy project currently under construction. Both projects will substantially reduce Scope 1 and 2 carbon emissions for these operations while also creating long-term energy resilience at reduced costs (Gold Fields Limited Climate Change and Environment Report, 2024).

3-6.2 Community Policy

Gold Fields seeks to develop mutually beneficial relationships with host communities, host governments and other key stakeholders, through meaningful engagement founded on mutual respect and trust. Gold Fields aims to continually improve its social performance, strengthen its social licence to operate and deliver enduring value in collaboration with host communities and governments.

To attain this goal, Gold Fields commits to:

- Apply culturally appropriate engagement processes with communities and other key stakeholders, that also ensures meaningful and fair participation of Indigenous Peoples in decisions impacting them;
- Timely, on-going and inclusive engagement with stakeholders through appropriate processes that provide a platform for dialogue, understanding stakeholder views and understanding their impacts on those around them;
- Provide effective grievance mechanisms for communities in accordance with the United Nations (UN) Guiding Principles on Business and Human Rights;
- Work to obtain the free, prior, and informed consent of communities in accordance with the International Council on Mining and Metals (ICMM) Position Statement on Indigenous People and Mining, including where projects are located on lands traditionally owned or under customary use by Indigenous Peoples and are likely to have significant adverse impacts on Indigenous Peoples;
- Pursue partnerships with non-governmental organisations, development organisations, other stakeholders and governments, to deliver enduring social and economic well-being to host communities in accordance with development priorities;
- Prioritise host community and in-country procurement and job creation;
- Deliver sustainable benefits for host communities, including Indigenous Peoples;
- Measure their contribution to socio-economic development and diversity as well as their relations with host communities and governments;

- Implement impact, risk and crisis management strategies and systems to avoid, prevent, minimise, mitigate and/ or remedy impacts to communities, cultural heritage, and the environment;
- Plan and design for closure, including social considerations, in consultation with relevant stakeholders;
- Avoid the involuntary physical or economic displacement of communities and ensure that any resettlement restores or improves livelihoods and standards of living of displaced people in accordance with Gold Fields Community Relations and Stakeholder Engagement standard on delivering good practice resettlement;
- In collaboration with government, and where appropriate, support improvements in environmental and social practices of Artisanal and Small-scale Mining in host communities;
- Stipulate that their suppliers, contractors and where relevant their community trusts and foundations conduct themselves in accordance with the principles outlined in their policies, standards and guidelines; and
- Respect the rights, interests, culture, perspectives and special connections to land and water of host communities, including Indigenous Peoples, in project design, development, operation and closure.

3-6.3 Stakeholder Relationship and Engagement Policy

Stakeholders are an integral part of Gold Fields' business, representing a wide range of rights and interests that both influence and are impacted by their business and operations. Ensuring that their stakeholders' interests are appropriately represented, considered and acted upon, is critical to achieving their purpose of creating enduring value beyond mining.

This purpose, together with their vision of being the preferred gold mining company, delivering superior, sustainable value, requires them to develop strong relationships with their stakeholders, built on open, transparent, and meaningful engagement.

For engagement to be meaningful, it must have mutual respect and trust at its core, and allow for participative and informed decision-making, balancing their stakeholders' interests, needs and expectations with their own. This balance is also reflected in their approach to shared value, with a commitment to achieving outcomes that are mutually beneficial.

To attain this vision, they commit to:

- Embed the practice across their business of ongoing, meaningful and transparent engagement and communication with their stakeholders;
- Mandate and enable Gold Fields' stakeholder representatives;
- Undertake respectful, inclusive and culturally appropriate engagement processes;
- Create platforms for open and participative engagement;
- Undertake comprehensive analysis of their stakeholders, and understand their rights and interests and the intersection with their business activities;
- Work collaboratively with stakeholders to mitigate and manage risks and impacts as well as explore and seek to realise opportunities;
- Provide appropriate and effective feedback and grievance mechanisms; and comply with all applicable regulatory requirements and obligations contained in relevant rules, codes and standards to which they subscribe;
- Implement formal management, reporting, monitoring and measurement systems in respect of their engagement activities;
- Provide transparent, relevant factual reporting of material information;
- Adhere to leading corporate governance principles with reference to disclosure and reporting; and
- Conduct continuous review and improvement processes.

3-6.4 Environmental Policy

Gold Fields is committed to responsible stewardship of natural resources and the environment for present and future generations. They aim to operate in an innovative manner that minimises or mitigates adverse impacts and maximises positive impacts of an environmental and socio-economic nature.

To attain this vision, Gold Fields commit to:

- Establishing, implementing, maintaining and integrating internationally recognised and externally certified environmental management systems that ensure:
 - consideration of environmental issues in business strategies and initiatives;
 - a framework for setting environmental objectives;
 - continual improvement of the environmental management system and environmental performance; and
 - prevention of pollution
 - compliance to regulatory requirements, and obligations relating to industry rules, codes and standards to which they subscribe, that relate to their environmental aspects and impacts.
 - sustainable use of resources and responsible management of waste streams.
 - effectively manage water and apply strong and transparent water governance to achieve responsible and sustainable water use in a collaborative manner.
 - addressing potential adverse impacts on biodiversity through application of the mitigation hierarchy and integrated approaches to land management.
 - including social considerations and progressive rehabilitation as part of their integrated approach to mine closure planning.
 - establishing an appropriate level of awareness and training for their workforce related to their environmental responsibilities.
 - reporting and publicly disclosing their material environmental performance indicators.

3-6.5 Ethics and Corporate Governance Policy

Gold Fields is committed to ethical and fair business dealings and promotes a corporate culture which is non-sectarian, non-political, and socially and environmentally responsible and thus subscribes to the core values of the company and the following principles:

- Fairness and integrity in all business dealings, including the ethical handling of actual or apparent conflicts of interest between personal and professional relationships;
- Respect for human rights and dignity of others;
- Acceptance of diverse culture, regions, race disability, gender and sexual orientation;
- Embarking on business activities in a manner that is free of bribery and corruption;
- Honesty and accountability; and
- Adherence to sound standards of corporate governance and applicable laws and commit to working with relevant stakeholders to achieve appropriate public policy, laws, regulations, and procedures that facilitate a contribution to sustainable development.

SECTION 4: POLICY AND LEGAL CONTEXT

There are a number of legal and regulatory frameworks which regulate mine water management in South Africa. A summary is provided in Table 17 with specific details relating to the NWA and the National Environmental Management: Waste Act, 2008 (Act. 59 of 2008) (NEMWA) provided in the remainder of this section.

Table 17: Water and waste management legal and regulatory framework requirements

Legislation
Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)
The Act describes the Bill of Rights, and it is the cornerstone of democracy in South Africa, enshrining the rights of all people and affirming the democratic values of human dignity, equality and freedom. Section 24 is directly relevant to environmental law. The Bill of Rights states that everyone has the right to an environment that is not harmful to their health or well-being.
National Water Act, 1998 (Act No. 36 of 1998)
The Act provides for the protection of the quality of water and water resources in South Africa, for the establishment of WMAs to be managed by CMAs and describes the actions that can be taken by the CMAs to enforce the requirements of the NWA.
Section 19 of the NWA sets out the principles for “an owner of land, a person in control of land or a person who occupies or uses land” to:
• Cease, modify or control any act or process causing pollution; • Comply with any prescribed waste standard or management practice; • Contain or prevent the movement of pollutants; • Eliminate any source of pollution; • Remedy the effects of the pollution; and • Remedy the effects of any disturbance to the bed and banks of a watercourse.
In terms of Section 21 of the NWA, there are eleven (11) water uses that require authorisation including:
(a) taking of water from a water resource; (b) storing of water; (c) impeding or diverting the flow of water in a watercourses; (d) engaging in a stream flow reduction activity; (e) engaging in a controlled activity, such as irrigation of any land with waste or water containing waste generated through any industrial activity or by a waterworks; (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) disposing of waste in a manner which may detrimentally impact on a water resource; (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial process or power generation process; (i) altering the bed, bank, course or characteristics of watercourses; (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; (k) use of water for recreational purposes.
NWA Amendment Act, 2014 (Act No. 27 of 2014)
This Act makes provision for integration and alignment of the IWULA process with applications in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and MPRDA.
NWA Regulations:

Legislation
Regulation 704 (GN 704, Gazette No. 20119, 1999): Regulations that require separation of clean and dirty water systems, including restrictions on activities within the 1:100 floodline or 100 m from a watercourse or use of waste rock in the construction of the TSF.
Regulations regarding the procedural arrangements for WULAs and appeals (GNR. 267, Gazette No. 40713, 24 March 2017): Consideration of and decision on IWULAs is time regulated. The final decision on the IWULA is required within 90 calendar days from submission of the application.
General Authorisation (GA) for Section 21 (c) and (i) water uses (GN509, Gazette No. 40229, 26 August 2016): Defines a regulated area of a watercourse as: - 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; - 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 - a 500 m radius from the delineated boundary (extent) of any wetland or pan.
Water Services Act, 1997 (Act No. 108 of 1997)
The Act provides for the regulation of water boards and the setting of national water quality standards.
National Environment Management Act, 1998 (Act No. 107 of 1998)
Sections 28(1) and (3) of NEMA set out the duty of care principle, which is applicable to all types of pollution and must be considered in considering any aspects of potential environmental degradation. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.
EIA Regulations of 2014, as amended, GNR. 982, GNR. 983, GNR. 984 and GNR. 985
These regulations were developed for the preparation, evaluation, submission, processing and consideration of, and decision on, applications for Environmental Authorisations (EAs).
National Environment Management: Waste Act, 2008 (Act No. 59 of 2008)
The Act follows the principle that waste generation be avoided, or if it cannot be avoided, that it is reduced, reused, recycled or recovered, and as a last resort treated and/or safely disposed of. The objects of this Act are- (a) to protect health, well-being and the environment by providing reasonable measures for- (i) minimising the consumption of natural resources; (ii) avoiding and minimising the generation of waste; (iii) reducing, re-using, recycling and recovering waste; (iv) treating and safely disposing of waste as a last resort; (v) preventing pollution and ecological degradation; (vi) securing ecologically sustainable development while promoting justifiable economic and social development; (vii) promoting and ensuring the effective delivery of waste services; (viii) remediating land where contamination presents, or may present, a significant risk of harm to health or the environment; and (ix) achieving integrated waste management reporting and planning; (b) to ensure that people are aware of the impact of waste on their health, well-being and the environment; (c) to provide for compliance with the measures set out in paragraph (a); and (d) generally, to give effect to Section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being.
Waste Classification and Management Regulations
The Waste Classification and Management Regulations require that all waste generators must ensure that the waste they generate is classified in accordance with South African National Standards (SANS) 10234 within 180 days of generation and if the waste is to be disposed of to a waste disposal facility that the waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal.
Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits (Government Gazette No. 39020, GNR. 632 of 24 July 2015)
The regulations specify the requirements relating to residue stockpiles and residue deposits as follows: - Assessment of impacts and analysis of risks - Characterisation - Classification - Site selection - Design - Impact management - Monitoring and reporting - Dust management and control

Legislation
Decommissioning, closure and post closure management
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
The Act seeks amongst other things, to manage and conserve biological diversity, to protect certain species and ecosystems, to ensure the sustainable use of biological resources and to promote the fair and equitable sharing of benefits arising from bioprospecting involving those resources. The National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA) includes a Regulation related to the management of threatened and protected species. A similar Regulation is applied to Threatened Ecosystems. NEMBA has a set of norms and standards for the development of management plans for both species (e.g. Threatened or Migratory Species) and ecosystems [Endangered or Critically Endangered (CR)].
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
The MPRDA makes provision for equitable access to and sustainable development of South Africa's mineral resources. The MPRDA requires that the environmental management principles set out in NEMA shall apply to all mining operations and serves as a guideline for the interpretation, administration and implementation of the environmental requirements of NEMA.

In addition to the above, DWS has developed the National Water Resource Strategy (NWRS) to give effect to Section 5 of the NWA. The second edition of the NWRS [NWRS2, Department of Water Affairs (DWA) 2013] is the primary mechanism to manage water across all sectors towards achieving national government's development objectives. The water sector vision for the NWRS2 is "sustainable, equitable and secure water for a better life and environment for all" and is aligned with the vision of South Africa 2030. Towards achieving this vision, the overall goal is: "Water is efficiently and effectively managed for equitable and sustainable growth and development".

NWRS2 strives to achieve three main objectives (DWA, 2013):

- Water supports development and the elimination of poverty and inequality;
- Water contributes to the economy and job creation; and
- Water is protected, used, developed, conserved, managed and controlled sustainably and equitably.

The core strategies of the NWRS2 (DWA, 2013) include the following:

- Implementation of Equity Policy;
- Putting water at the centre of integrated development planning and decision-making;
- Ensuring water for equitable growth and development;
- Contributing to a just and equitable South Africa;
- Prioritising and ensuring the implementation of water conservation and demand management;
- Optimising and stretching of available water resources [groundwater, water reuse, desalination (including seawater), water systems optimisation and rainwater harvesting];
- Committing to the protection of water resources and ecosystems;
- Achieving effective and smarter water governance;
- Embedding sustainable business principles and practices in water resources and systems management;
- Implementing a water sector investment framework for infrastructure, human resource capacity and institutions; and
- Engaging the private and water use sectors.

Strategic actions have been developed per sector for the key priority areas. Measures to give effect on the strategies and priority areas are discussed in SECTION 7: of this IWWMP.

4-1 SUMMARY OF ALL WATER USES

South Deep JV: South Deep Gold Mine is engaged in various water uses, as stipulated in Section 2-1 above. South Deep JV: South Deep Gold Mine water use activities were authorised in the 2011 WUL (03/C22J/ACFGIJ/1369), which was later superseded by the 2018 WUL (08/C22J/GCEFIJA/8705). Table 18 highlights a list of IWULs issued to South Deep JV: South Deep Gold Mine indicating which IWULs are still applicable and enforceable, and which have been superseded. This document aims to provide a summary of the water uses currently permitted at the mine.

Table 18: South Deep JV: South Deep Gold Mine IWULs

Approval	Reference	Licence Type	Approval Date
WUL	DWS Reference Number: 03/C22J/ACFGIJ/1369	First issue of WUL (Superseded by 2018 IWUL).	21 November 2011
WUL	DWS Reference Number: 08/C22J/GCEFIJA/8705	WUL (Superseded the 2011 WUL).	19 November 2018
WUL Addendum/ Amendment	DWS Reference Number: 08/C22J/GCEFIJA/8705	WUL Addendum/ Amendment to be read together with the 19 November 2018 WUL.	29 July 2021

4-2 EXISTING LAWFUL WATER USES

In terms of Section 32 of the NWA, an existing lawful water use is defined as follows: *"Water use which has taken place at any time during a period of two years immediately before the date of commencement of the Act (01 October 1996 to 30 September 1998) (This does apply to South Deep JV: South Deep Gold Mine as the mine started operating in the 1970s) and which was authorised by or under any law which was in force immediately before the date of commencement of this Act, or which has been declared an existing lawful water use in terms of Section 33 of the Act"*.

There are no existing water uses approvals associated with South Deep JV: South Deep Gold Mine.

As per legislation, when an amendment to IWUL is granted, the previously granted licence is usually superseded by the new IWUL. However, the previously approved water uses are then added to the new application to ensure all water uses are approved under one licence. Table 1 and Section 2-1 provides all the existing water uses that were incorporated into the WUL issued in 2018, and its addendum/ amendment issued in 2021.

4-2.1 Regulation GN 704

GN 704 (Government Gazette 20118, 04 June 1999), under the NWA stipulates conditions for managing water on a mine and was drawn up to address Section 26 (1) of the NWA in relation to mining activities. Section 26 provides for the development of regulations that:

- Require that the use of incoming and discharging water from a water resource be monitored, measured and recorded.
- Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat.
- Prescribe the outcome or effect that must be achieved through management practices for the treatment of waste, or any class of waste, before it is discharged or deposited into or allowed to enter a water resource.

Sub-section 4 of 26 provides for the Minister to take all relevant considerations into account when making regulations, including the need to:

- Promote the economic and sustainable use of water;
- Conserve and protect water resources or in-stream and riparian habitat;
- Prevent wasteful water use;
- Facilitate the management of water use and waterworks;
- Facilitate the monitoring of water use and water resources; and
- Facilitate the imposition.

Regulation 3 of GN 704 makes provision for the Minister to authorise, in writing, an exemption from the requirements of regulations 4, 5, 6, 7, 8, 10 or 11 on his or her own initiative or on the application, subject to such conditions as the Minister may determine.

Regulation 4 of GN 704 makes provision for restrictions on locality. No person in control of a mine or activity may place or dispose of any residue or substance which causes or is likely to cause pollution of a water

resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation.

Regulation 5 of GN 704 makes provision for restrictions on use of material and no person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.

Regulation 7 of GN 704 makes provision for the protection of water resources, and states that every person in control of a mine or activity must take reasonable measures to prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act.

South Deep JV: South Deep Gold Mine is exempted from the following conditions of GN 704 (DWS letter with reference: 16/2/7C231/C41), as summarised in Table 19 (Refer to Appendix K).

Table 19: Government Notice 704 Assessment (DWS, 2010)

Regulation	GN 704 condition	Applicability
4 a	Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of ground water, or on ground likely to become water-logged, undermined, unstable or cracked.	The mine has an exemption from Regulation 704 (issued in 2010) for surface infrastructure located within the 100m offset from the centre of the Kariegaspruit on the basis that the infrastructure is located outside the 1:100-year floodline and that the dirty water diversion berm acts as a flood barrier.
4c	No placement or disposal of any residue or substance which causes or is likely to cause pollution of a water resource, in the underground workings or opencast excavation.	The mine has an exemption from Regulation 704 (issued in 2010) for the following: • The South Shaft WRD footprint which was rehabilitated in 2018. • The Twin Shaft WRD on condition that the results of seepage and surface runoff prove the water to be 'clean' and that the dolomite waste rock is non-polluting. • The administration areas, Refrigeration Plant and parking areas on the basis that surface runoff will be 'clean.' • Surface infrastructure located within the 100 m offset from the centre of the Kariegaspruit, on the basis that the infrastructure is located outside the 1:100 year floodline and that the dirty water diversion berm acts as a flood barrier.
7a	Prevent water containing waste or any substance which causes or is likely to cause pollution of water resource from entering any water resource, either by natural flow or by seepage and retain or collect such water for use, reuse, evaporation or for purification and disposal.	The following clause needs to be incorporated into the IWUL: In terms of the conditions of this licence, the Licence Holder is exempted from clause 7a of GN 704, on use of water for mining and related activities aimed at the protection of water resources.

Refer to Appendix K for the above permits/ exemptions/ authorisations.

4-3 GENERALLY AUTHORISED WATER USES

In terms of Section 22(1) of the NWA, a person may use water without a licence if that water use is permissible in terms of a GA issued under Section 39 of the Act. For the proposed WUL and its addendum amendments, and consolidation project, an IWUL is being applied for, for all triggered NWA water uses, and therefore, no generally authorised water uses are described in this report.

4-3.1 Other Authorisations

4-3.1.1 Environmental Management Programme

The Environmental Management Programme (EMPr) in terms of section 39 (4) of the MPRDA was approved in February 2012 for the mining of gold ore (AU) on various farms situated in Westonaria.

4-3.1.2 Nuclear Energy Act, 1999 (Act No. 46 of 1999)

The Nuclear Energy Act, 1999 (Act No. 46 of 1999) regulates the possession, processing, and disposal of source material (such as uranium) produced during gold mining in South Africa. It governs the acquisition, import/export, and disposal of radioactive waste, ensuring compliance with international safeguards and the South African Nuclear Energy Corporation (Necsa).

The Act provides measures for the management of radioactive waste, which is particularly relevant to tailings dams and residue deposits in the Witwatersrand area. The National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) (NNRA) established the National Nuclear Regulator (NNR) as the statutory body responsible for regulating mining and mineral processing facilities that carry out activities and operations involving Naturally Occurring Radioactive Material (NORM). While the NNR monitors radiation safety, the Act regulates the material itself, ensuring that uranium produced or concentrated during mining does not pose an unauthorised risk. As per Section 2(1)(c) of the NNRA: *“Any person wishing to engage in any action which is capable of causing nuclear damage may apply in the prescribed format to the chief executive officer (CEO) for a Certificate of Registration and must furnish such information as the board requires.”*

South Deep JV: South Deep Gold Mine holds a Certificate of Registration (CoR-18) issued by the NNR for their South Deep Gold Mine operations. Section 1.4.2.1 of the Certificate of Registration, *inter alia*, states that: *“Based on the results of the assessments referred to in clause 1.2.1, programmes embodying all aspects as required by NNR document RD-007: “Requirements for Control over Radioactive Effluent Discharges and Environmental Surveillance: Mining and Mineral Processing”, in the revision specified in Section 2.4.2 of this Authorisation, must be established and be submitted to the NNR for approval. These must ensure and demonstrate that radiation doses to members of the public are in compliance with the radiation dose limitation system set down in the NNR document RD-010: “Requirements for Radiation Dose Limitation: Mining and Mineral Processing”, in the revision specified in Section 2.4.1 of this authorisation. The programmes, as approved by the NNR, shall be implemented by the holder.”*

CoR holders are required to submit to the NNR the following documents:

- A Radiological Public Safety Assessment Report which is a mandated document evaluating potential radiation doses to the public from authorised facilities, ensuring safety through Source-Pathway-Receptor analysis; and
- A Public Radiation Protection Programme (PRPP) which ensures safety from ionising radiation by regulating radioactive sources, monitoring environmental exposure, and implementing emergency preparedness.

4-3.1.3 Other Permits

Refer to Appendix L for the Certificate of Registration (CoR-18), and Appendix M for the SAPS approval.

SECTION 5: SPECIFIC BASELINE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITE

5-1 GEOLOGY

Regionally, the South Deep Gold Mine is underlain by rocks of the Pretoria Group from the Transvaal Super-Group (Figure 9). The Doornpoort TSF is underlain by a geological contact between the Hekpoort andesite and Strubenkop shale and quartzite. The old TSFs (Phase 1 and Phase 2) area is underlain by the Timeball Hill formation which consists of ferrogenous shale and hornfels of the Pretoria Group (Figure 10). An E-W trending diabase dyke crosscuts below the old TSFs (Phase 1 and Phase 2) area.

5-2 TOPOGRAPHY AND DRAINAGE

The area under study is in quaternary catchment C22J in the Upper Vaal WMA, covering an area of 670 km² [Department of Water and Forestry (DWAF¹), 2011]. The area is characterised by gently undulating topography, sloping from 1660 mamsl in the North to 1540 mamsl in the South near the Doornpoort TSF (Figure 8). The site falls within quaternary catchment C22J.

5-3 HYDROGEOLOGY

The hydrogeological map series of South Africa indicates that the area falls within the d2: Intergranular and Fractured Type Aquifer with average borehole yields (0.1 – 0.5 l/s) (Figure 9). Regionally, there are three different aquifer systems in the area which developed from the Pretoria group.

5-3.1 Upper Regolith (Unsaturated Zone)

The upper regolith comprises a relatively thin soil and transported cover underlain by a variably weathered bedrock profile developed on the Karoo/ Transvaal/ Witwatersrand succession above the deep mining horizons. Regionally, the weathered zone in the Far West Rand/ South Deep JV: South Deep Gold Mine area is typically on the order of 5–10 m thick, with shallow saprolitic and fractured bedrock aquifers hosted within this profile before grading into fresher, more competent rock at depth. With depth, the regolith grades into partially weathered, fractured rock forming the shallow bedrock aquifer. This marks the transition from dominantly vadose to saturated conditions; the water table typically occurs within the lower regolith to upper fractured zone, depending on topography, dewatering and local recharge. Effective porosity is estimated to be in the range of 5 to 15%.

5-3.2 Shallow Weathered Aquifer

Situated within the weathered formation because of increasing secondary porosity, 5-30 metres below ground level (mbgl), limited and variable in extent.

5-3.3 Deeper Semi-Confined Fractured Zone Aquifer

Situated below the weathered aquifer and expected to be hydraulically connected to the overlying weathered aquifer due to the absence of consistent confining and impermeable zones (aquitards) within the weathered formations. Based on existing information the fractured aquifer extends to a depth of approximately 60 to 100 m.

¹ The DWAF is now called the DWS.

5-3.4 Deeper Confined Compartmentalised Dolomitic (Karst) Aquifer

This aquifer is associated with the deep confined compartmentalised dolomitic (karst) lithology. It underlies a thick succession of impermeable dolerite, shale and lava, some 400 m in thickness.

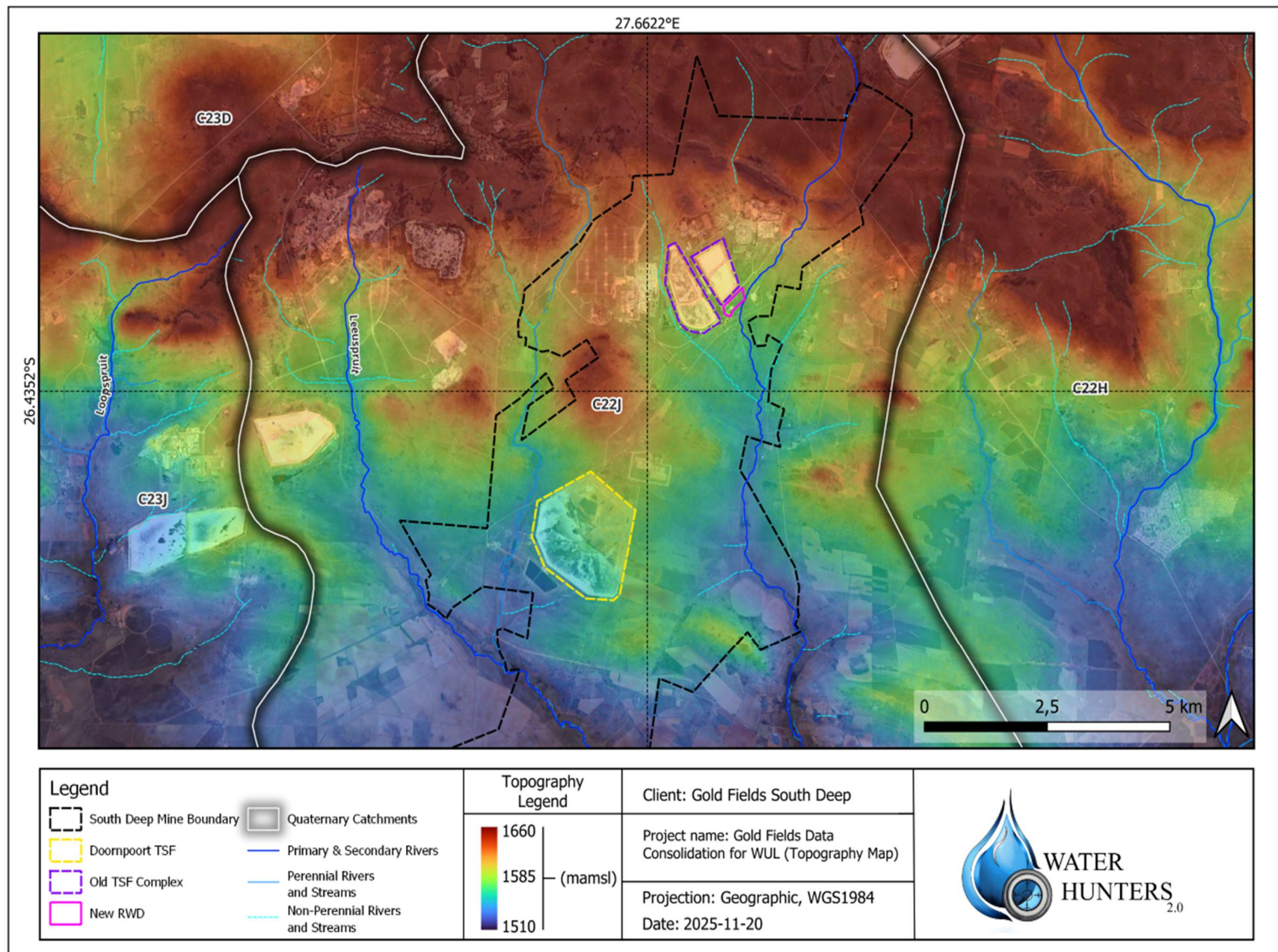


Figure 8: Topography and drainage

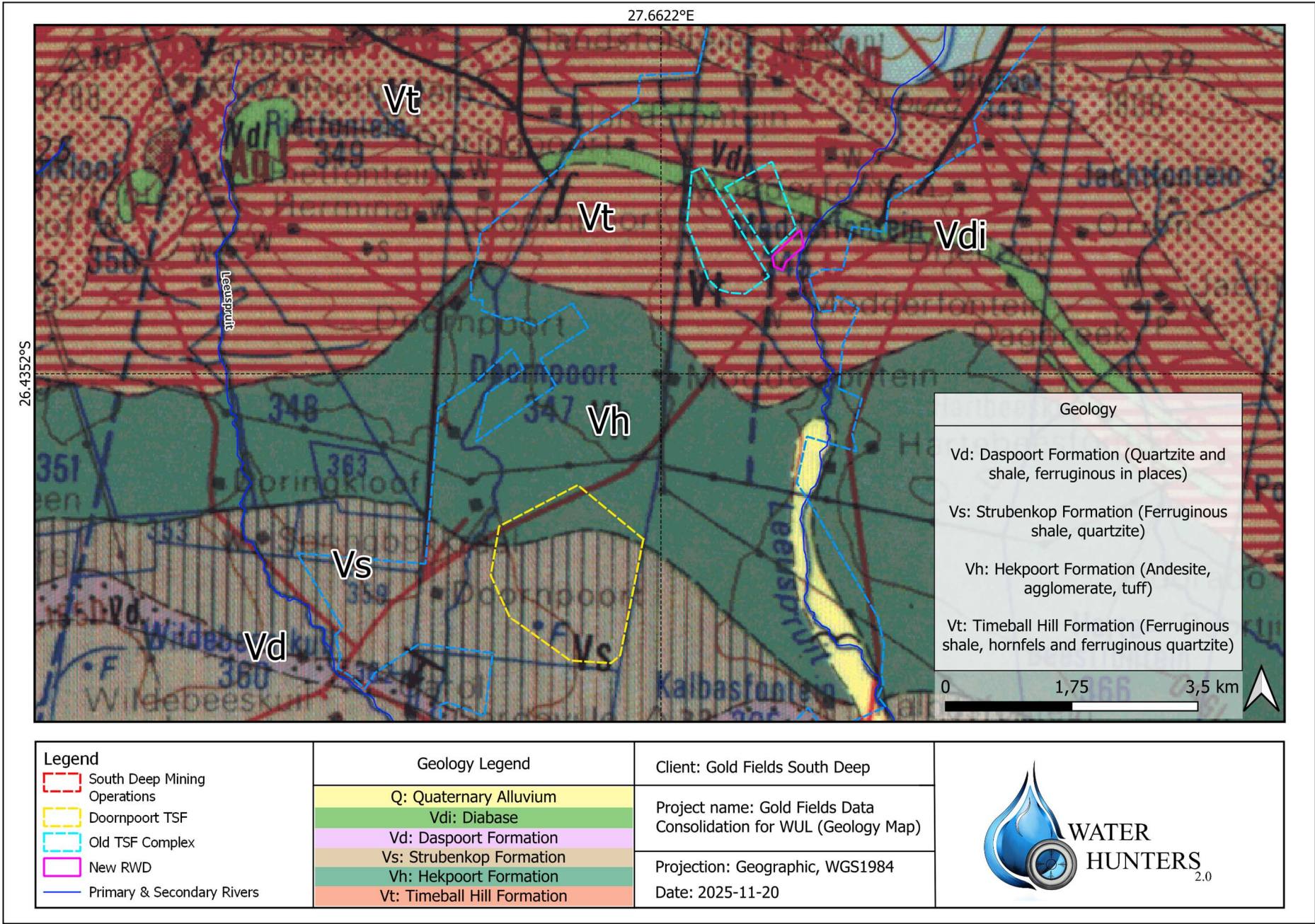


Figure 9: Geological map of the study area

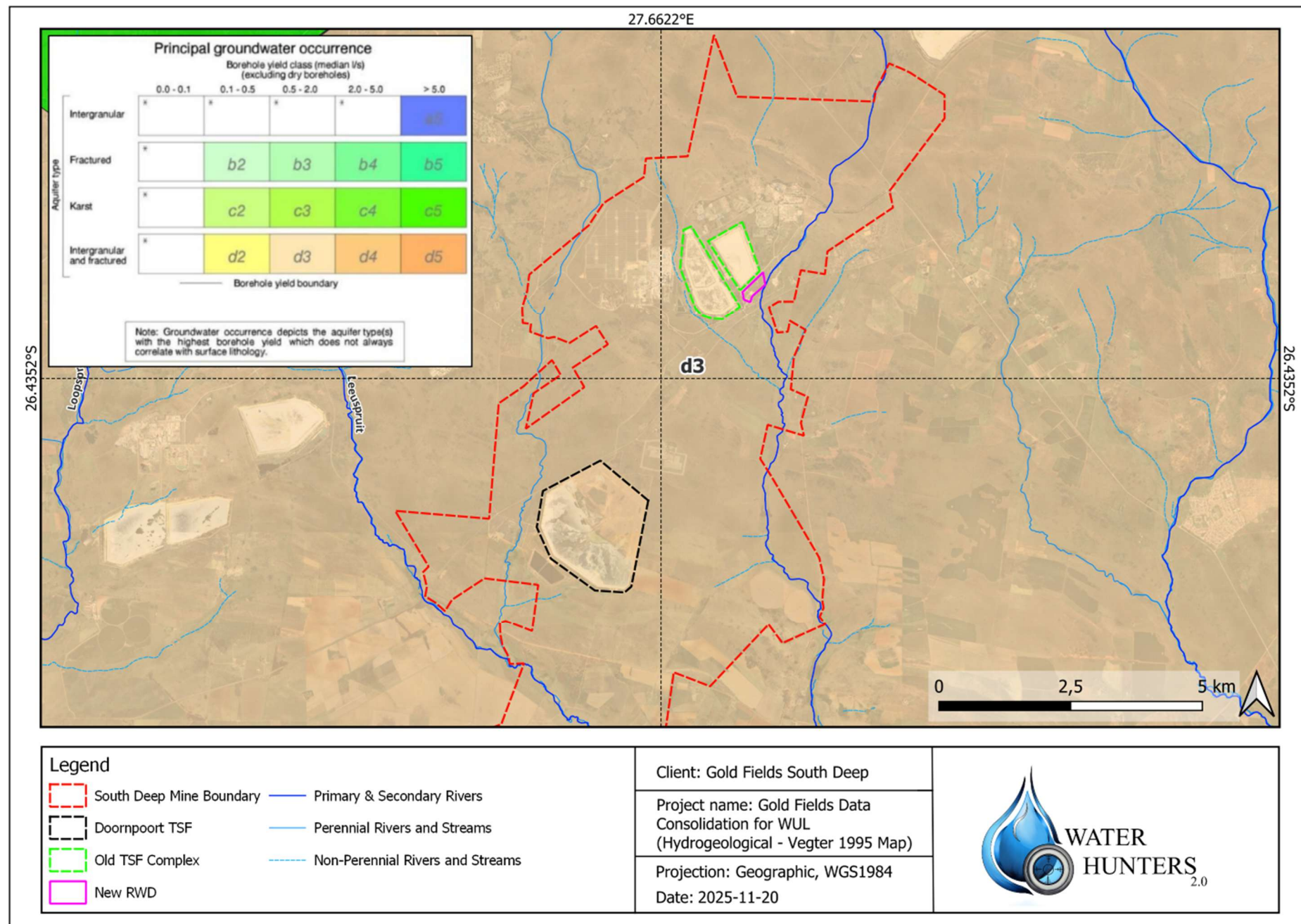


Figure 10: Hydrogeological classification map (Vegter, 1995)

5-4 CLIMATE

The average climate for the site is presented in Figure 11. While evaporation is shown to exceed rainfall greatly, this is representative of the maximum A-Pan equivalent potential evaporation that could occur, assuming no limitations are placed on evaporative demand. The combination of rainfall, evaporation, and temperature results in a temperate climate characterised by warm, wet summers and cool, dry winters.

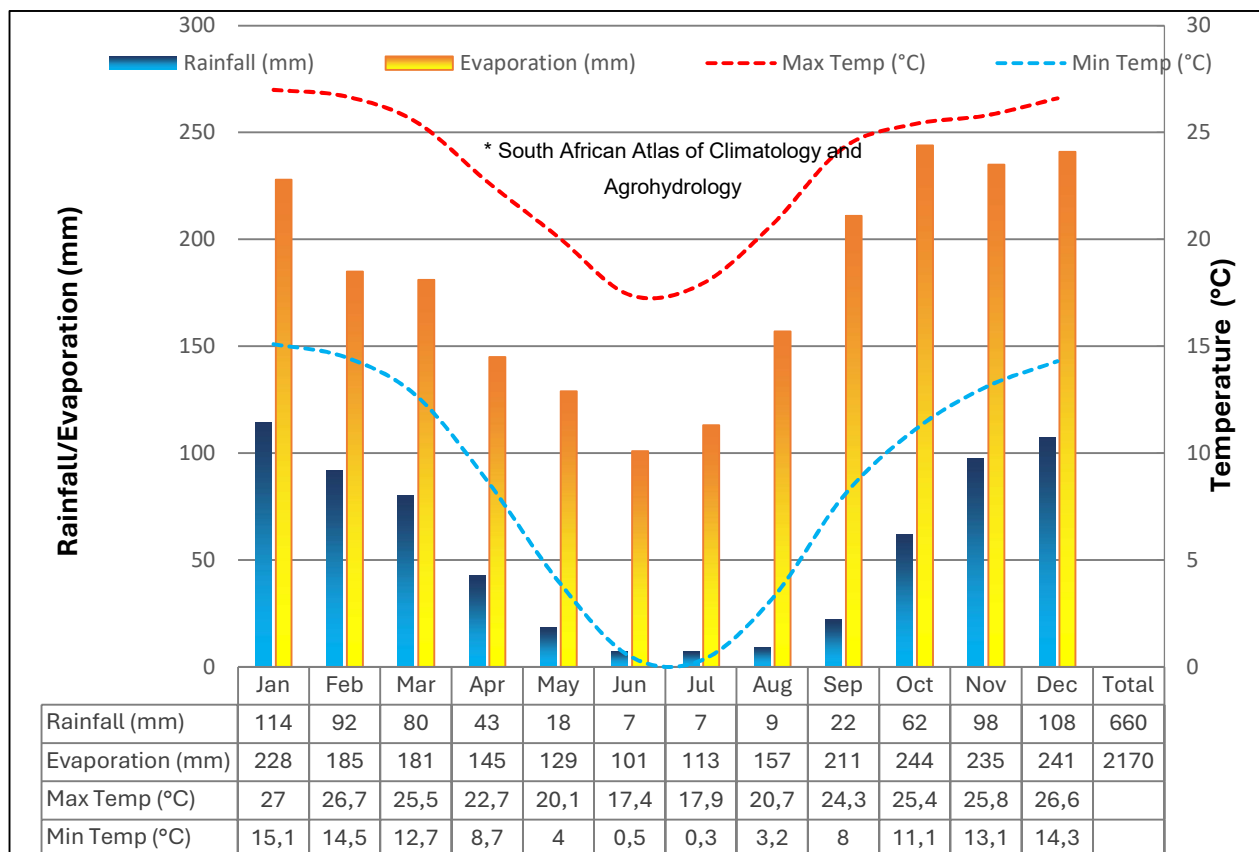


Figure 11: Average Monthly Climate for the site

5-4.1 Rainfall

Various weather stations managed by both the South African Weather Services (SAWS) and the DWS are positioned about the site as illustrated in Figure 12. The closest SAWS station to the site is station 475174 W (Kloof, GM) located approximately 8km west of the site. This SAWS station has a record length in excess of 33 years with a Mean Annual Precipitation (MAP) of 695mm. There are no DWS rainfall stations within close proximity to the site.

The potential for rainfall distributions to change over distance can be significant. Figure 12 presents the variation in MAP in the greater area. As such, an alternative and site-specific source of rainfall data was used to provide average monthly rainfall values for the actual site as per Pegram et al (2016). This eliminates any risk associated with relying on a single rainfall station which may or may not be representative of the site.

Pegram et al (2016) includes details on the development of a raster database of monthly rainfall data for Southern Africa. Table 20 presents the site specific average monthly rainfall estimates from Pegram et al (2016) indicating a MAP of 621mm, comparing well to the distribution of rainfall as illustrated in Figure 12, as well as SAWS stations located in close proximity to the site. Table 20 presents the average monthly rainfall estimates from Pegram et al (2016) for the site.

Table 20: Average Monthly Rainfall Distribution (mm)

Month	Rainfall (Pegram)
Jan	114
Feb	92

Month	Rainfall (Pegram)
March	80
April	43
May	18
June	7
July	7
August	9
September	22
October	62
November	98
December	108
Total	660

** Estimates were sourced for the area of hydrological relevance.*

5-4.2 Day Design Rainfall Depths

For modelling flooding, design rainfall is one of the most important variables to consider as it is the driver behind runoff volumes and peak flows. Design rainfall estimates for various recurrence intervals and durations were sourced from the Design Rainfall Estimation Software for South Africa (DRESSA), developed by the University of Natal in 2002 as part of Water Research Commission (WRC) project K5/1060 (WRC, 2002). This method uses a regional I-moment algorithm in conjunction with a scale invariance approach to provide site-specific estimates of design rainfall (depth, duration and frequency), based on surrounding station records. WRC (2002) provides more detail on this method of design rainfall estimation.

Table 21 presents the average DRESSA design rainfall estimates for the site.

Table 21: DRESSA 24-hour rainfall depth

Recurrence Interval (Years)	Rainfall Depth (24 hour)(mm)
2	57.2
5	79.0
10	95.5
20	113.0
50	138.6
100	160.0
200	183.6

** Estimates were sourced for the area of hydrological relevance.*

A risk analysis using the expected life of a structure or process will indicate the relevance of considering climate change (i.e. as the expected life increases the influence of climate change increases). Climate change is expected to exacerbate any flooding due to an increase in rainfall intensities.

5-4.3 Evaporation

Evaporation data was sourced from the South African Atlas of Climatology and Agrohydrology (Schulze and Lynch, 2006) in the form of A-Pan equivalent potential evaporation. The average monthly evaporation distribution is presented in Table 22 and shows an annual potential evaporation of 2170 mm for the centre of the site.

Table 22: Monthly A-Pan Equivalent Potential Evaporation

Recurrence Interval (Years)	Rainfall Depth (24 hour)(mm)
2	57.2
5	79.0
10	95.5
20	113.0
50	138.6
100	160.0
200	183.6

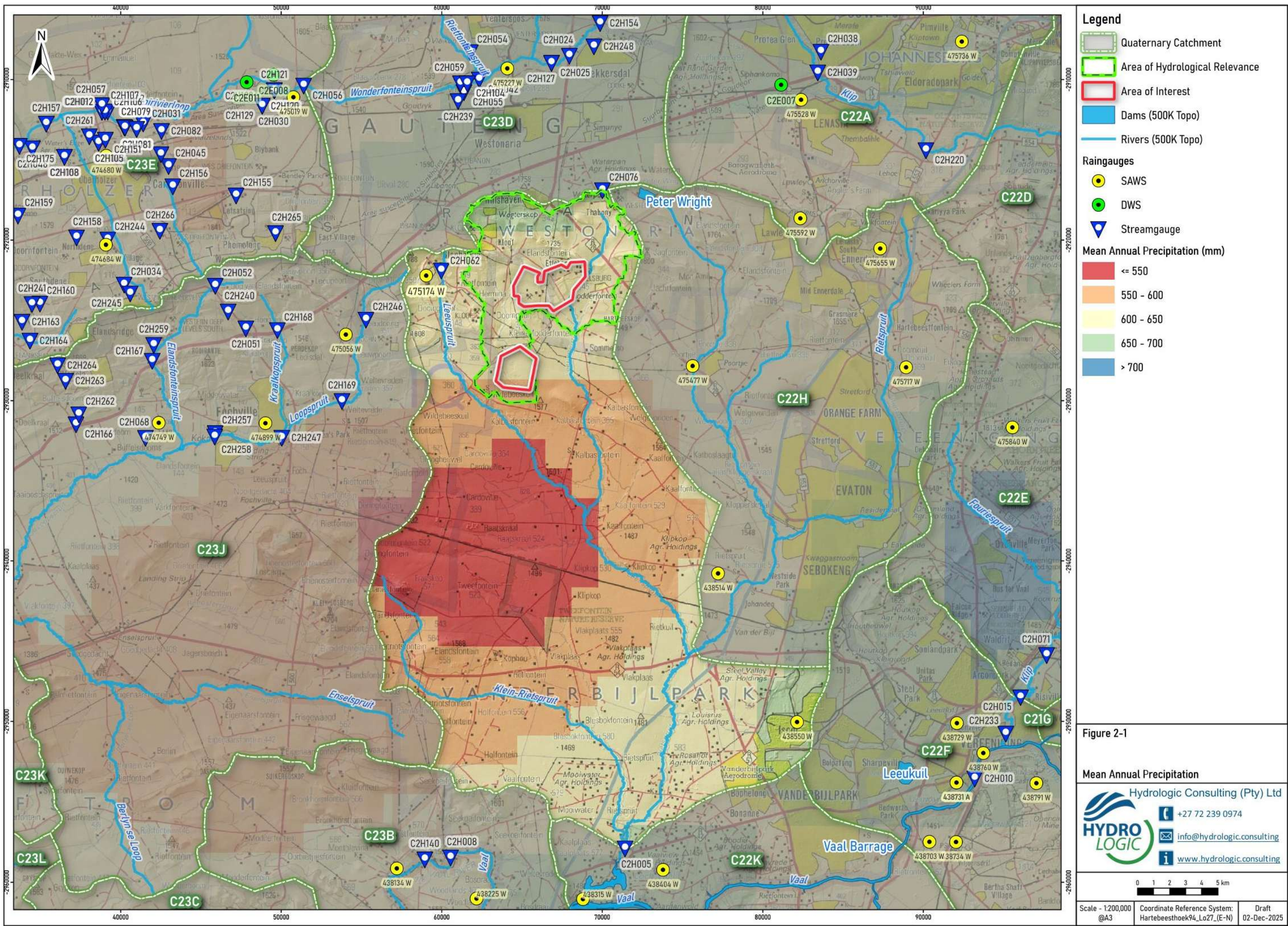


Figure 12: Weather Stations and Mean Annual Precipitation

5-5 TERRAIN

The following terrain (elevation) datasets were used:

- i. 0.2 m Digital Terrain Model (DTM) derived from two client-provided² Light Detection and Ranging (LiDAR) dataset; hereafter referred to as the 0.2m DTM;
- ii. 2 m DTM hereafter referred to as the 2 m DTM, purchased from Geosmart;
- iii. 30 m Digital Surface Model (DSM) COP30³ data, hereafter referred to as the 30 m DSM; and
- iv. The National Geospatial Institute (NGI)³ 1:50,000 topographical map 5m contours.

The 0.2 m DTM provides a bare-earth representation of the terrain by removing surface features such as vegetation and built structures, thereby offering a more suitable elevation surface for flood modelling than a DSM, which retains these obstructions. Filtering of surface features to achieve a bare-earth model, does result in some areas in which the point density and resulting terrain representation is poorer (given a high incidence of vegetation which obscures terrain).

To supplement the areas of missing 0.2 m DTM data, a 2 m DSM purchased from Geosmart was incorporated. With reported vertical and horizontal accuracies of 0.5 m and 1 m, respectively, the 2 m DTM offered the more comprehensive coverage. The coverage of the 0.2 m DTM and 2m DTM was sufficient with regard to the river reaches for which flood modelling was undertaken.

Additionally, a 30 m DSM was employed for mapping and hydrological modelling in locations where neither the 0.2 m DTM nor the 2 m DTM provided sufficient coverage.

Ground elevations on the site are approximately 1,725 meters above mean sea level (mamsl) whilst elevations over the non-perennial river reaches of interest range between approximately 1,615 m and 1,565 mamsl. Slopes within the Area Of Interest (AOI) vary from gentle to mild, with slopes typically below 10%. Higher slopes are observed at the TSFs. The river channels within the modelled reaches exhibit low gradients, with channel slopes typically remaining below 3%. Refer to Figure 13 for the terrain map.

² South Deep Doornpoort Wg27 Lidar 2025-04-08 Points.XYZ and South Deep TSF Wg27 Lidar 2025-04-12 Points.XYZ.

³ Copernicus Digital Elevation Model - Copernicus Contributing Missions Online

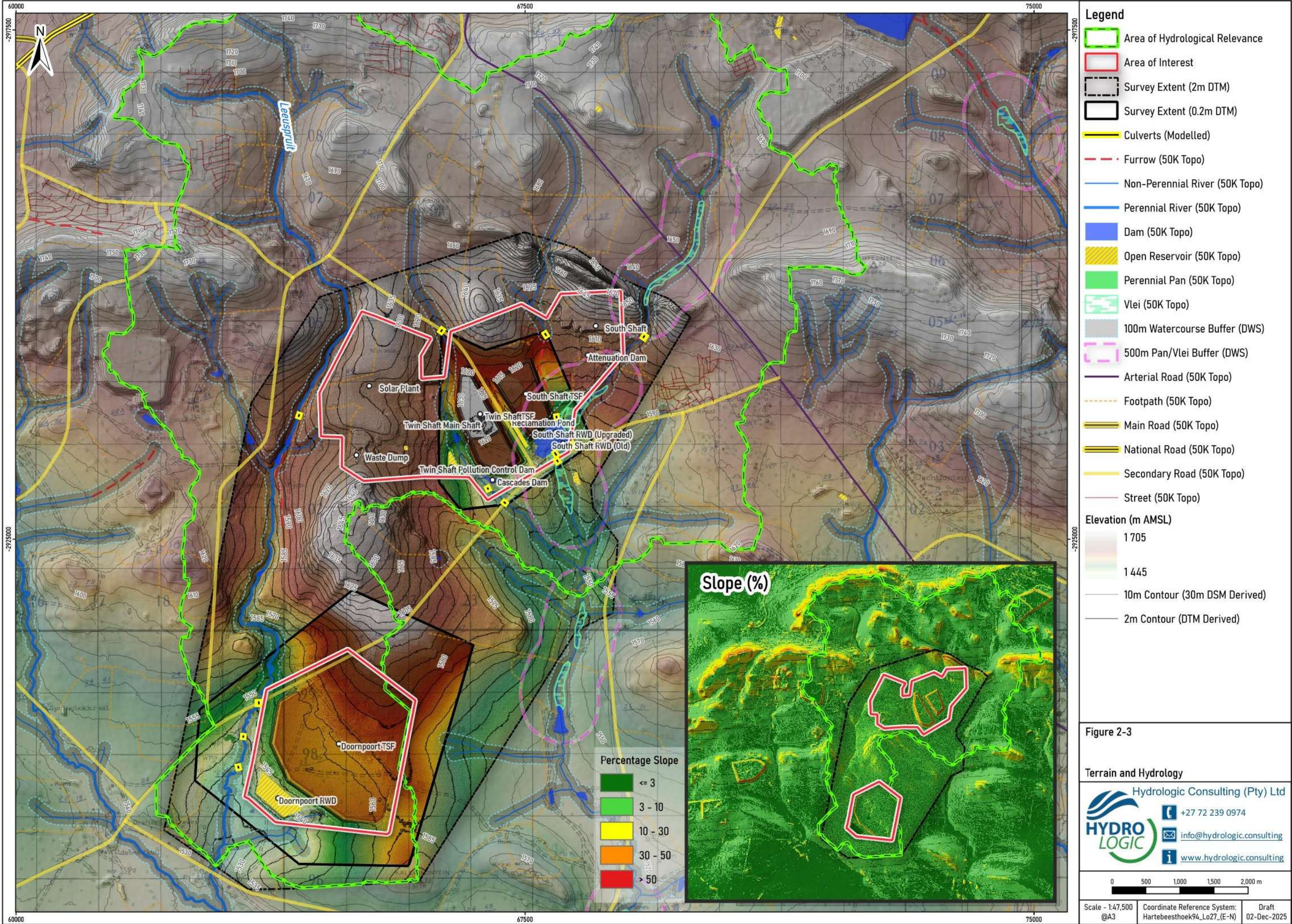


Figure 13: Terrain and Hydrology

5-6 SOILS AND HYDROPEDOLOGY

5-6.1 Soils

Soils are structured with a high clay content. Land capable for use as grazing dominates the project area. Different soil types are typically encountered within the shoulder, mid-slope and valley positions of the project area (referred to as soil hillslope) and are mainly due to sub-surface geology, products of weathering, degree of saturation, soil texture and slope position. The Terrain Morphological Units (TMU) are illustrated within Figure 14 with the crest (1), scarp (2), midslope (3), secondary midslope [3(1)], footslope (4), and valley floor (5). The terrain in the project area is generally on a gentle slope (3.5% for length of site – middle footslopes to valley floor), with soil depths ranging from 100 mm to > 1.2 m generally with clay content ranging from 4% - 15% and some areas with shallow horizons underlain by rock.

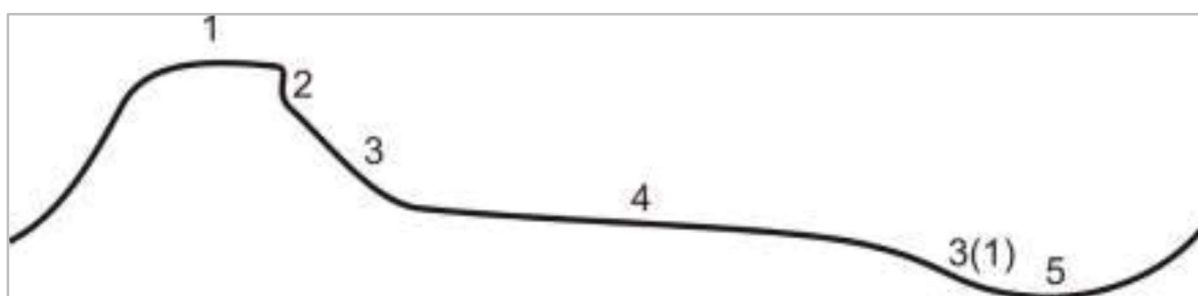


Figure 14: Terrain Morphological Units (LTSS, 1972 – 2006)

According to the World Reference Base for Soil Resources (WRB, 2022) world soil map, the majority of the study area is located within the Lixisols (LX) or Group 7 area. This area consists of: “Soils with clay enriched subsoil. A further subdivision can be made depending on the base status and/ or type of clay minerals. Contains soils with retic properties; soils with low-activity clays and low base status; soils with low-activity clays and high base status; soils with high-activity clays and low base status, and soils with high-activity clays and high base status” (Caspari and Schad, 2022).

The study area (where the operational activities are situated) is located within the Fb5 and Ba1 land types (LTSS, 1972 – 2006) which is characterised by a plinthic catena: upland duplex and marginalitic soils rare (ARC, 2006); red soils widespread and can consist of dystrophic and/ or mesotrophic materials with shallow soils also present. Figure 15 indicates the Fb5 land type and Figure 16 the Ba1 land type as well as the general position of specific soil forms within this land type. The terrain units are described in Table 23 and Table 24 below.

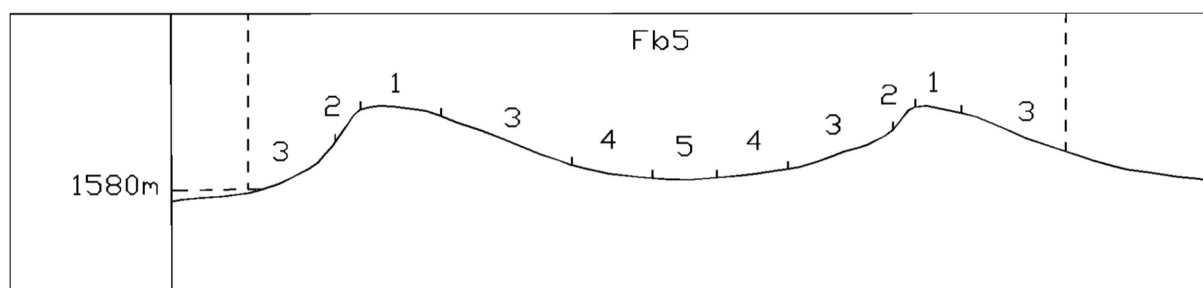


Figure 15: Fb5 land type (ARC, 2006)

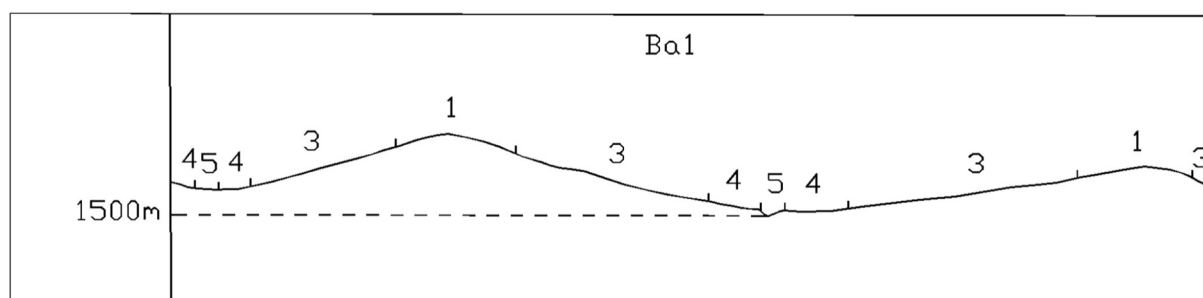


Figure 16: Ba1 land type (ARC, 2006)

Table 23: Fb5 terrain units (ARC, 2006)

Soil Form/ Identifier	Terrain Unit									
	1		2		3		4		5	
	ha	%	ha	%	ha	%	ha	%	ha	%
Rock	1948	40	1136	70	2249	21	682	5	192	12
Mispah (Mispah Ms10)	1607	33	325	20	2678	25	1500	11	260	16
Glenrosa (Williamson Gs16, Trevanian Gs17)	1120	23	162	10	3106	29	1636	12	-	-
Hutton (Msinga Hu26, Hutton Hu16)	195	4	-	-	2464	23	6543	48	-	-
Oakleaf and Dundee (Leeufontein Oa16, Jozini Oa36, Highflats Oa17, Dundee Du10)	-	-	-	-	-	-	1227	9	162	10
Arcadia an Rensburg (Gelykvakte Ar20, Rensburg Rg20)	-	-	-	-	-	-	-	-	844	52
Clovelly (Southwold Cv26, Oatsdale Cv16)	-	-	-	-	-	-	818	6	-	-
Shortlands (Doveton Hu27, Glendale Sd21)	-	-	-	-	214	2	409	3	-	-
Clovelly (Ofazi Cv23, Vidal Cv13)	-	-	-	-	-	-	545	4	-	-
Avalon (Avalon Av26)	-	-	-	-	-	-	273	2	-	-
Stream beds	-	-	-	-	-	-	-	-	162	10

Table 24: Ba1 terrain units (ARC, 2006)

Soil Form/ Identifier	Terrain Unit							
	1		3		4		5	
	ha	%	ha	%	ha	%	ha	%
Rock	2292	5	-	-	-	-	-	-
Hutton (Msinga Hu26, Shorrock Hu36, Makatini Hu37)	4583	10	-	-	-	-	-	-
Mispah (Mispah Ms10)	4583	10	-	-	-	-	-	-
Hutton (Msinga Hu26, Shorrock Hu36)	4583	10	33610	40	6111	40	-	-
Hutton (Msinga Hu26, Shorrock Hu36)	9166	20	16805	20	-	-	-	-
Mispah (Mispah Ms10, Klipfontein Ms11)	9166	20	8402	10	764	5	-	-
Hutton (Makatini Hu37, Doveton Hu27)	4583	10	8402	10	1528	10	-	-
Glencoe (Glencoe Gc26, Leslie Gc36)	2292	5	4201	5	764	5	-	-
Clovelly (Southwold Cv26, Blinkklip Cv36)	2292	5	4201	5	764	5	-	-
Glenrosa (Trevanian Gs17, Williamson Gs16)	2292	5	4201	5	-	-	-	-
Avalon (Avalon Av26, Soetmelk Av36, Bezuidenhout Av37)	-	-	4201	5	1528	10	-	-
Valsrivier (Lindley Va41)	-	-	-	-	1528	10	764	10
Rensburg and Willowbrook (Rensburg Rg20, Sarasdale Wo20, Chiyika Wo21)	-	-	-	-	-	-	2291	30

Soil Form/ Identifier	Terrain Unit							
	1		3		4		5	
	ha	%	ha	%	ha	%	ha	%
Oakleaf and Dundee (Jozini Oa36, Dundee Du10)	-	-	-	-	-	-	2291	30
Bonheim (Glengazi Bo31, Bonheim Bo41)	-	-	-	-	764	5	764	10
Kroonstad (Mkambati Kd14, Kroonstad Kd13, Avoca Kd17)	-	-	-	-	764	5	382	5
Westleigh (Sibasa We13)	-	-	-	-	764	5	382	5
Champagne (Champagne Ch11)	-	-	-	-	-	-	764	10

The largest areas, as per the LTSS (1972 – 2006) consists of red-yellow apedal and shallow soils. A red-yellow apedal horizon has defined red/ yellow colours and has a structure weaker than moderate on the moist state (SCWG, 2018). The essential uniform, red pigmentation is due to the presence of evenly distributed hematite which, even when it is not necessarily the dominant iron oxide present, typically indicates well aerated swell conditions in warmer climates. The clay mineral suite of red apedal horizons is similar to its yellow-brown apedal counterparts. Kaolinite is the dominant clay mineral.

Poorly ordered or amorphous clay minerals are also present in the clay fractions of soils in humid climates, while limited proportions of 2:1 clay minerals can be present in semi-arid climates, with increasing quartz contents in sandy textured horizons. The apedal or weak structure forms in sandy textured soils, while within clay textured horizons it results either from the low activity, non-swelling clay minerals or from a soil moisture regime lacking severe desiccation. The horizon may experience only short durations of water saturation, while at greater depths, water saturation may last for longer periods. The sandy loam and finer textured horizons have a strong micro-aggregate structure resulting in stable pores and a moderate high infiltration rate (SCWG, 2018).

The shallow soils within this land type are characterised by a shallow A horizon (between 100 mm – 400 mm thick) overlying a hard rock horizon. The hard rock horizon comprises hard country rock where primarily physical weathering has taken place, ranging from a fractured rock horizon variant with numerous closely aligned fractured planes, but lacking soil development between fractures, to a solid rock horizon variant with limited and widely spaced fractures. It includes all igneous, sedimentary and metamorphic rock types (SCWG, 2018).

5-6.2 Hydropedological Soil Types and Hillslopes

Figure 21 indicates the dominant soil forms identified over the project area within each hillslope (then extrapolated over the entire project area) where Table 25 provides information regarding the diagnostic horizons of the soil families. Figures Figure 17 to Figure 20 provides a photographic record of selected soil properties used to identify the various soil forms and families.

Table 25: Soils identified on-site.

Soil Form and Family	1 st Horizon	2 nd Horizon	3 rd Horizon	Size (ha)	Percentage of study area
Bainsvlei (Bv) 1220	Orthic A	Red apedal	Soft plinthic	2 450.449 ha	23.34%
Clovelly (Cv) 1222	Orthic A	Yellow-brown apedal	Lithic	3 323.154 ha	31.69%
Glencoe (Gc) 1220	Orthic A	Yellow-brown apedal	Hard plinthic	21.242 ha	0.20%
Glenrosa (Gs) 2110	Orthic A	Lithic	-	1 434.352 ha	13.68%
Hutton (Hu) 1220	Orthic A	Red apedal (thick)	-	1 238.324 ha	11.81%
Johannesburg (Jo) 2200 (Urban technosol)	Exposed subsoil, asphalt, infrastructure	Where present, exposed red/ yellow apedal, gley material, hard rock and lithic material	-	313.422 ha	2.99%

Soil Form and Family	1 st Horizon	2 nd Horizon	3 rd Horizon	Size (ha)	Percentage of study area
	and other urban areas				
Mispah (Ms) 1120	Orthic A	Solid rock	-	72.449 ha	0.69%
PCDs	-	-	-	42.893 ha	0.41%
Rensburg (Rg) 1000	Vertic A	Gley	-	920.15 ha	8.77%
Vaalbos (Vb) 1221	Orthic A	Red apedal	Hard rock	13.964 ha	0.13%
Witbank (Wb) 1200 (Transported technosol)	Ex-natural soil	Tailings material	-	156.32 ha	1.49%
Wb 1300	Ex-natural soil	Backfilled material	-	79.338 ha	0.76%
Wb 2100	Anthropogenic material	Undisturbed natural soils	-	6.296 ha	0.06%
Wb 2200	Anthropogenic material (TSF)	Anthropogenic material (TSF)	-	383.988 ha	3.66%
Willowbrook (Wo) 1000	Melanic A	Gley	-	29.912 ha	0.29%
			Total	10 486.253 ha	100%

The study area primarily comprises of natural soils that have not been impacted with agricultural land scattered throughout. The soils that form part of the hillslopes, on the contrary, consists largely of anthropogenic soils from mining and processing activities. The topsoil has been extensively removed, and/ or covered as a result of construction and operations typical of underground mining and processing in regions like Gauteng or Mpumalanga.

The subsoil is characterised by yellow and red apedal soils, alongside gley material indicative of periodic waterlogging, hard rock formations, and lithic/ plinthic material often found in the Highveld and other geologically diverse areas. In some sections of the study area, subsoil have been excavated (or covered by the TSFs) and used as backfill and subsequently transported through alluvial processes during seasonal rains or aeolian processes during dry, windy conditions. This material has been deposited into adjacent wetlands and streams, potentially impacting hydrogeological functions such as water retention and filtration. These disturbances may exacerbate soil erosion and sedimentation, further affecting the ecological integrity of local wetland systems, which are vital for biodiversity conservation and water resource management.



Figure 17: Red apedal B horizon.



Figure 18: Yellow-brown B horizon.



Figure 19: Shallow, rocky soils.



Figure 20: Lithic material in the subsoil horizon.

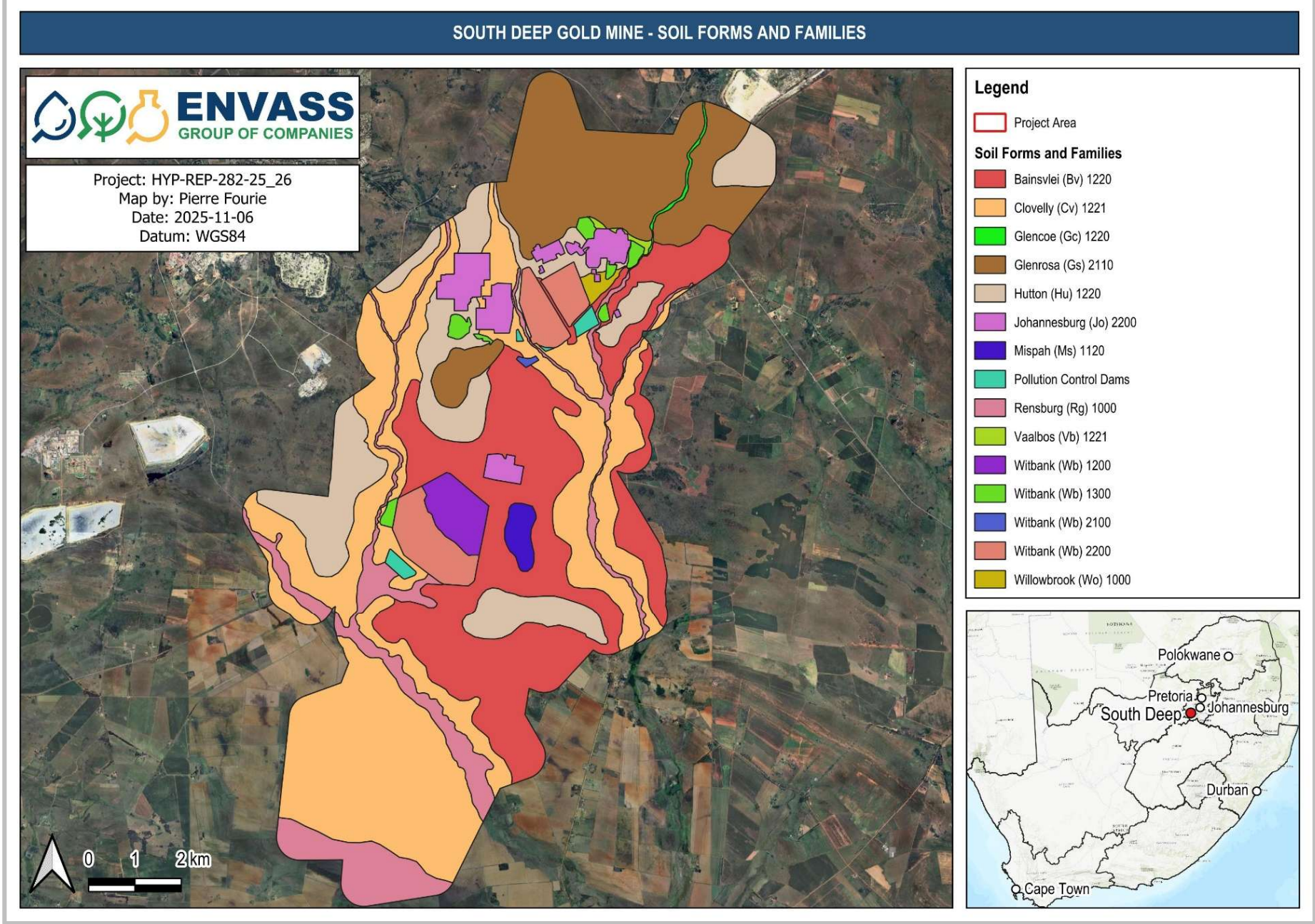


Figure 21: Soil forms and families present on site

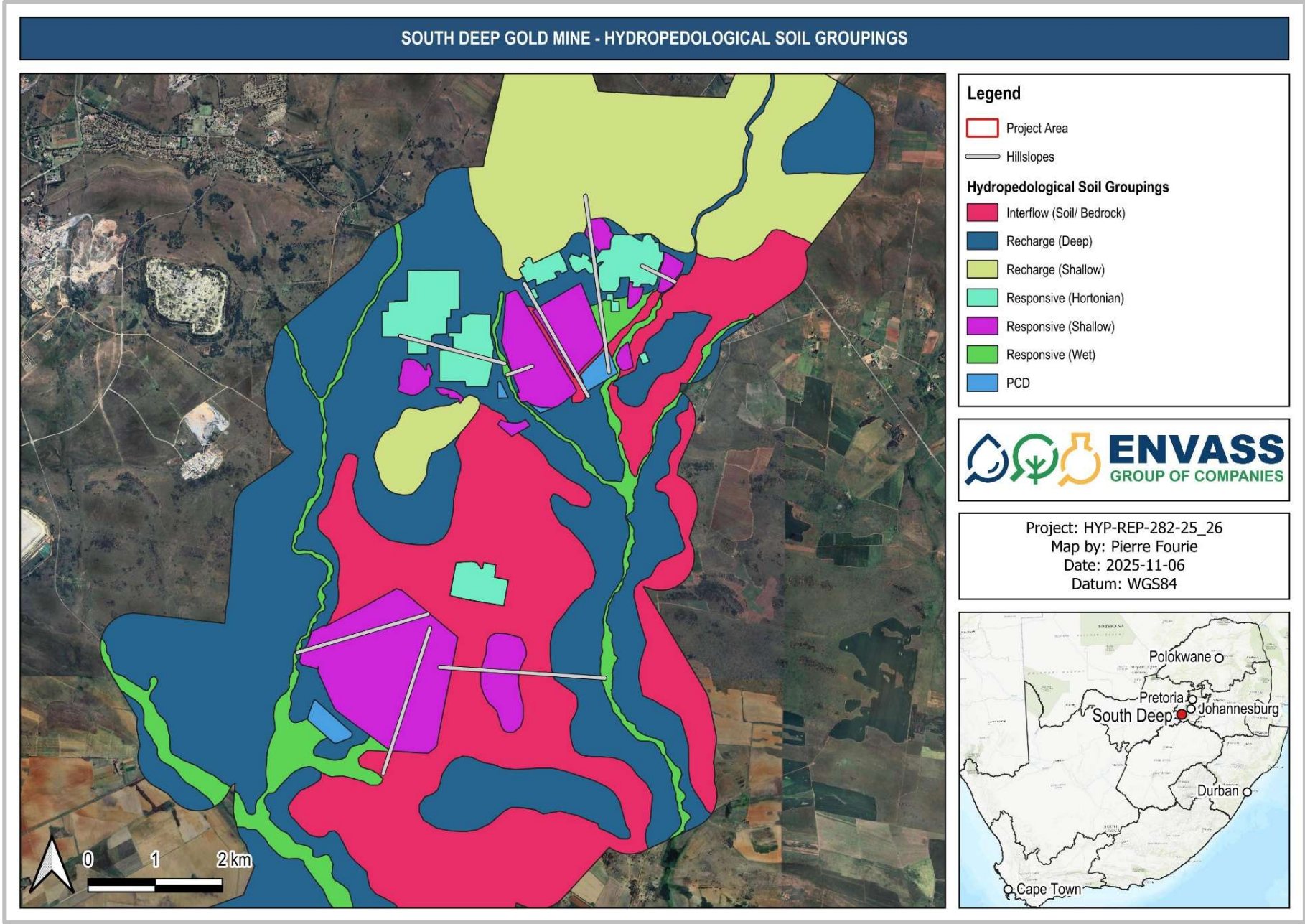


Figure 22: Hydropedological soil groups present on site

Soil genesis is influenced by physical and chemical water-related processes and soils are, therefore, the first-order control of hydrological processes. The water transfer function of soils varies on several factors including soil properties, topography, and climate. Characteristic soil properties make it possible to conceptualise hillslope hydrological responses within catchments. The approach followed in this study includes the classification of hillslopes for the site, and the development of a soil map, which were used to determine the hydrological soil types (HSTs). Finally, a conceptualisation of hydrological processes (Van Tol, et al. 2023) that occur on the various hillslopes, based on HST was undertaken. Table 26 indicates the identified soil forms and their hydrological soil counterpart (Van Tol and Bouwer, 2024) and is illustrated in Figure 22.

Table 26: Hydropedological soil groups present on site.

Soil Form and Family	Hydrological Counterpart	Area (ha)	Percentage of study area (%)
Jo 2200	Responsive (Hortonian).	313.422 ha	2.99%
Gs 2110	Recharge (Shallow).	1 434.352 ha	13.68%
Vb 1221	Recharge (Deep)	4 639.577 ha	44.24%
Cv 1221			
Gc 1220			
Hu 1220			
Bv 1220			
Bv 1220	Interflow (Soil/ Bedrock).	2 450.449 ha	23.37%
Wo 1000	Responsive (Wet).	950.062 ha	9.06%
Rg 1000			
Ms 1120	Responsive (Shallow).	698.391 ha	6.66%
Wb 1200			
Wb 1300			
Wb 2100			
Wb 2200			
Wb 2200			
Total		10 486.253 ha	100%

5-6.2.1 Responsive (Hortonian) Soils

Soils with vertic horizons will swell and close during wet periods. The hydraulic conductivity/ infiltration rate of these soils with high 2:1 clay content is less than the rainfall intensity and will therefore generate overland flow due to infiltration excess. This is often referred to as Hortonian overland flow. Degraded soils with surface crusting or sodic soils will behave similarly (Van Tol and Bouwer, 2024).

5-6.2.2 Recharge (Shallow) Soils

These are freely drained topsoil horizons overlying fractured rock or saprolite. The contribution of these soils to transpiration is lower than that of 'recharge (deep)' soils. Due to the relatively short residence time in the biological zone (solum), water exiting 'recharge (shallow)' soils has a lower reduction potential (oxygenised) (Van Tol and Bouwer, 2024).

5-6.2.3 Recharge (Deep) Soils

These are deep, freely drained soils without any indication of saturation overlying fractured rock or deeply weathered saprolite. In drier areas, the underlying bedrock might not be permeable, and the absence of hydromorphic properties is due to insufficient rainfall to cause saturation for significant periods (Van Tol and Bouwer, 2024). 'Recharge (deep)' soils contribute significantly to transpiration, but downward ET excess flow is the dominant flowpath.

5-6.2.4 Interflow (Soil/ Bedrock) Soils

In this group, lateral flow is generated, either due to low permeability of the bedrock which restricts vertical drainage, or due to return flow from the bedrock flow path to the soils. The flow rate via this pathway is determined by the slope and conductivity of the interflow horizon. Flow is normally maintained on a seasonal basis, but it depends on the length and recharge area of the bedrock-return flow path (Van Tol and Bouwer, 2024).

5-6.2.5 Responsive (Wet) Soils

These are soils marked by saturation close to the surface layers for extended periods, especially during the wet season (Van Tol and Bouwer, 2024). Additional precipitation will not infiltrate but overland flow will be generated. These soils respond quickly to rain events, resulting in high peak flows.

5-6.2.6 Responsive (Shallow) Soils

These are soils with limited depth and hence small storage capacity. Underlying rocks are slowly permeable and rapid recharge of bedrock flowpaths is not likely. When significant rainfall is received, the storage capacity of the soil is exceeded, and overland flow is then generated (Van Tol and Bouwer, 2024). These soils 'respond' quickly to rain events.

5-7 TERRESTRIAL ECOLOGY (FLORA AND FAUNA)

5-7.1 Biodiversity Conservation Plan

One (1) Critical Biodiversity Area (CBA), an irreplaceable unit is situated within the study area in the vicinity of the ridge habitat located to the northwest of the South Shaft surface infrastructure. The remaining ridge habitat in the northern portion of the study area, aside from all disturbance associated with the mine, was classified as CBA: Important Areas or Ecological Support Areas (ESAs). In addition to this, large areas located in the southern portion of the study area, to the northwest of the Doornpoort TSF, were observed to be classified as CBA: Important Areas. Scattered CBA: Important Areas were also observed in the western and northeastern sections of the study area. CBA: Irreplaceable Areas are considered critical for meeting provincial biodiversity targets and are required to ensure the persistence of species and the functioning of ecosystems. CBA: Important Areas have a lower irreplaceability but collectively, incorporate the most biodiversity in the smallest area, and therefore provide the most cost-effective options for biodiversity conservation.

The rivers flowing through the study area, including the locally named Leeu East, Kariega and Leeu West (Leeuspruit) Rivers, were all observed to fall within ESAs. Additional ESAs were scattered within the study area, situated primarily adjacent to CBA: Important Areas. ESAs are not essential for meeting biodiversity targets but play an important role in supporting Irreplaceable and Important areas and/or in delivering ecosystem services. In Gauteng, ESAs include dolomite outcrops, rivers, wetlands, pans, corridors for climate change and species migration, rocky ridges, and low-cost areas for Johannesburg and Tshwane (refer to Figure 23).

5-7.2 Threatened Ecosystems

The majority of the study area was observed to fall within the Rand Highveld Grassland Threatened Ecosystem, which is classified as Vulnerable. The northern portion of the study area falls within the Gauteng Shale Mountain Bushveld, classified as Least Concern, while the south falls within the Soweto Highveld Grassland, classified as Vulnerable (refer to Figure 24).

5-7.3 Protected Areas

No Protected Areas (PAs) were situated within the study area. The closest PA was observed to be the Tweefontein Private Nature Reserve to the south and the Johanna Jacobs Private Nature Reserve to the west (refer to Figure 24).

5-7.4 Vegetation Types

The majority of the study area falls within the Rand Highveld Grassland, which is classified as Vulnerable. The northern portion of the study area falls within the Gauteng Shale Mountain Bushveld, classified as Least

Concern, while the south falls within the Soweto Highveld Grassland classified as Vulnerable (refer to Figure 25).

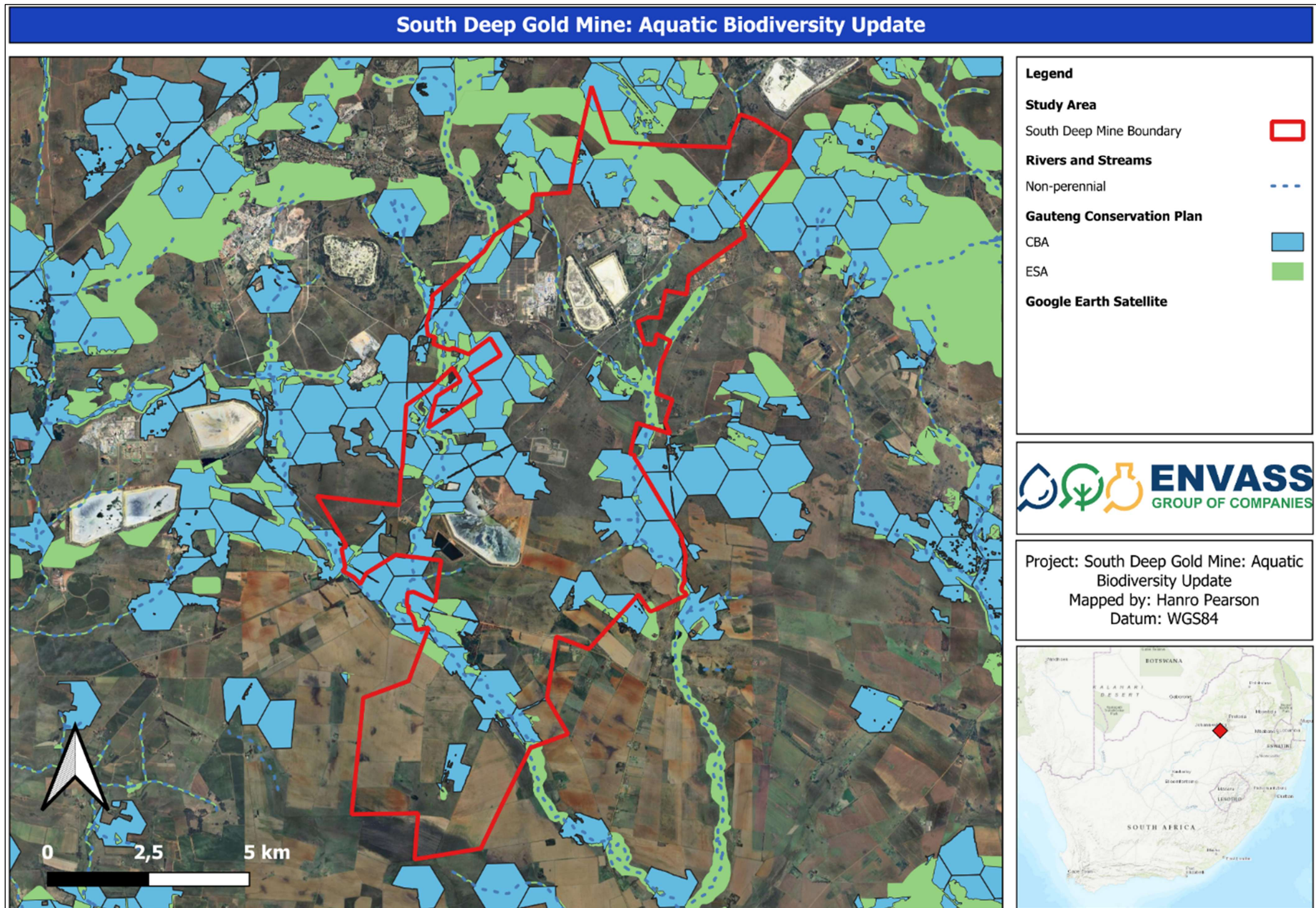


Figure 23: Gauteng Biodiversity Conservation Plan units relevant to the study area

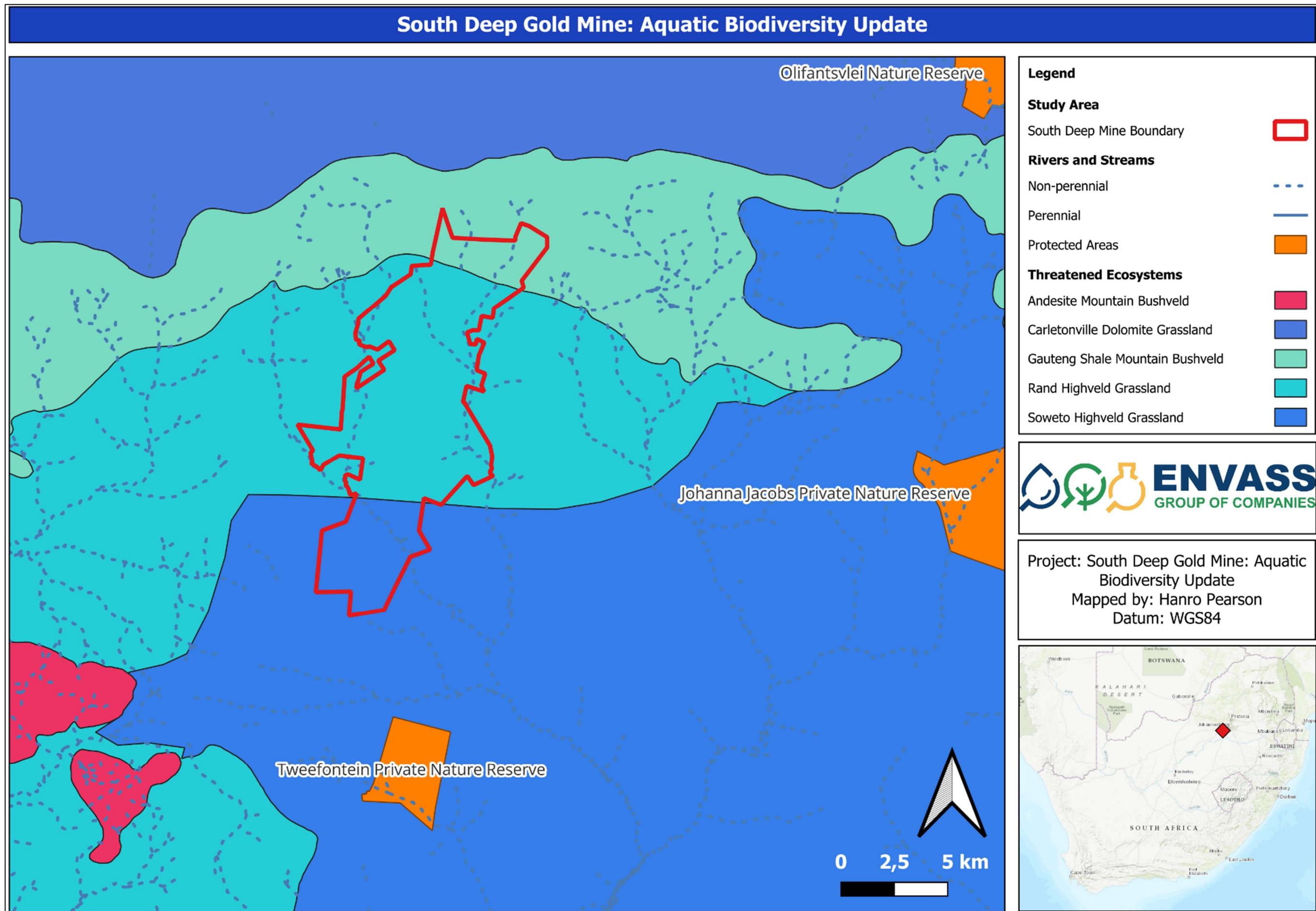


Figure 24: Threatened Ecosystems and Protected Areas within and surrounding the study area

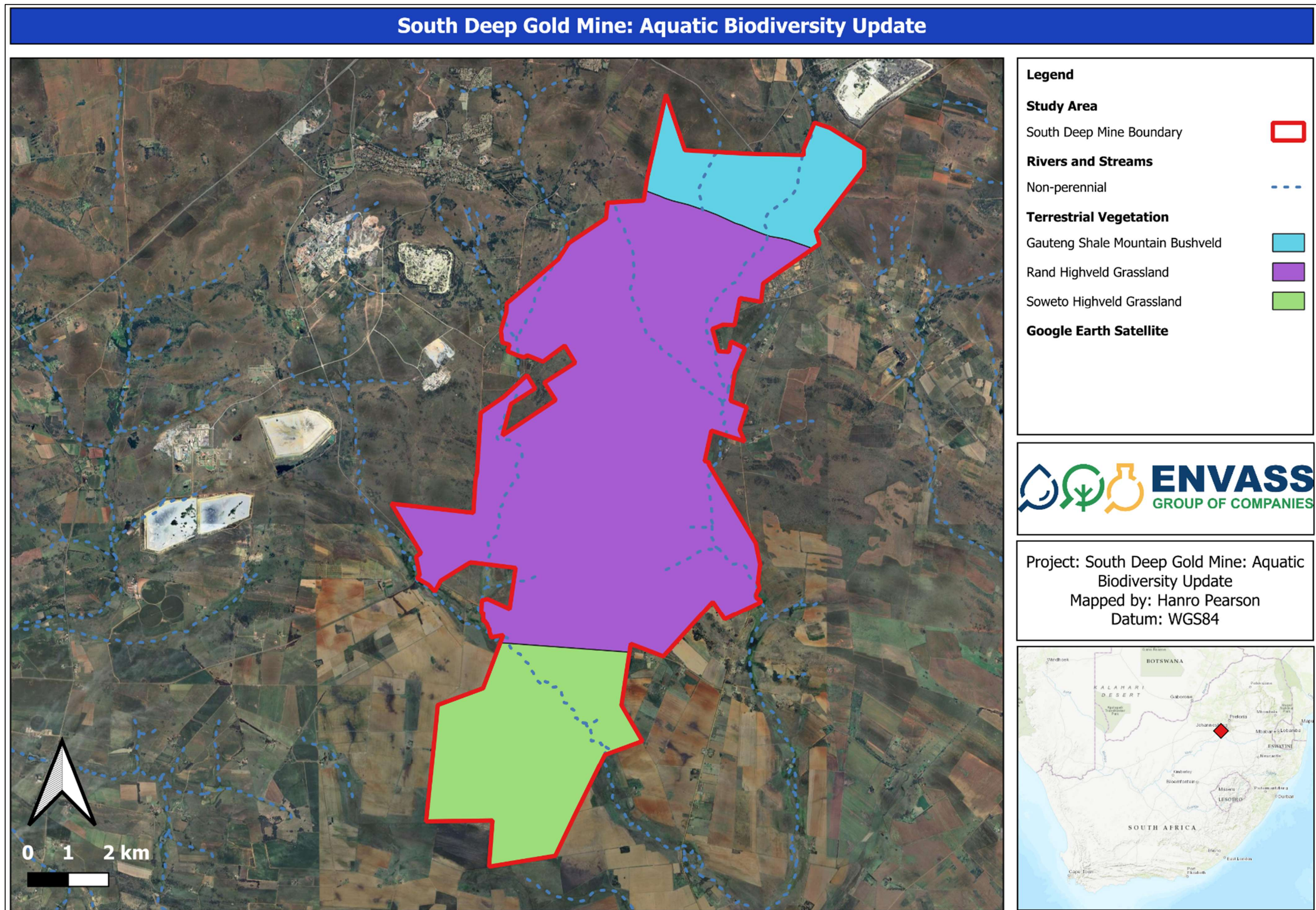


Figure 25: Terrestrial vegetation types situated within the study area

5-8 AQUATIC ECOLOGY

Several wetland systems were modelled at a desktop level within the study area. These included: seven (7) Channelled Valley Bottom (CVB), five (5) Unchannelled Valley Bottom (UVB), one (1) Depression and one (1) Hillslope Seepage wetlands. At a desktop level, their Present Ecological State (PES) scores ranged from Class A/B (Near natural) to Class D/E/F (Largely to seriously modified). Onsite, the eight (8) systems previously delineated and assessed were classified as UVB and CVB wetlands with Hillslope Seepage wetlands following into them at the head of the systems (refer to Figure 26 and Figure 27).

One (1) National Freshwater Ecosystem Priority Areas (NFEPA) River, an unnamed tributary of the downstream NFEPA Leeuwspruit River locally named Leeu East River (Nel et al., 2011), flows to the east of the study area surface infrastructure, with the closest interaction being with the old South Shaft RWDs, which was constructed in its natural course. The desktop PES score modelled for the unnamed tributary (Leeu East River) falls within Class D (Largely modified) (Nel et al., 2011). No other NFEPA rivers are situated within the study area, however, the NFEPA Leeuwspruit River flows approximately 2.5 km downstream of the Doornpoort TSF RWD. NFEPA systems are required to remain in good condition to conserve freshwater ecosystems, but also to protect water resources for human consumption (Nel et al., 2011). The systems must be supported by good planning, decision-making and management in order to ensure that human use does not detrimentally impact the condition of the ecosystem (Nel et al., 2011) (refer to Figure 26 and Figure 27).

A total of three (3) natural NFEPA wetlands were modelled within the study area. These included two (2) Depressions and one (1) Hillslope Seep wetland, which were both determined at a desktop level to be in modified condition (Nel et al., 2011). The desktop delineation and classification of these wetland systems were determined to be incorrect during the field investigation. In addition to the natural wetland systems, a total of fourteen (14) artificial watercourses, including farm dams, wastewater storage facilities and RWDs, were modelled at a desktop level within the study area (refer to Figure 26 and Figure 27).

The study area was observed to be dominated by the Mesic Highveld Grassland (Group 4) Wetland Vegetation (WetVeg) type, with the Central Bushveld (Group 1) WetVeg unit covering the northern extent and the Mesic Highveld Grassland (Group 3) covering the southern extent of the study area. These WetVeg units are classified as CR at a national scale (Nel et al., 2011). Remnants of the presumed natural state of the WetVeg unit were recorded within the delineated wetland systems during the field investigation, however, the current condition of the wetland vegetation was determined to be degraded in comparison to the reference state. This was primarily attributed to disturbance from historic and current land uses such as but not limited to: agriculture, rural settlement development and expansion, servitudes (e.g. roads, pipelines and powerlines) livestock grazing and mining activities (refer to Figure 28).

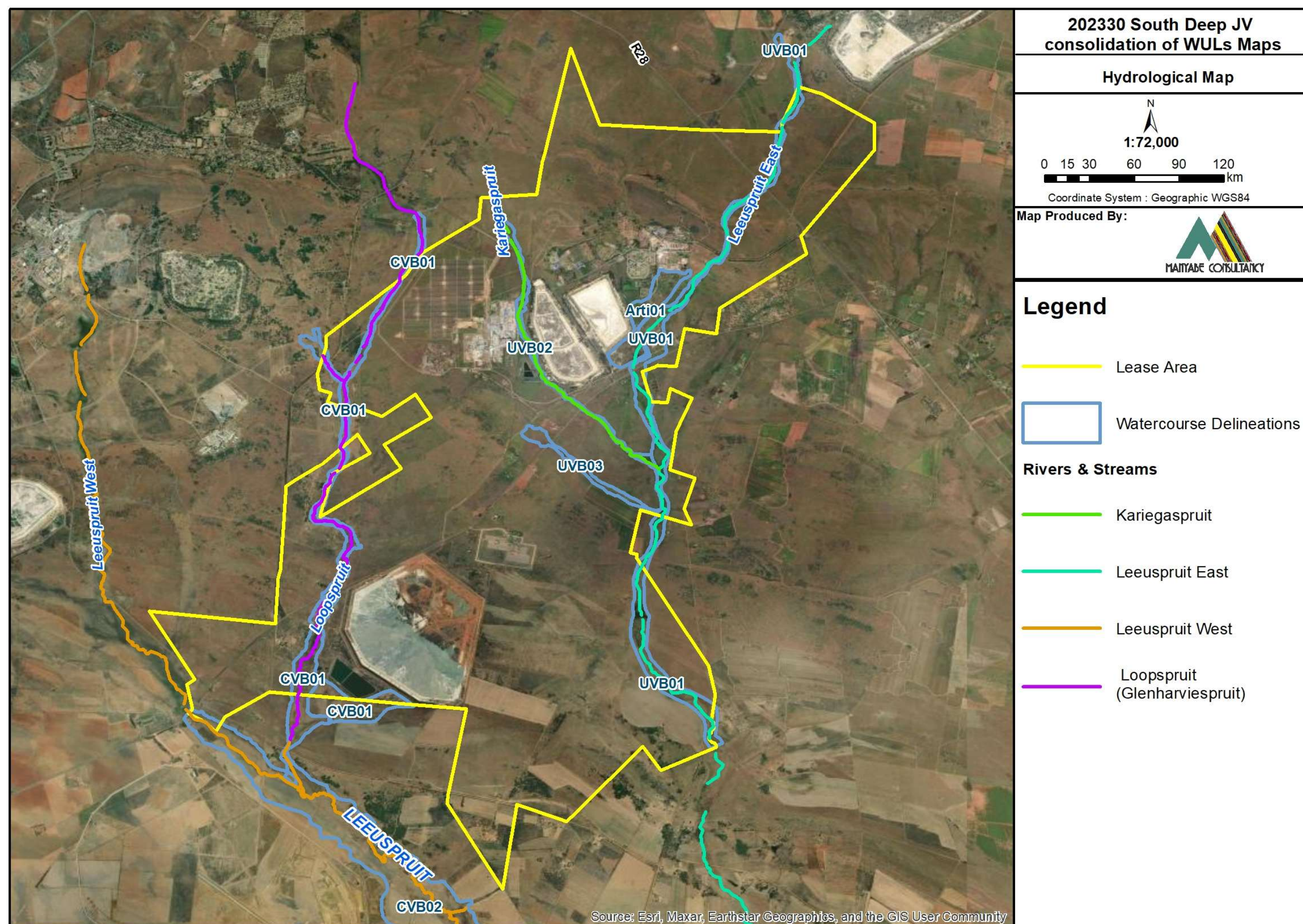


Figure 26: NFEPA wetlands and rivers relevant to the study area

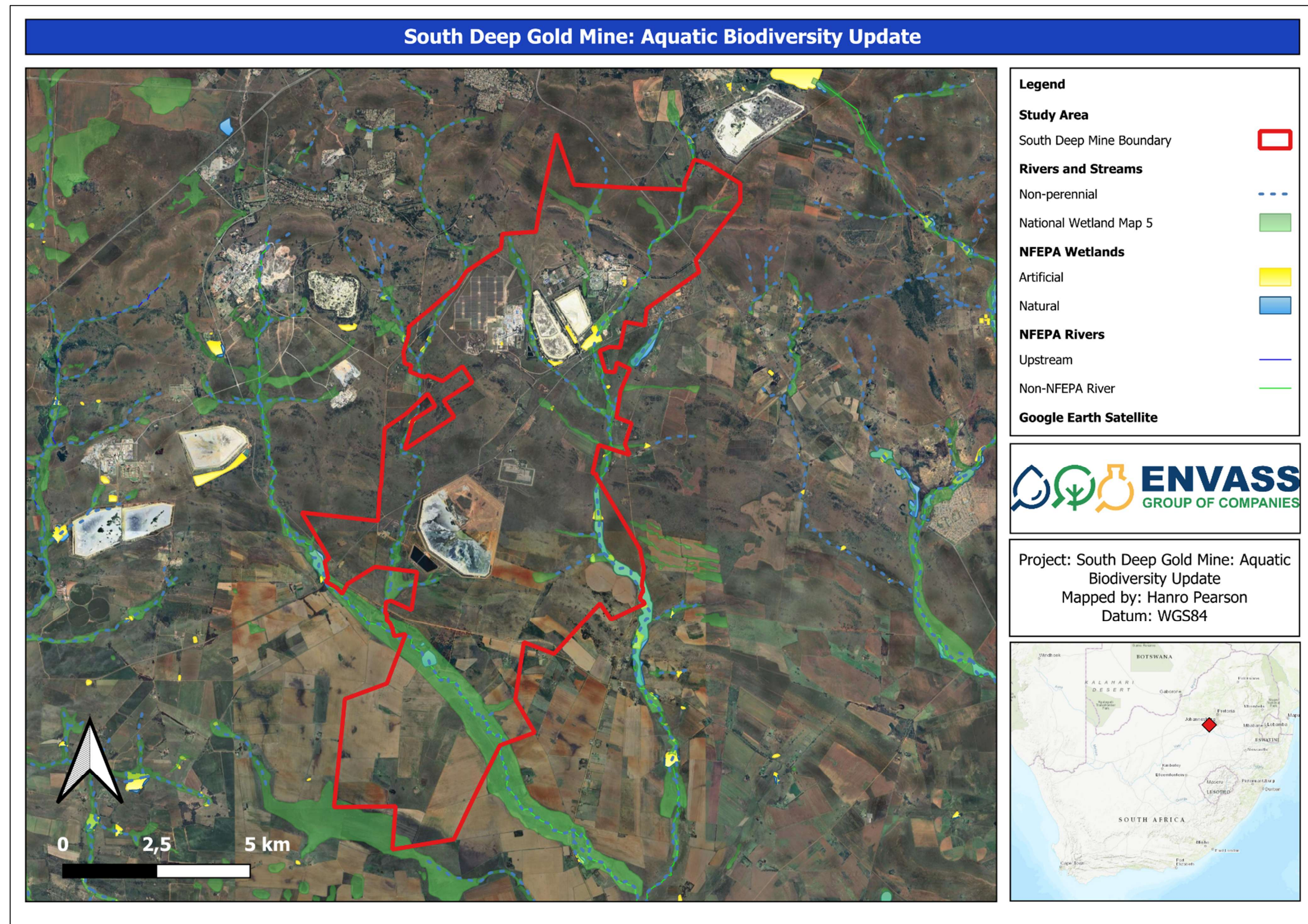
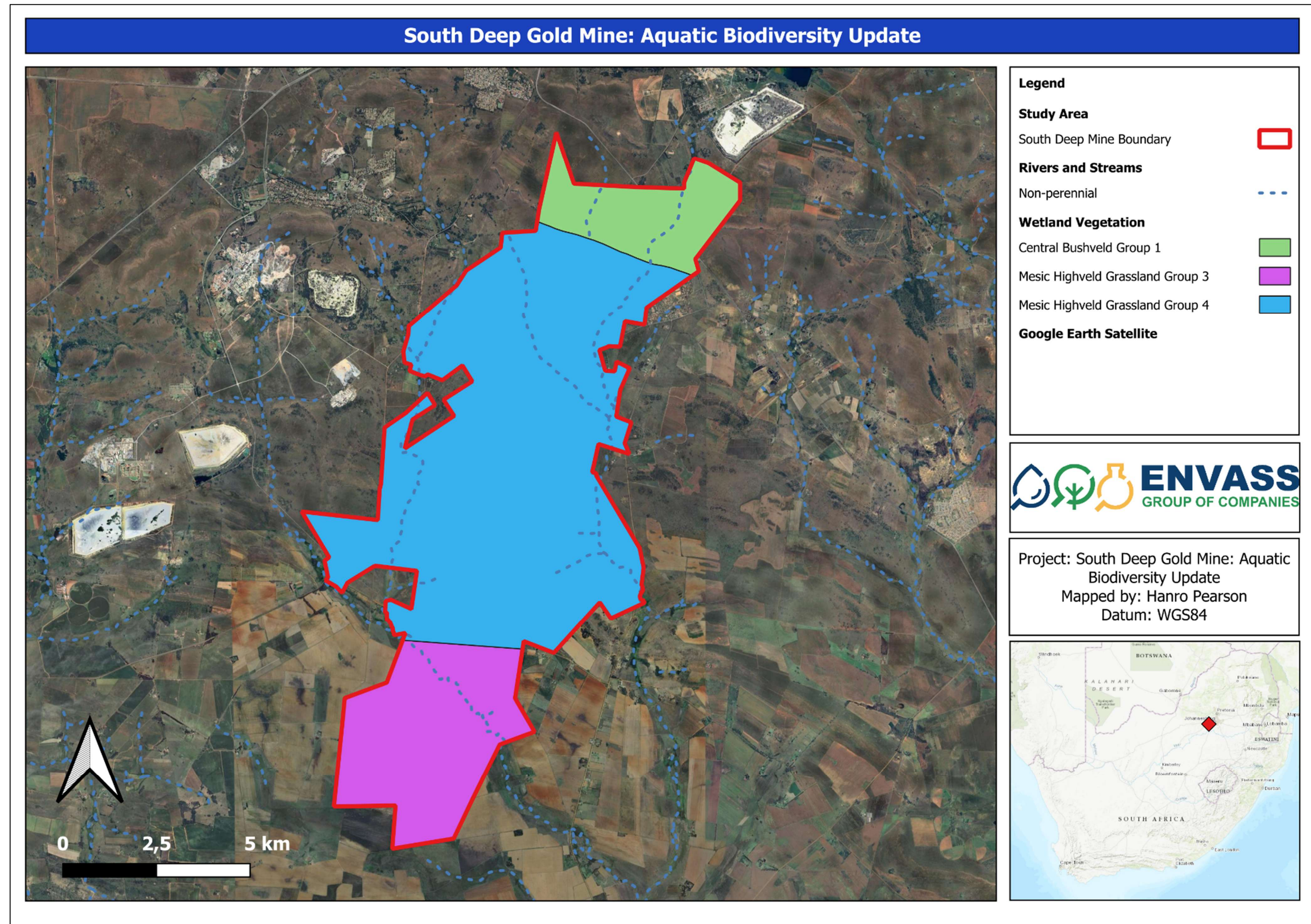


Figure 27: NFEPA wetlands and rivers and National Wetland Map 5 relevant to the study area



The watercourses within the study area were identified at a desktop level, classified and delineated in-field and subsequently mapped utilising Geographic information system (GIS) (QGIS and Google™ Earth Pro) and available spatial data. The delineation was developed with the presumed natural flow of water through the site in mind and based on wetness indicators (i.e. terrain unit, soil, vegetation and hydrology) recorded onsite.

The following legislated definitions have specific relevance to this section, as they were utilised in justifying the classification of each Hydrogeomorphic (HGM) unit as a watercourse:

“Watercourse” means- (a) a river or spring; (b) a natural channel in which water flows regularly or intermittently: (specifically relevant to drainage lines); (c) a wetland, lake or dam into which, or from which, water flows; and (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes where relevant, its bed and banks.

“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; and

“Wetland” means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Several watercourses were delineated and verified infield. These include two (2) CVB (CVB01 and CVB02) wetlands, three (3) UVB (UVB01 to UVB03) wetlands, and one (1) Artificial Watercourse (Arti01) associated with the study area. Refer to Figure 29 for the overall watercourse delineation map.

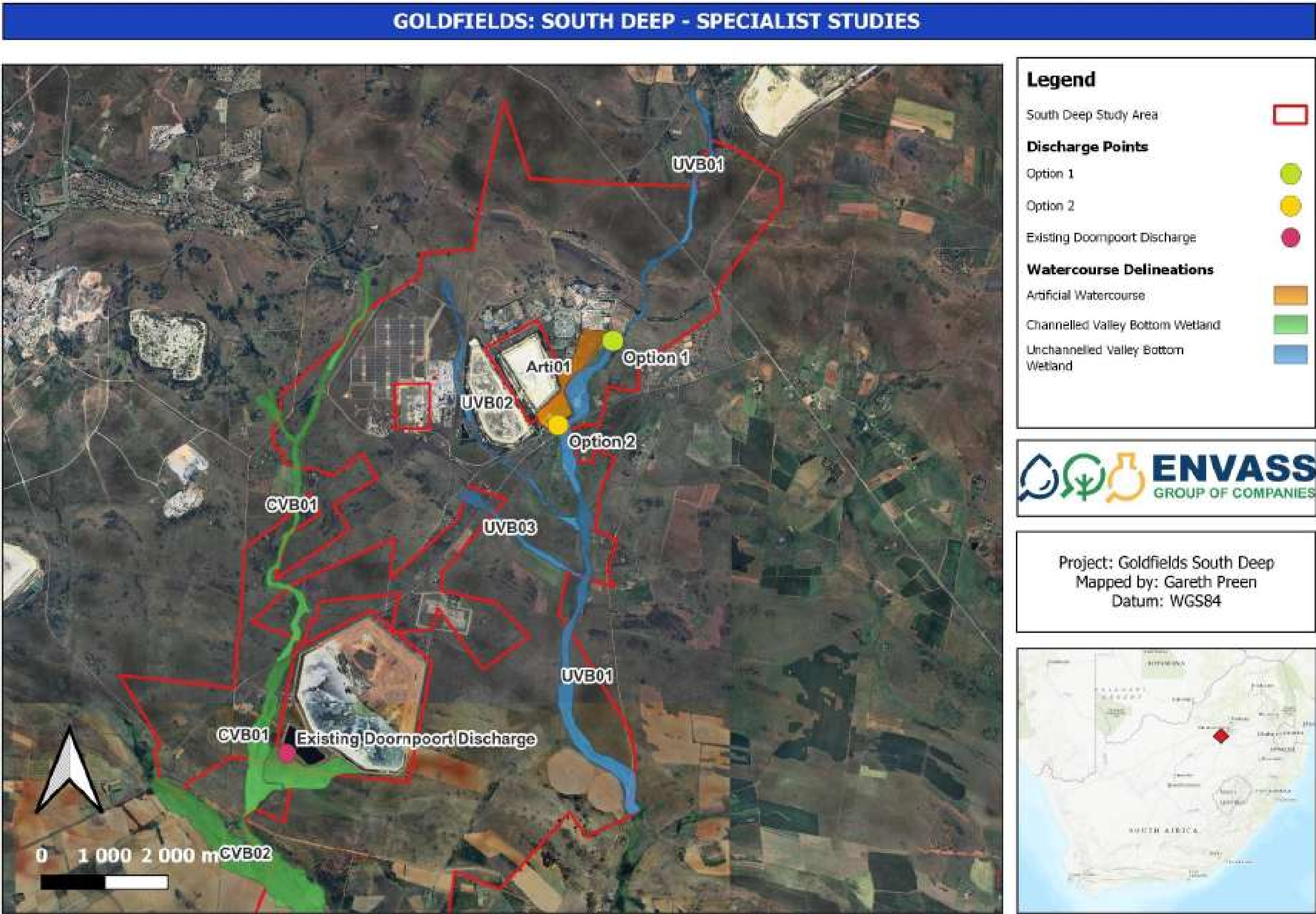


Figure 29: Map illustrating the overall watercourse delineation for the study area

5-9 SURFACE HYDROLOGY

Figure 30 illustrates the hydrological setting of the site, while Figure 12 presents the river network of the greater region. The study site is positioned in the quaternary catchment C22J, which is drained by the Rietspruit River. The site is bounded by two primary rivers, according to the 1:500,000 topographical map dataset: the perennial Leeuspruit River to the west and a non-perennial Leeuspruit East River to the east.

In Figure 12, the Area of Hydrological Relevance (AHR) captures the rivers relevant to this study and has an area of 84.8 km². Apart from the river to the west, which comes close to the Doornpoort TSF, all rivers are non-perennial (per the NGL's 1:50,000 topographical map data). Four rivers are relevant to the flood study, given their intersection with the AOI and are from west to east:

- The Leeuspruit River (1:50,000 topographical map name) (also referred to as Leeu West);
- Kariegaspruit;
- Unnamed tributary of the Leeuspruit (referred to by the mine as the Loopspruit and not to be confused with the Loopspruit that feeds Klipdrif Dam); and
- Leeuspruit East River (also referred to as Leeu East).

The Leeuspruit originates north-east of the mine and flows in a southerly direction to the east of the South Shaft complex. Within the mine property, below the old Gold Plant and South Shaft complex, an undefined watercourse (expected to be a tributary of the Leeuspruit) flows from an area known as the South Delta into the Leeuspruit. In the vicinity of the South Delta it is difficult to define one flow channel for the Leeuspruit.

The Kariegaspruit, a tributary of the Leeuspruit, flows in a south easterly direction between the old TSFs (Phase 2) and the Twin Shaft complex to its confluence with the Leeuspruit, 3km south of the mine. South of the old TSF (Phase 2), the ground along the Kariegaspruit becomes marshy.

The Loopspruit runs in a southerly direction west of the mine's operations. The confluence of the Leeuspruit and Loopspruit is approximately 9.5 km downstream of the mine. The Leeuspruit ultimately flows into the Rietspruit, which ultimately flows into the Vaal River via the Vaal Barrage. The Vaal Barrage is approximately 32.5 km downstream of the mine.

The Leeuspruit contributes about 4.8% (WR90) of the flow to the Rietspruit (WR90 catchments C22H and C22J). The contribution to the Vaal River is considered negligible.

The general flow direction in these catchments is southerly to south easterly.

Within the AHR, there are a few small dams, including a larger dam i.e. South Shaft RWD, which has been upgraded. It originally comprised of two components; an upgraded operational RWD and an old (historical) RWD which is now the recipient of clean water inflows from the river system to the north. The old RWD is planned to be rehabilitated. Open reservoirs are also present in the AHR and are typically either RWDs or PCDs. A 100m watercourse buffer is presented in Figure 12 (relevant to the interpretation of GN 704).

5-9.1 Leeuspruit catchment

The Leeuspruit catchment comprises of natural grassland; Harmony No. 4 Shaft, now the First Uranium Ezulwini Mine mining infrastructure; South Deep Gold Mine mining infrastructure (including the South Shaft complex, Backfill Plant, industrial waste site, WRDs, tailings dams, RWDs and WWTW); agricultural land and residential areas (formal settlements, mine hostels).

In the past, the Leeuspruit also received runoff from the South Shaft complex and old Gold Plant area which has been rehabilitated [this also includes existing Backfill Plant runoff, backwash water from the Refrigeration Plant, water from the surface fans, overflow from the mine water dams, overflow from the old thickeners and effluent (grey water) from the hostels]. However, a trench has been established by the mine, down gradient of the South Shaft area (South Shaft storm water separation system), to channel all collected water to the

RWD complex and recycle it back to the process. It is noted that during the rainy season, the channel overflows into the Leeuspruit.

Prior to plugs being established between First Uranium Ezulwini Mine Shaft (old Harmony No. 4 Shaft) and South Shaft, underground water that flowed into the mine workings from First Uranium Ezulwini Mine Shaft was discharged into the Leeuspruit.

In addition, South Deep JV: South Deep Gold Mine has been abstracting surface water from the Leeuspruit. Considering the non-perennial nature of the Leeuspruit, the abstracted water is expected to be underground water discharged from First Uranium Ezulwini Mine Shaft.

The Kariegaspruit and Leeuspruit are naturally non-perennial streams but discharge from various mines along the streams has resulted in more frequent flow. Kloof Gold Mine and Ezulwini Gold Mine are located upstream of South Deep Gold Mine in the Loopspruit catchment. The following activities take place in the surrounding areas:

- informal abstraction of water from the watercourses takes place. The communities settled along the streams abstract the water for drinking and domestic purposes. This is difficult to control or prevent, and domestic use can be considered a potential use of the surface water resources.
- Due to cattle farming in the area, livestock watering is considered a potential use of surface water. The livestock drink from streams on properties where they graze. Water for livestock drinking is supplemented by borehole water. Water from the streams is used by farmers downstream of the mine, for irrigation of their lands. Extensive irrigation systems have been installed to utilise the water in the streams for irrigation purposes. Flowers, maize and fruit are grown on the surrounding farms.
- The natural aquatic environment in the Leeuspruit, Kariegaspruit and Loopspruit, is regarded as a legitimate water user.

5-9.2 Surface Water Quality

Surface water quality data is available in electronic format at the mine's Environmental Control Department (1998 to current). The monitoring programme includes weekly monitoring of the reused sewage effluent from the mine property, weekly in-stream surface water monitoring in the Leeuspruit and Kariegaspruit, and annual biomonitoring in the Leeuspruit, Kariegaspruit and Loopspruit. In addition, the mine monitors internal process-related water on a weekly basis.

Surface water is monitored at points S6, S9E, S10, S13, S14, S11A, S11B, S19, S20, RWD. It must however be noted that as per the issued WUL, the following monitoring points have been provided: S6, S10, S11A, S11B and S13.

The locations of the monitoring points as per the issued WUL (2018) are described in Section 6-11.1 and Table 62. The water quality records for the above-mentioned sites were made available for the period of March 2026.

The parameters of concern related to elevated concentrations are as follows:

- Suspended Solids;
- Sulphates (SO₄);
- Magnesium;
- Nitrate in N;
- Uranium;
- Manganese;
- Arsenic;
- Nickel; and
- Total dissolved Solids (TDS).

Detailed water quality results are found in Appendix N.

5-10 SOILS, VEGETATION AND LAND COVER

According to the Soil Conservation Service for South Africa (SCS-SA) dataset, soils over the AHR are classified as being in the C hydrological soil group with moderately high runoff potential. According to South African National Biodiversity Institute (SANBI) (2018), the natural vegetation coverage of the rivers of relevance and the AHR is Rand Highveld Grassland (to the south) and Gauteng Shale Mountain Bushveld (to the north). As per the Department of Forestry, Fisheries and the Environment (DFFE) 2022 dataset, the most dominant land cover is grassland and cultivated land. Other land cover classifications within the AHR include mines & quarries, waterbodies, forested land, as well as some built-up areas.

Figure 31 illustrates the natural vegetation and runoff potential while Figure 32 illustrates the land cover.

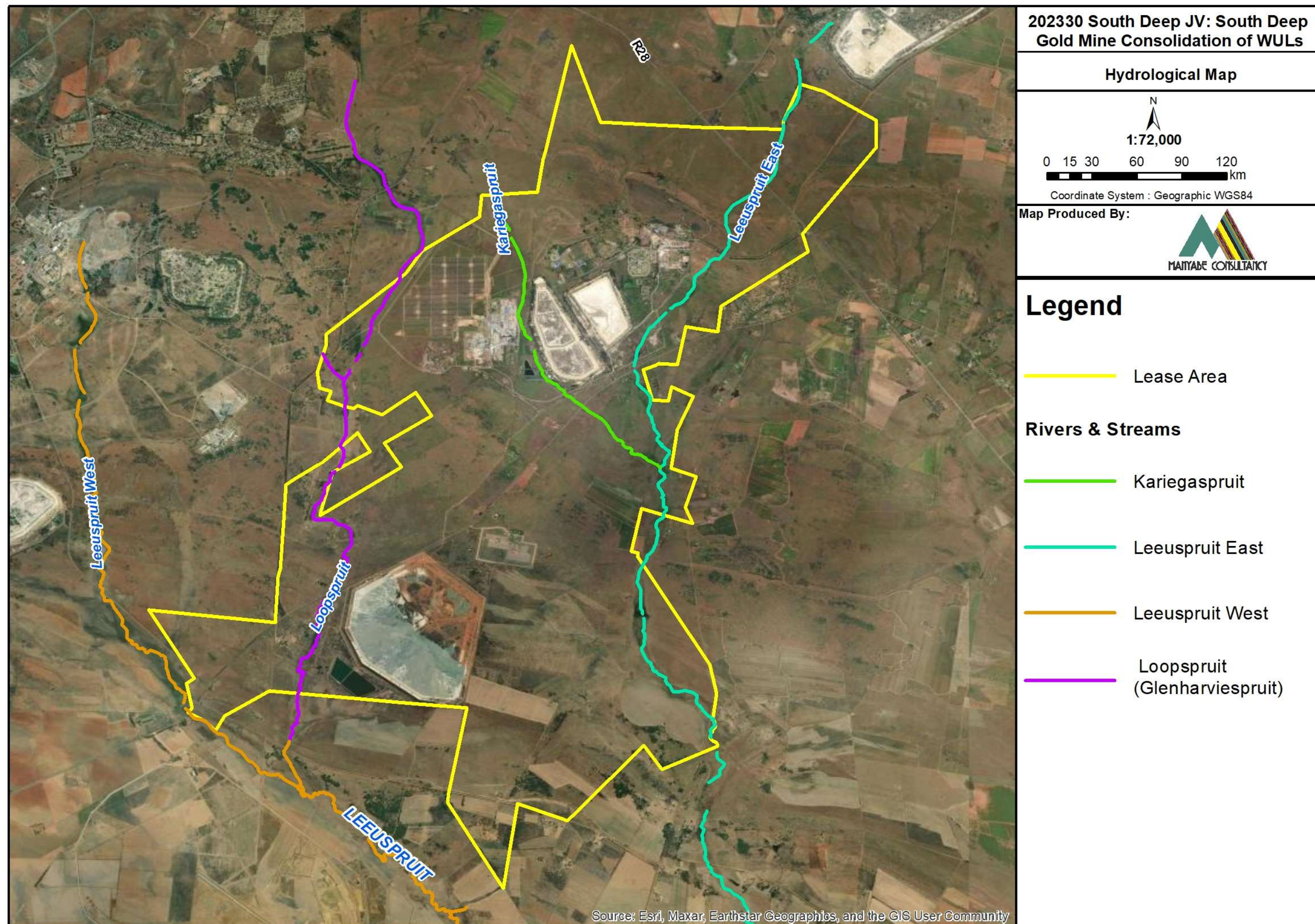


Figure 30: Hydrological Map

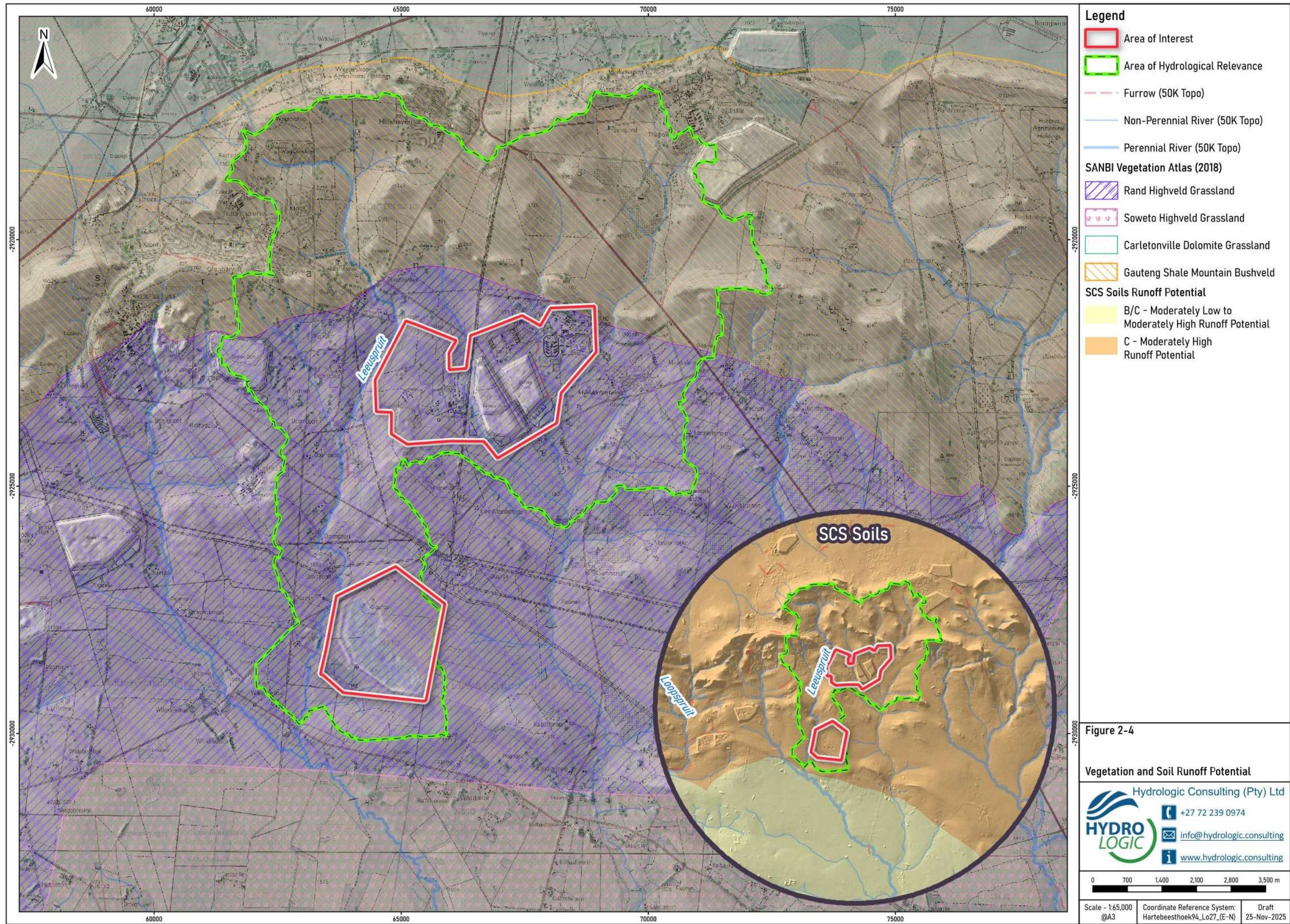


Figure 31: Vegetation and Soil Runoff Potential

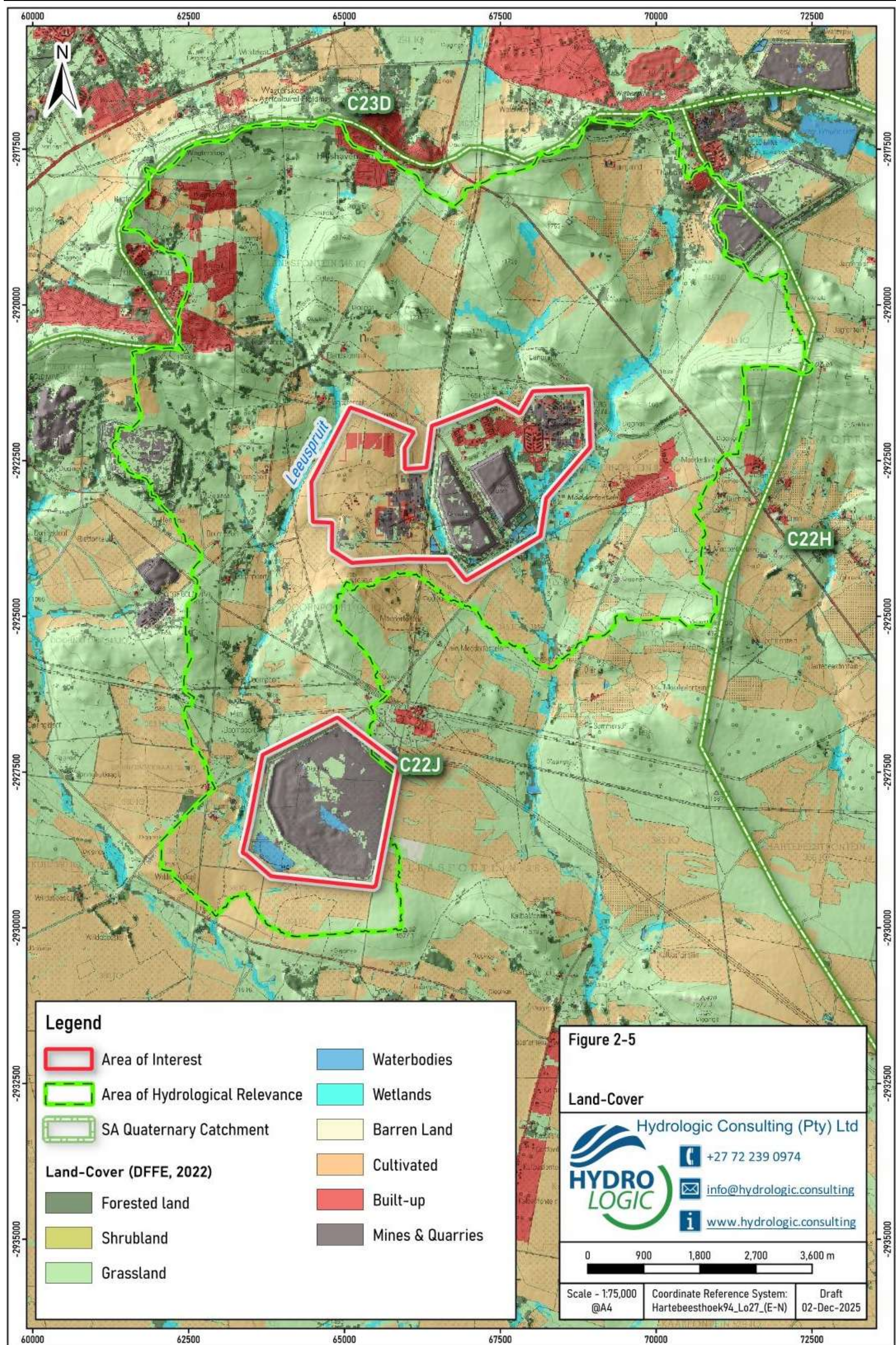


Figure 32: Land Cover

5-11 GROUND WATER

5-11.1 Aquifer Characterisation

5-11.1.1 *Aquifer Vulnerability*

Aquifer vulnerability assessment indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Stated in another way, it is a measure of the degree of insulation that the natural and manmade factors provide to keep contamination away from groundwater.

- Vulnerability is high if natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Vulnerability is low if natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.

The DRASTIC method, proposed by Aller et al., 1985, is regarded as one of the best indices for groundwater vulnerability estimation. The DRASTIC index is obtained using the following equation:

$$\text{DRASTIC index} = D_R D_W + R_R R_W + A_R A_W + S_R S_W + T_R T_W + I_R I_W + C_R C_W$$

The following definitions are provided for the factors influencing groundwater vulnerability:

- Depth to groundwater: Indicates the distance and time required for pollutants to move through the unsaturated zone to the aquifer.
- Recharge: The primary source of groundwater is precipitation, which aids the movement of a pollutant to the aquifer.
- Aquifer media: The rock matrices and fractures which serve as water bearing units.
- Soil media: The soil media (consisting of the upper portion of the vadose zone) affects the rate at which the pollutants migrate to groundwater.
- Topography: Indicates whether pollutants will run off or remain on the surface allowing for infiltration to groundwater to occur.
- Impact of the vadose zone: The part of the geological profile beneath the earth's surface and above the first principal water-bearing aquifer. The vadose zone can retard the progress of the contaminants.
- Hydraulic Conductivity: The permeability of the main aquifer unit.

Based on the following assumptions (assuming a worst-case scenario):

- Depth to groundwater was calculated from the aquifer tests and is 3.32 mbgl.
- Groundwater recharge is estimated to be around 3 % of MAP, which would equate to 20 mm/a.
- The aquifer media is classified quartzites and shale, with some andesite.
- Soil media is classified as sand, clay and silt.
- A gradient of 1 % was calculated for the underlying site.
- The vadose zone is classified as sand, clay and silt.
- Transmissivity of host geology is between 4 and 9 m²/day.
- Dykes 0.1 m²/day.
- Contact zones: 30 m²/day.

Table 27: Aquifer Vulnerability Rating

Vulnerability	Rating
Highly vulnerable > 137	Natural factors provide little protection to shield groundwater from contaminating activities at the land surface.

Vulnerability	Rating
Medium Vulnerability 93 to 136	Natural factors provide some protection to shield groundwater from contaminating activities at the land surface. However, based on the contaminant toxicity, mitigation measures will be required to prevent any surface contamination from reaching the groundwater table.
Low Vulnerability < 92	Natural factors provide relatively good protection and there is little likelihood that contaminating activities will result in ground water degradation.

The application of the DRASTIC method resulted in a vulnerability rating of 71, classifying the aquifer as having a low vulnerability.

5-11.1.2 *Aquifer Classification*

The aquifer(s) underlying the subject area were classified in accordance with A South African Aquifer System Management Classification (Parsons, 1995).

The aquifers are classified according to the following definitions:

- **Sole Aquifer System:** An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there are no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- **Major Aquifer System:** Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good [Electrical Conductivity (EC) of less than 150 mS/m].
- **Minor Aquifer System:** These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- **Non-Aquifer System:** These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on locality and geology, it can be concluded that the aquifer system in the study area can be classified as a “minor aquifer system”.

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management (GQM) Index, a points scoring system as presented in Table 28 and Table 29 was used.

Table 28: Ratings – Aquifer System Management and Second Variable Classifications

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 29: Ratings - Groundwater Quality Management Classification System

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	
Major Aquifer System:	4	
Minor Aquifer System:	2	2
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Aquifer Vulnerability Classification		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

As part of the aquifer classification, a GQM Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 30.

The level of groundwater protection based on the GQM Classification:

$$\begin{aligned}\text{GQM Index} &= \text{Aquifer System Management} \times \text{Aquifer Vulnerability} \\ &= 2 \times 2 = 4\end{aligned}$$

Table 30: GQM Index for the Study Area

GQM Index	Level of Protection	Study Area
<1	Limited	
1 – 3	Low Level	
3 – 6	Medium Level	4
6 – 10	High Level	
>10	Strictly non-degradation	

There exists a moderate likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. In terms of the GQM Index, the aquifer has medium vulnerability, and protection level is **medium**.

5-11.2 Water Quality Analysis

Twenty-four (24) water quality samples were collected from the boreholes during the eight-hour tests and sent to Environmental Pollution Laboratory (EPL) which is a South African National Accreditation System National (SANAS) accredited Laboratory.

The groundwater chemistry is compared to the SANS 241 (2015) specifications for drinking water. Concentrations that exceed the SANS 241 guideline limits are highlighted in red. The borehole water quality is also compared to the South African Water Quality (SAWAQ) Guidelines Volume 4: Agricultural Use: Irrigation and Volume 5: Agricultural Use: Livestock Watering (DWA, 1996). The following observations are made in terms of the hydrochemistry:

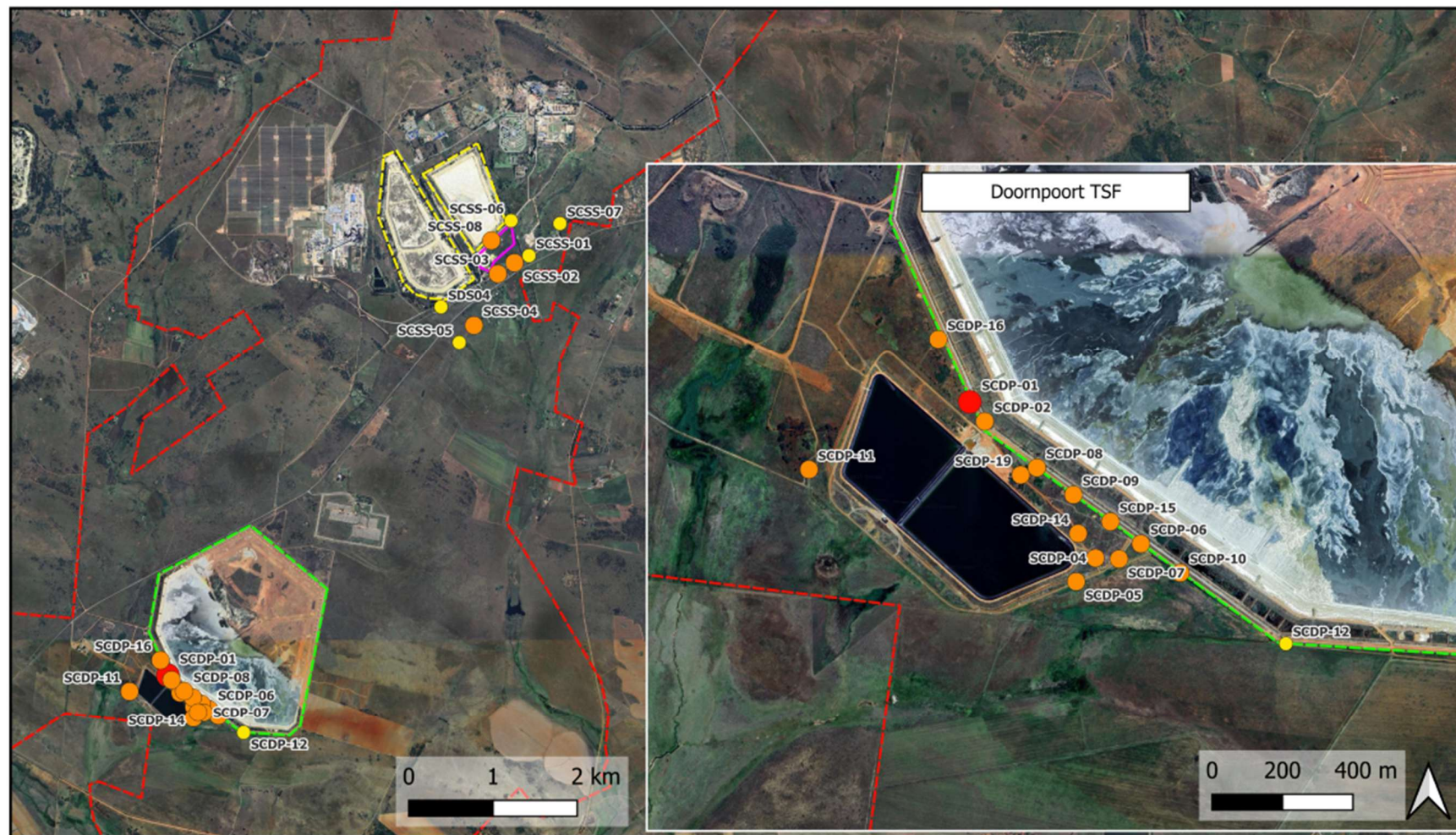
- The pH values from the groundwater samples for the scavenger boreholes are circum-neutral, with a range of 6.4 and 7.5.
- The groundwater is moderately saline, with all samples measuring EC values above the DWS Irrigation limit (< 40 mS/m) and 21 of the 24 samples exceeding the SANS 241 limit of 170 mS/m. The main contributing ions to the salinity are bicarbonate alkalinity, magnesium, sodium and to some extent chloride.
- The most notable consistent exceedances and element of concern is Sulphate (SO₄). Factors contributing to the elevated Sulphate (SO₄) in groundwater are mainly mining activities with runoff and

seepage from the TSFs. The groundwater from all boreholes is therefore not fit for human consumption.

- Boreholes which recorded both elevated sulphate and manganese concentrations are SCSS-01, SCSS-02, SCSS-03, SCSS-06, SCSS-07 and SCSS-08.

Table 31: Hydrochemistry Results for boreholes tested at Gold Fields

Sample ID	Unit	SANS 241	DWS Irrigation 1996	DWS Livestock	Gold Fields																							
					SCDP -01	SCDP -02	SCDP -07	SCDP -05	SCSS -04	SCSS -03	SCSS -07	SCDP -12	SCDP -06	SCDP -10	SCDP -19	SCSS -02	SCSS -01	SCDP -11	SCDP -16	SCSS -05	SCSS -06	SCDP -14	SCDP -04	SDS0 4	SCSS -08	SCDP -15	SCDP -09	SCDP -08
pH	pH	<5 & >9.7	<6.5 & >8.4	NG	7.28	7.14	7.21	7.3	7.27	7.1	6.9	6.89	6.8	7.15	7.41	7.12	6.86	7.32	7.04	7.53	7.35	7.22	7.07	7.57	6.47	7.42	7.35	7.27
EC	mS/m	170	40	NG	375	369	315	281	230.1	292.4	144.8	221.4	318	284.3	359	325	132.3	234.3	374	212.9	117.9	272.5	266.1	200.4	233.6	288.2	318.2	340.2
TDS	mg/l	1200	NG	<1000	3868	4004	3080	2622	2873	2851	1282	1904	3146	2550	3380	2919	1005	2085	3617	1803	954	2537	2497	1620	2104	2650	3002	3318
Total Alkalinity	CaCO ₃	NG	NG	NG	98.1	115	93.2	116.4	137	135.7	99.56	106.7	74.26	153.8	126	164.9	103.4	72.87	89.67	164.7	111.5	129.9	60	134.1	63.33	115.2	137.7	133.5
P-Alk	CaCO ₃	NG	NG	NG	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.06	<0.6	<0.6	<0.6	<0.6	
Chloride	mg/l Cl	300	100	<1500	270.3	250.6	270.1	236.4	162.8	154.2	69.24	215.9	282.7	256.3	228.5	178.9	72.76	163	275.1	117.6	64.1	235.4	305.2	151.8	131.1	236.9	234.6	240.4
Sulphate	mg/l SO ₄	500	NG	<1000	2186	1983	1670	1450	1172	1628	686.1	922.6	1703	1409	1771	1675	516.4	1175	1903	902.7	501.3	1364	1312	839.9	1122	1539	1749	1924
Fluoride	mg/l F	<1.5	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.07	<0.05	<0.05	0.07	0.07	<0.05	0.06	<0.05
Nitrate as N	mg/l N	11	5	100	<0.5	<0.5	<0.5	1.07	<0.5	<0.5	1.16	1.12	<0.5	1.11	<0.05	1.65	0.76	2.05	<0.5	<0.5	<0.5	<0.5	1.18	3.52	<0.5	<0.5	<0.5	<0.5
Calcium	mg/l Ca		NG	<1000	526.1	456.8	419.7	378.2	334.1	486.5	183.1	256	469.1	370	466.4	449.4	136.1	299.5	520.9	339.7	156.4	0	0	0	0	428.7	455.3	480
Magnesium m	mg/l Mg		NG	<500	307.1	263.8	216.6	185.7	179.1	123	87.89	161.1	226.7	203.9	255.9	123.5	67.31	159.8	256.2	103.1	69.52	176.5	171	66.73	138.2	202.9	239.8	272.2
Sodium	mg/l Na	<200	70	<2000	92.57	74.84	49.43	49.74	43.06	94.19	30.53	46.91	47.31	63.86	57.76	159.4	60.21	41.37	91.82	46.81	13.9	44.99	42.75	55.63	36.07	51.97	54.56	71.21
Potassium m	mg/l K		NG	NG	5.03	5.25	5.78	4.83	4.78	2.83	1.17	5.88	5.74	5.12	5.12	4.56	2.28	3.29	4.05	1.33	0.54	3.91	4.09	1.49	2.06	4.73	5.18	5.55
Al	mg/l Al	0.3	5	<5	0.32	0.11	0.15	0.12	0.13	0.25	0.19	0.11	<0.05	<0.05	0.09	0.09	0.06	0.07	0.18	0.15	0.09	0.09	0.14	<0.05	0.13	0.08	0.11	0.14
Arsenic	mg/l As	≤0.01			<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01
Iron	mg/l Fe	2	5	<10	0.23	0.15	0.23	0.06	0.1	0.09	1.59	0.66	0.11	<0.05	0.21	0.11	0.06	0.09	1.07	0.1	0.72	0.08	<0.05	0.07	0.12	0.38	0.67	0.48
Manganese se	mg/l Mn	0.4	0.02	<10	<0.05	<0.05	<0.05	<0.05	<0.05	6.37	1.05	0.37	<0.05	<0.05	<0.05	4.82	0.45	0.14	<0.05	<0.05	0.78	<0.05	<0.05	<0.05	2.74	<0.05	<0.05	<0.05
Copper	mg/l Cu	2	0.2	<0.5	0.11	<0.01	<0.01	0.05	0.08	0.07	0.08	0.06	0.04	0.03	0.09	0.04	0.05	0.05	0.04	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.02
Free CN	mg/l CN				<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.002	0.017	0.088	<0.002	<0.02	<0.02	<0.002	0.074	0.099	0.125	0	0.004	<0.002	0.002
Total CN	mg/l CN	≤1.5			<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Ammonium m	mg/l NH ₄	NG	5	NG	0.68	0.47	0.35	0.97	1.06	0.31	0.06	0.09	0.37	0.47	0.12	2.12	0.26	0.21	0.76	0.26	0.11	0.08	0.08	0.12	0.44	0.7	0.1	0.36
Zinc	mg/l Zn	5	1	20	1.05	<0.05	<0.05	<0.05	<0.05	0.08	0.05	0.05	<0.05	<0.05	<0.05	0.12	0.26	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	0.05	0.54	<0.05	0.06	<0.05



Legend

SO₄ Spatial Distribution (mg/L)

• <500

• 500 - 1000

• 1000 - 2000

• >2000

South Deep Mine Boundary

Doornpoort TSF

Old TSF Complex

New RWD

Client: Gold Fields South Deep

Project name: Gold Fields Data
Consolidation for WUL (SO₄ Spatial
Distribution Map)

Projection: Geographic, WGS1984

Date: 2025-11-20



Figure 33: Map indicating the sulphate (SO₄) distribution.

5-11.3 Groundwater Reserve Determination

A Groundwater Reserve Determination (GRD) aims to establish a groundwater reserve (GW) to help quantify the likely impacts of the proposed groundwater abstraction. It is important to quantify groundwater volume and the potential impact of rainfall and abstraction on this volume. A groundwater balance helps determine the safe abstraction rate for the boreholes in use. The GRD was assessed using Aquiworx, which is a surface and groundwater monitoring application that features a GIS front end, and utilises Microsoft Excel as a database.

The data used for the GRD calculation was derived from the field investigation, and the South African Groundwater Resource Assessment Ver. 2 (GRAII) datasets, and the National Integrated Water Information System (NIWIS) (DWS, 2025).

5-11.3.1 Catchment Area Delineation

The site falls within quaternary catchment C22J, covering an area of 670 km² (DWAF, 2011).

5-11.3.2 Calculation of Reserve

Effective groundwater recharge is the portion of rainfall that replenishes the aquifer, while the rest flows as surface water, evaporates, or is stored in the soil. Geology, soil properties, surface runoff, and stream characteristics all influence recharge rates. The estimated recharge for the area is detailed in Table 32.

Table 32: Estimated Recharge Calculation Summary

Description	Unit	C22J
Annual Total Rainfall	mm	697
Recharge	(mm/a)	46.01
Delineated Catchment Area	(km ²)	670.00
Delineated Project Area	(km ²)	74.4
Annual Recharge Volume	(m ³ /a)	30 821 005
Project Area Annual Recharge Volume	(m ³ /a)	3 422 512

5-11.3.3 Total Abstraction

Based on the findings of the sustainable yield assessment, and the proposed sustainable yields for the water supply boreholes, a summary of current use in the catchment and total proposed abstraction, based on the maximum sustainable yield is summarised in Table 33.

Table 33: Groundwater Abstraction Summary

Groundwater Requirement	
Use	C22J m ³ /a
Proposed Abstraction	3 686 544
Water Authorisation and Registration Management System (WARMS) Abstraction	2 379 256

5-11.3.4 Delineated Catchment Area Water Balance Calculation

The catchment area water balance is based on the information obtained from the NIWIS and Aquiworx and is summarised in Table 34 below.

Table 34: Water Balance Summary

Description	Quaternary C22J	Unit
Recharge through Precipitation	30 821 005	(m ³ /a)
Proposed Abstraction	3 686 544	(m ³ /a)
Abstracted (WARMS)	2 379 256	(m ³ /a)
Surplus Amount	24 755 205	(m³/a)

Table 35 provides with the project water balance summary. For the project area, the abstraction amount exceeds the recharge through precipitation amount. With reference to the catchment, the abstraction is within recharge limits.

Table 35: Project Area Water Balance Summary

Description	Project area	Unit
Recharge through Precipitation	3 422 512	(m ³ /a)
Proposed Abstraction	3 686 544	(m ³ /a)
Surplus Amount	-264 032	(m ³ /a)

5-11.3.5 Scale of Abstraction

The DWS categorises groundwater abstraction licence applications based on the amount of recharge that is used by the applicant in relation to the specified property. The category of abstraction is calculated as follows:

$$\begin{aligned} \text{AREA}_{\text{PROP}} * \text{RE} &= \text{RE}_{\text{AREA}} \text{ (m}^3\text{/a)} \\ \text{ABS}_{\text{EX}} + \text{ABS}_{\text{NEW}} &= \text{ABS}_{\text{TOTAL}} \text{ (m}^3\text{/a)} \\ \text{ABS}_{\text{SCALE}} &= (\text{ABS}_{\text{TOTAL}} / \text{RE}_{\text{AREA}}) * 100 \end{aligned}$$

Where:

- Size of property (Area PROP)
- Recharge to Property (RE)
- Existing Use Volume (ABSEX)
- New Use Volume (ABSNEW)
- Scale of Abstraction (ABSSCALE)

Categories A, B, and C each have specific information requirements that applicants must provide to the DWS. The category of abstraction is summarised in Table 36.

Table 36: Categories of Abstraction

Category	Description
A	Small-scale abstractions (<60% Recharge)
B	Medium-scale abstractions (60 - 100% Recharge)
C	Large-scale abstractions (>100% Recharge)

The proposed groundwater abstraction is 3 686 544 m³/a (10 100 m³/day) falls under the DWS classification of " Medium-scale abstractions (60 - 100% Recharge)".

5-11.3.6 Conceptual Site Model

Three distinct aquifers are present in the study area, comprising:

- an upper, shallow weathered-material aquifer,
- an intermediate competent and fractured-rock aquifer extending to depths of approximately 60–100 m below surface, and
- a deep, confined aquifer.

Groundwater levels show a clear hydraulic separation between the shallow weathered aquifer and the underlying fractured-rock system. Water levels in the weathered zone range from surface to approximately 12 mbgl, whereas the fractured-rock aquifer exhibits deeper water levels of 15–35 mbgl. Regional groundwater flow broadly mimics topography, and there is no evidence of mine dewatering affecting the natural flow regime. Instead, regional flow is primarily controlled by two impermeable Gemsbokfontein dykes that transect the area. Enhanced transmissivity along the dyke–host rock contact zones form preferential groundwater flow pathways.

Several surface infrastructure components act as potential sources of contamination to the underlying aquifer systems. Contaminants are expected to migrate along the prevailing groundwater gradients, moving from topographically elevated areas toward lower-lying discharge zones. Structural geological features, particularly the Gemsbokfontein dykes underlying both the old TSFs complex and the Doornpoort TSF, are likely to influence plume geometry by constraining or redirecting flow pathways.

Geochemical characterisation of leachates from operational and post-closure phases indicates that tailings seepage is likely to exhibit Acid Rock Drainage (ARD) characteristics, with elevated TDS (2,000–4,000 mg/L) and sulphate (800–2,800 mg/L), accompanied by elevated metals including Mn (3–24 mg/L), Ni (2–14 mg/L), Al (0–38 mg/L) and As (1–2 mg/L) (Cruywagen & Usher, 2008; Metago, 2008; 2009; Mintek, 2008). These concentrations represent the upper-bound contaminant load likely to migrate into the shallow and fractured aquifer systems beneath the TSF complexes.

The site model is summarised in the Table 37 below. Scavenger is deemed to provide effective hydraulic containment by reversing and flattening local gradients, intercepting seepage directly beneath and adjacent to the TSF, and preventing plume migration into transmissive pathways. This breaks the Source–Pathway–Receptor model by removing the hydraulic connection between the contamination source and downstream receptors, thereby eliminating exposure and ensuring controlled management of contaminated groundwater.

Hydraulic containment through scavenger boreholes contributes directly to Water Conservation and Water Demand Management by preventing seepage losses, capturing and reusing groundwater within the mine's process water circuit, reducing external freshwater abstraction, and stabilising the operational water balance. This intervention therefore not only protects groundwater quality but also reduces overall water demand and enhances water-use efficiency across the facility.

Table 37: Summarised Conceptual Site Model (CSM)

Source	Primary Contaminants / Characteristics	Pathway	Receptor	Controls / Notes
Old TSFs complex	Acidic seepage with elevated TDS, SO ₄ and metals	Infiltration through TSF base and sidewalls → percolation through unsaturated weathered zone → advective–dispersive transport in shallow weathered aquifer → downward leakage into fractured-rock aquifer	Shallow weathered aquifer; fractured-rock aquifer; down-gradient boreholes; discharge areas in lower-lying terrain and surface water features	Seepage migration follows groundwater gradients; plume geometry influenced by Gembokfontein dykes and contact zones
Doornpoort TSF	Acidic seepage with elevated TDS, SO ₄ and metals	Infiltration through TSF footprint → unsaturated weathered zone → shallow groundwater → preferential flow along fracture zones and dyke–host contacts	Shallow and fractured aquifers beneath and down-gradient of Doornpoort TSF; down-gradient abstraction/monitoring boreholes; possible baseflow to streams/wetlands	Structural controls (dykes) may impound or channel plume; contact zones provide high transmissivity pathways

5-12 AQUATIC BIOMONITORING AND TOXICITY TESTING

The primary objective of the Aquatic Biomonitoring Assessment is to gather results from the potentially at-risk aquatic systems in the vicinity of the South Deep Gold Mine to ascertain whether the production and associated activities have had an impact on the PES of the downstream systems.

The quantitative data gathered by implementing best-practice and legislated methodologies and techniques are compared to the baseline condition of the various assessed biomonitoring sites to determine long-term PES (integrity) trends of the aquatic ecosystems. Based on the identified trends and the impacts recorded (if any), mitigation and/or rehabilitation measures are recommended and must be implemented to maintain the Recommended Management Objectives (RMOs) that have been set for each system by the DWS River Health Programme (RHP) (now the River Eco-status Monitoring Programme). The results are compared to results that are obtained during previous wet season assessments to ensure that the trends maintain relevance.

The study encompasses desktop information analysis relevant to the study area, in situ water quality and toxicity analysis, and assessments including the Index of Habitat Integrity (IHI), Integrated Habitat Assessment (IHAS), South African Scoring System Version 5 (SASS5), and Fish Response Assessment Index (FRAI).

As per the assessment conducted in January 2026 (Envass, 2026), the findings indicate that the aquatic systems near the South Deep Gold Mine have been moderately disturbed and degraded due to current and historical land use within the Quaternary catchment area, compared to reference sites from the River Eco-status Monitoring Programme.

The biomonitoring points are shown in Table 38 and Figure 34.

Table 38: Biomonitoring Testing Points

Sample point	Description	Coordinates
Leeu East 0	The uppermost biomonitoring site on the Leeuspruit Stream, situated just downstream of where the stream exits the confined upstream escarpment into the valley bottom, and immediately upstream of a road crossing.	26° 24' 17.61" S 27° 41' 40.32" E
Leeu East 1	This site was previously located on an unnamed tributary below the South Deep Gold Mine at 26°24'33.14" S, 27°41'19.67" E. Although water was present, there was no flow. Therefore, the SASS5 protocol could not be applied.	26° 24' 36.90" S 27° 41' 23.47" E
Leeu East 2	Located downstream of a section of the Leeuspruit Stream that had been channelised to reroute flow through and around the South Deep Gold Mine site, a weir was observed upstream of the site. A dense reedbed was noted immediately upstream and downstream of the weir.	26° 25' 16.10" S 27° 40' 58.76" E
Leeu East 3	The assessed reach is located on a plateau where the Leeuspruit Stream meanders down a gentle gradient, passing through several sections of infill composed of rubble.	26° 25' 48.66" S 27° 41' 1.56" E
Leeu East 4	This site is located between two informal gravel road crossings which have resulted in impoundment and ponding of water with very little through flow of water.	26° 26' 23.70" S 27° 41' 4.71" E
Leeu East 5	The most downstream site on the Leeuspruit East Stream is located where a provincial road crosses the stream.	26° 28' 23.90" S 27° 41' 31.74" E
Kariega 1	Downstream of a weir structure in a section of the Kariega Stream that exhibits a gradual gradient, between two impeding features that were approximately 274 m apart.	26° 25' 37.58" S 27° 40' 20.87" E
Kariega 2	This site is located at an informal gravel road crossing which comprises of two piped culverts.	26° 25' 45.92" S 27° 40' 32.51" E
S- Deep Loop 1	The most upstream site on the Loopspruit Stream, downstream of a tar road crossing.	26° 23' 50.20" S 27° 38' 44.65" E
S- Deep Loop 2	Downstream of an old dam wall that had been breached and not rehabilitated, the exposed soil from the dam wall was historically recorded	26° 25' 24.38" S 27° 38' 24.36" E

Sample point	Description	Coordinates
	as slumping into the channel. Although the historic sedimentation has undergone natural revegetation, it has slightly confined the stream channel.	
S- Deep Loop 3	An informal gravel road crossing bisected this site which made provision for through flow via a box culvert.	26° 26' 57.83" S 27° 38' 21.35" E
S- Deep Loop 4	Upstream of a bridge structure associated with a large gravel road.	26° 28' 38.67" S 27° 37' 51.05" E
Leeu West 3	This site is intersected by a gravel roadway with an associated culvert structure.	26° 28' 51.48" S 27° 37' 38.92" E
Leeu West 4	This site is intersected by a gravel roadway with an associated culvert structure.	26° 29' 3.49" S 27° 38' 13.67" E

In situ water quality analysis indicated that water EC levels exceeded the acceptable Target Water Quality Range (TWQR) at several sites, as well as the WUL limit at biomonitoring site Leeu East 3, posing a risk to aquatic biodiversity and abundance. Dissolved Oxygen (DO) levels were below acceptable ranges at all biomonitoring sites, presenting a major limiting factor to aquatic biota.

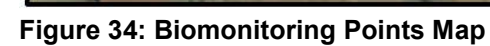
Water toxicity analysis indicated that sites Leeu East 2, Leeu West 3, Leeu West 4, SC54, SC45, and the RWD presented no lethal/sub-lethal (Class I Hazard) effects. Only Sample Leeu East 4 presented a slight lethal/sub-lethal environmental toxicity hazard (Hazard Class II) based on the 30% micro-algae (*S. capricornutum*) growth inhibition effect (sub-lethal) and the 15% macro-invertebrate (*D. magna*) mortalities observed following testing. The Leeu East 4 biomonitoring site is located within the boundary of the South Deep Gold Mine and therefore warrants further investigation to determine the potential source of the presented Class II Hazard.

The IHI results indicated that the Leeu East, Kariega, Loop, and Leeu West reaches had Largely Modified (category D) instream and riparian habitat integrity, reflecting a large loss of natural habitat and ecosystem functions. These alterations were mainly due to flow modifications and channel changes from dams and crossings, as well as shifts in water quality from land use changes, including mining and agriculture, and the encroachment of AIPs.

The IHAS analyses indicated that the aquatic habitat at all sampled sites, except Loop 2 and Leeu West 4, was inadequate to support diverse macroinvertebrate communities. Limited marginal vegetation and biotope diversity resulted in restricted habitat availability. The SASS5 assessment revealed a Seriously Modified (E/F) ecological status for all sampled sites, attributed to inadequate habitat and modified water quality. Average Score Per Taxon (ASPT) scores indicated dominance by pollution-tolerant taxa, reflecting the altered water quality.

The overtopping event, which occurred between 24 December 2025 and 05 January 2026, before the wet season survey, potentially experienced the mitigating effects of the adjacent wetland and the dilution provided by the cumulative rainfall of 104.8 mm over the course of twenty (20) days, which together would have reduced the impact of any constituents mobilised during the event.

This conclusion is supported by the in-situ water quality results and toxicity testing. Water quality results of Loop 4 indicated that both pH and EC remained within the TWQR and WUL limits. At Leeu West 3 and Leeu West 4, pH also complied with both limits, while EC exceeded the TWQR limit but remained within the WUL limit, indicating minor salinity input likely associated with rainwater runoff. Toxicity testing results indicated no lethal/sub-lethal effects (Class I Hazard). Toxicity results observed at the biomonitoring sites Leeu West 3, Leeu West 4, the RWD and associated boreholes SC54 and SC54.



5-13 SOCIO-ECONOMIC ENVIRONMENT

The mining sector is a big contributor to the economy of South Africa as well as the region. The area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities. The proposed project to be implemented has many positive benefits. The benefits and positive impacts have a countrywide reach. The impacts of the positive benefits of the projects have long-term implications starting from the lowest unit, which is the individual, graduating to households and/or family unit, to the local level up to the country level.

The study area falls within Ward 30 of the RWCLM, WRDM, Gauteng Province.

RAND WEST CITY LOCAL MUNICIPALITY

According to the latest population census [Statistics South Africa (Stats SA), 2022], the total population for the RWCLM is 334,773. As can be seen from Table 39 below, as recorded during the 2022 South African Census, the majority of the population is male by 50.40%.

Table 39: Population by sex

Population by sex	Value	Percentage
Female	166,048	49.60%
Male	168,729	50.40%

Source: Statistics South Africa, 2022

Table 40 below indicates that the majority of RWCLM population is aged between 20 and 29 (19.64%). The 120+ years of age population is relatively small.

Table 40: Population by age band

Population by age band	Value	Percentage
0-9	55,203	16.49%
10-19	50,540	15.10%
20-29	65,747	19.64%
30-39	63,767	19.05%
40-49	43,833	13.09%
50-59	28,605	8.54%
60-69	17,712	5.29%
70-79	6,945	2.07%
80-89	2,089	0.62%
90-99	299	0.09%
100-109	26	0.01%
110-119	2	0.00%
120+	3	0.00%
Unspecified	6	0.00%

Source: Statistics South Africa, 2022

Table 41 below, as recorded during the 2022 South African Census, indicates that the majority (84.37%) of RWCLM population is Black Africans. This number is followed by 8.47% of white persons.

Table 41: Population group

Population by group	Value	Percentage
Black African	282,458	84.37%
Coloured	21,647	6.47%
Indian or Asian	1,285	0.38%
White	28,370	8.47%
Other	836	0.25%
Unspecified	181	0.05%

Source: Statistics South Africa, 2022

Table 42 shows that the majority of persons within RWCLM speaks Setswana (31.55%) as their home language, followed by 13.69% of persons who speaks Afrikaans as their home language.

Table 42: Population by language most spoken at home

Language	Value	Percentage
Afrikaans	44,718	13.69%
Chichewa/Chewa/Nyanja/Chinyanja	1,196	0.37%
English	7,996	2.45%
Isindebele	1,011	0.31%
IsiXhosa	53,668	16.43%
IsiZulu	29,109	8.91%
Khoi,Nama and San languages	48	0.01%
Portuguese	1,315	0.40%
Sepedi	11,386	3.49%
Sesotho	42,609	13.05%
Setswana	103,039	31.55%
Shona	2,452	0.75%
Sign language	89	0.03%
Siswati	2,954	0.90%
Tshivenda	3,208	0.98%
Xitsonga	18,666	5.72%
Other	1,621	0.50%
Unspecified	1,472	0.45%

Source: Statistics South Africa, 2022

Table 43 below, as recorded during the 2022 South African Census, indicates that the majority (30.13%) of RWCLM population by highest education level holds Grade 12/ Standard 10/ Form 5/ Matric/ NCV Level 4/ Occupational Certificate NQF Level 4.

Table 43: Population by highest education level

Level of education	Value	Percentage
Grade R/0	6,167	2.04%
Grade 1/ Sub A/ Class 1	5,486	1.82%
Grade 2/ Sub B/ Class 2	6,021	2.00%
Grade 3/ Standard 1/ ABET/ AET 1	6,568	2.18%
Grade 4/ Standard 2	8,011	2.65%
Grade 5/ Standard 3/ ABET/ AET	8,824	2.92%
Grade 6/ Standard 4	10,121	3.35%
Grade 7/ Standard 5/ ABET/ AET	13,907	4.61%
Grade 8/ Standard 6/ Form 1	15,901	5.27%
Grade 9/ Standard 7/ Form 2/ ABET/ AET 4/ Occupational Certificate NQF Level 2	18,743	6.21%
Grade 10/ Standard 8/ Form 3/ NCV Level 2/ Occupational Certificate NQF Level 2	29,484	9.77%
Grade 11/ Standard 9/ Form 4/ NCV Level 3/ Occupational Certificate NQF Level 3	30,336	10.05%
Grade 12/ Standard 10/ Form 5/ Matric/ NCV Level 4/ Occupational Certificate NQF Level 4	90,920	30.13%
NTC I/N1	288	0.10%
NTC II/N2	522	0.17%
NTC III/N3	884	0.29%
N4/NTC 4/ Occupational Certificate NQF Level 5	1,150	0.38%
N5/NTC 5/ Occupational Certificate NQF Level 5	888	0.29%
N6/NTC 6/ Occupational Certificate NQF Level 5	1,956	0.65%
Certificate with less than Grade 12/ Standard 10	394	0.13%
DipLoMa with less than Grade 12/ Standard 10	977	0.32%
Higher/ National/ Advanced Certificate with Grade 12/ Std10/ Occupational Certificate NQF Level 5	1,566	0.52%
DipLoMa with Grade 12/ Standard 10/ Occupational Certificate NQF Level 6	7,450	2.47%
Higher DipLoMa/ Occupational Certificate NQF Level 7	2,522	0.84%
Bachelors Degree/ Occupational Certificate NQF Level 8	5,270	1.75%
Honours Degree/ Postgraduate DipLoMa/ Occupational Certificate NQF Level 8	1,735	0.57%
Masters/ Professional Masters at NQF Level 9	507	0.17%

Level of education	Value	Percentage
PHD (Doctoral Degrees)/ Professional Doctoral Degree at NQF Level 10	206	0.07%
Other	1,738	0.58%
Do not know	10,307	3.42%
No schooling	11,218	3.72%
Unspecified	1,733	0.57%

Source: Statistics South Africa, 2022

Table 44 below indicates, as recorded during the 2022 South African Census, there is a total of 72.7% main dwelling type in the RWCLM that are classified as formal dwelling/house or brick/concrete block structure on a separate stand or yard or on farm.

Table 44: Population by main dwelling type

Population by main dwelling type	Value	Percentage
Formal dwelling/house or brick/concrete block structure on a separate stand or yard or on farm	216,763	72.7%
Traditional dwelling/hut/structure made of traditional materials	1,092	0.4%
Flat or apartment in a block of flats/flat or apartment in a block of flats in a complex	12,560	4.2%
Cluster house in complex	545	0.2%
Town house (semi-detached house in complex)	684	0.2%
Semi-detached house	7,599	2.5%
Formal dwelling/house/flat/room in backyard/servants' quarters/granny flat/cottage	21,351	7.2%
Informal dwelling/shack in back yard	16,245	5.4%
Informal dwelling/shack not in backyard, e.g. in an informal/squatter settlement or on farm	21,047	7.1%
Caravan/tent	30	0.0%
Other	413	0.1%

Source: Statistics South Africa, 2022

From Table 45 below, the source of water in the RWCLM, shows that a large percentage (94.6%) of the population are getting water from a regional/local water scheme (operated by municipality/other service provider) as recorded during the 2022 South African Census.

Table 45: Population by Source of water

Source of water	Value	Percentage
Borehole	10,415	3.5%
Dam/pool/stagnant water	63	0.0%
Flowing water/river/stream	79	0.0%
Rain-water tank	249	0.1%
Regional/local water scheme (operated by municipality/other service provider)	282,122	94.6%
Spring	653	0.2%
Water tanker	2,866	1.0%
Water vendor	250	0.1%
Other	1,640	0.5%

Source: Statistics South Africa, 2022

In terms of access to toilet facilities, as recorded during the 2022 South African Census, 83.2% of the population has access to flush toilet connected to a public sewerage system, as shown in Table 46 below.

Table 46: Population by type of toilet facilities

Toilet facilities	Value	Percentage
Bucket toilet (collected by municipality)	5,661	1.9%
Bucket toilet (emptied by household)	866	0.3%
Chemical toilet	4,091	1.4%
Ecological toilet (e.g. urine diversion, enviroloo, etc)	437	0.1%
Flush toilet connected to a public sewerage system	248,151	83.2%
Flush toilet connected to a septic tank or conservancy tank	14,306	4.8%
Pit latrine/toilet with ventilation pipe (VIP)	8,666	2.9%

Pit latrine/toilet without ventilation pipe	12,950	4.3%
Other	657	0.2%
None	2,543	0.9%

Source: Statistics South Africa, 2022

Another variable to consider when looking at service delivery indicators is access to refuse disposal. Within RWCLM, 81.7% of the population is getting refuse removal by local authority/private company/community members at least once a week (Table 47 below) as recorded during the 2022 South African Census.

Table 47: Population by Refuse (rubbish) service

Refuse (rubbish) service	Value	Percentage
Removed by local authority/private company/community members at least once a week	243,786	81.7%
Removed by local authority/private company/community members less often	5,799	1.9%
Communal refuse dump	9,426	3.2%
Communal container/central collection point	7,819	2.6%
Own refuse dump	22,149	7.4%
Dump or leave rubbish anywhere (no rubbish disposal)	8,793	2.9%
Other	557	0.2%

Source: Statistics South Africa, 2022

SECTION 6: ANALYSES AND CHARACTERISATION OF ACTIVITY

This section contains an analysis and/or characterisation of all the water uses and waste management aspects of the proposed WUL and its addendum amendments, and consolidation project.

6-1 SITE DELINEATION FOR CHARACTERISATION

All mining and related activities that take place at South Deep JV: South Deep Gold Mine occur within the mine boundary area (refer to Figure 1 and Figure 4). Figure 36 illustrates the clean and dirty water areas at South Deep Gold Mine.

The current operational mine water flow circuits and water infrastructure include the following components (Figure 35):

- Sewage Facilities;
- Underground Facilities;
- Mine Water Storage Facilities;
- Process and Potable Water;
- Make Up Water; and
- Clean and Dirty Water Management Facilities including several RWDs and PCDs.

The wastewater management infrastructure is managed in accordance with BPG H1 [Integrated Mine Water Management (2008)] principles. The wastewater management at South Deep Gold Mine is underpinned by the following principles:

- Clean water must be kept clean and be routed to a natural watercourse by a system separate from the dirty water system, while preventing, or minimising the risk of spillage of clean water into dirty water systems;
- Dirty water must be collected and contained in a system separate from the clean water system and the risk of spillage, or seepage into clean water systems must be minimised;
- The Stormwater Management Plan (SWMP) must be sustainable over the life cycle of the mine and over different hydrological cycles, and it must incorporate principles of risk management; and
- The statutory requirements of various regulatory agencies and the interests of stakeholders must be considered and incorporated (including the Regulation 704 of the NWA).

6-1.1 Sewage Facilities

There is currently one operational WWTW at the mine located at South Shaft. The WWTW currently does not produce sewage sludge. The treated effluent (1.4Ml/day) is reused in the system and is also used for irrigation. The mine recently upgraded its WWTW, pump stations and pipelines, as follows:

- A pump station has been established at Twin Shaft to pump sewage to the WWTW at South Shaft;
- A pipeline was established between the new pump station at Twin Shaft and an existing pump station in the South Shaft area; and
- The existing WWTW at South Shaft was upgraded.

An overview of the design and operation of the pump stations and South Shaft WWTW is provided in Table 48.

Table 48: Summary of the Wastewater Treatment Specifications

Aspect	Treatment facility	Pump stations
Design capacity	Average daily flow of 2 768 m ³ /day.	South Shaft: 2 x pumps (one operating, one on stand-by).
	Maximum daily flow of 8 304 m ³ /day.	

Aspect		Treatment facility	Pump stations
		People: 9 700 (at full operating capacity).	Twin shaft: 2 x pumps (one operating, one on stand-by).
Current use		Average daily flow of 1 357 m ³ /day. Maximum daily flow of 1 598 m ³ /day. People: 2 930.	South shaft: Same as plant. Twin shaft: pump station only.
Inputs	Raw sewage	Pumped from pump station in South Shaft area. Twin Shaft pump station.	South Shaft: sewage from the ablution facilities at mine housing, South Shaft complex and offices. Twin shaft: Gravity flow from ablution facilities at the shaft complex and Gold Plant.
	Chlorine	Chlorine dosing done using a gas chlorinator (dosing of 600g/hr). Storage and handling of chlorine on site complies with South African Bureau of Standards (SABS) 0298:1999 Code of Practice.	None.
Outputs	Treated effluent	A maximum of 1.4 Ml/day treated effluent discharged into the Leeuspruit.	None.
	Wastes (sludge)	Currently, the upgraded WWTW does not produce any dried sludge. It must be noted that the upgraded WWTW was originally designed to generate sludge, and hence the plant has existing drying beds. The disposal of dried sludge is one of the water uses that are currently being applied for should the need arise for such disposal.	None.
	Grit and screenings	Screenings consist of paper, plastic and rags. Approximately 1 black bag per week. These are incinerated at Kloof Gold Mine. Grit comprises small stones and sand.	None.
Treatment process	Type and design	Activated sludge plant with biological nutrient removal. The plant is divided into two identical modules operating in parallel, both in the UCT configuration. The UCT system is a biological nutrient removal activated sludge system. Plant comprises intake works, aerators, secondary clarifiers, drying beds, chlorine disinfection.	None.
Staff	Number and skills	Contractor (WWTW contractor): 1 classified operator and 2 general (shift) workers.	Same contractor: 1 classified operator.

6-1.2 Underground Facilities

The underground facilities comprise of the following water infrastructure:

- Settling ponds and mine water reservoirs located on most levels underground;
- Fissure water ponds (groundwater leaking into the underground mine workings); and
- Recycled underground dams for recycling of water between fissure and settling dams.

Settled water from the ponds is pumped to the mine water dams on surface (refer to Figure 35). Silt/mud from the maintenance of the facilities is pumped to surface and reprocessed through the Gold Plant. The mine water reservoirs are used to store cooled water from the Refrigeration Plant used for cooling air underground.

6-1.3 Mine Water Storage Facilities

Mine water storage facilities are located on surface in the South Shaft area. These facilities form part of the mine water circuit. Excess backwash water from cleaning of the Refrigeration Plant filters is stored in thickeners in the old Gold Plant area. From the thickeners, water is pumped into mine water dams which are operated in series. Settled water pumped from underground (temperature of 29°C) is also pumped into the mine water dams. Sludge from the maintenance of the mine water dams is pumped into evaporation dams from where the sludge is reprocessed at the Gold Plant.

Water from the mine water dams is either pumped into the Gold Plant or to a hot water dam, which forms part of the Refrigeration Plant circuit at South Shaft. Water from the hot water dam is then pumped to two pre-cooling towers where the water temperature is reduced from 29°C to 20°C. The water is then discharged into a cold-water dam which is the supply reservoir for the Refrigeration Plant. A condenser dam, located at the Refrigeration Plant, is used to store make-up water for the Refrigeration Plant. Make-up water is sourced from boreholes in the South Shaft area and is used to replace water lost through evaporation. The use of clean water reduces the need for de-silting and reduces the maintenance of the facilities. Should there be a problem with the boreholes, water from the Rand Water is then used as make-up water.

Chilled water (5°C) from the Refrigeration Plant is stored in three chilled water dams, which feed cooled water underground via a series of underground cascades.

6-1.4 Process and Potable Water

A summary of the South Deep JV: South Deep Gold Mine's potable and process water requirements are summarised in Table 49 below.

Table 49: South Deep JV: South Deep Gold Mine Process and Potable Water

Type of water	Source	Use
Potable Water	- Rand Water Board. - RO Plants (1,2 and 3).	- Domestic use. - Solution water in the Gold Plant. - Make-up water in South Shaft Refrigeration Plant when borehole water is unavailable.
Process Water	- Abstraction from on-site boreholes. - Fissure water. - RO Plants (1,2 and 3).	- Underground. - Dust suppression. - Gold Plant. - Backfill Plant. - Fire system. - Refrigeration Plant.

Potable water at the mine is received from Rand Water with water storage tanks linked to the Rand Water supply pipeline to the South Shaft area. The potable storage facilities are located north of South Shaft on the ridge within a fenced area, and include the following tanks:

- South Shaft 25m by 4m deep Potable Water Reservoir 1, with 2MI storage capacity;
- South Shaft 25m by 4m deep Potable Water Reservoir 2, with 2MI storage capacity; and
- South Shaft 35m by 3m deep Potable Water Reservoir, with 2.8 MI storage capacity.

The main process water sources for the mine are as follows:

- Fissure water;
- No. 4 Shaft (via a concrete culvert along the line of the Leeuspruit);

- Boreholes;
- Rainwater;
- Rand Water Board (industrial make-up water); and
- RO Plants Water.

Sources of dirty water include the following:

- Fissure water and return water, which present the greatest risk of spillage to the environment, and is used in the process stream before other water sources that present lower or no risk. It is not possible to use fissure water for domestic use.
- Rainwater falling on various 'dirty' areas is collected and used either directly for industrial applications or contributes to the process water used in the metallurgical plant.

6-1.5 Make Up Water

The WUL (DWS, 2021) allocation for borehole abstraction is 2 640 412 m³/a (7 234 m³/day). The proposed groundwater abstraction is 3 686 544 m³/a (10 100 m³/day) and falls under the DWS classification of Medium-scale abstractions (60 – 100% Recharge). Additional make-up water is also available from the Rand Water.

6-1.6 Clean and Dirty Water Management Facilities including several RWDs and PCDs

6-1.6.1 Polluted Water Holding Facilities

The mill circuit storage tank collects recycled water from the thickeners for use in the mill circuit, Knelson concentrator storage tank and gland service tank, which are all located within the Gold Plant (refer to Figure 35). The water is used in the gold recovery process. All water is recycled in the process.

The Gold Plant PCD located within the Gold Plant area is used to collect dirty water runoff from the Gold Plant area. Silt from the maintenance of the ponds is reprocessed through the Gold Plant. Water is recycled through the Gold Plant.

The Twin Shaft PCD collects dirty storm water runoff from the shaft complex and Gold Plant terraces. The Settlers (A & B), located in the vicinity of the Twin Shaft are used to store water before it is pumped underground.

6-1.6.2 South Shaft and Doornpoort Return Water System

(a) Old TSFs (Phase 1)

The current return water system is illustrated in Figure 35. Penstocks decant water from the old TSFs which flows directly into the upgraded RWD located down gradient of the TSFs. The water first gravitates into the Cascade Dams located on the western side of the old TSFs. Seepage from the underdrains at the old TSFs flows into a solution trench located around the perimeter of the TSFs, which feeds into the Cascade Dams. The Cascade Dams are used for cyanide degradation. From the Cascade Dams, the water flows (gravitates) to the upgraded RWD. The RWD is also used to collect storm water from the South Shaft area via a formalised trench. Water from the RWD which is then recycled back to the plant water circuit.

(b) Old TSFs (Phase 2)

Penstocks decant water from the old TSFs which flows directly into the new Cascade Dams located down gradient of the TSFs. The water first gravitates into the Cascade Dams located on the south western side of the old TSFs. Seepage from the underdrains at the old TSFs flows into the Cascade Dams. Similar to Phase 1 TSFs, the Cascade Dams are used for cyanide degradation. From the Cascade Dams, the water flows (gravitates) to the Twin Shaft PCD which is then recycled back to the plant water circuit.

(c) Doornpoort TSF

The return water system of the Doornpoort TSF complex comprises of:

- A solution trench collecting dirty water from the catchment paddocks;
- A dosing pond receiving seepage water from the underdrainage system (toe and blanket drains) and scavenger boreholes – the dosing pond receives a neutralising agent (e.g., lime);
- A silt trap receiving water from the solution trench – the silt trap acts as a settling facility;
- A concrete line solution trench conveying water from the silt trap and dosing pond to the RWDs;
- Lined RWDs, with two compartments;
- A return water pumping station; and
- A return water pipeline.



6-2 STORM WATER

Stormwater Management at South Deep Gold Mine is based on BPG for Stormwater Management (BPG1), which focuses on separating clean and dirty water, containing contaminated runoff, and prioritising water reuse.

The following key DWS BPG for Stormwater Management apply at the South Deep Gold Mine:

- Clean and Dirty Water Separation: Clean runoff around polluted areas is diverted to prevent contamination, using berms and channels.
- Dirty Water Containment: All contaminated runoff is captured in PCDs and managed to avoid overflowing or seepage.
- Water Management Hierarchy: The water management hierarchy is being implemented i.e. pollution prevention; impacts minimisation (water reuse); and treatment or disposal.
- Design and Maintenance: Stormwater infrastructure has been designed for appropriate flood events, and is regularly cleaned to prevent siltation, and is maintained to handle storm events.
- Construction/ rehabilitation Phase Controls: For all new infrastructure that is being constructed at the mine, which is necessary to ensure continued operation, minimal vegetation is removed, erosion is managed, and contaminated runoff is prevented from entering natural watercourses.
- Water Quality Standards: Stormwater discharged back into the environment complies with DWS water quality regulations/ standards. There is ongoing monitoring and measurement of water quantity and quality to support the site wide water balance and water management.

The current mining operation has altered the natural environment, thereby affecting stormwater generation. Volumes of storm water generated over areas disturbed by mining operations are generally expected to increase due to reduced natural vegetation, while the quality of the storm water is expected to decrease due to the nature of mining operations. An updated conceptual-level SWMP that identifies and manages clean and dirty water-generating areas appropriately has been developed [Highlands Hydrology (Pty) Ltd, 2025].

6-2.1 Management Approach

In Figure 36, areas requiring pollution control (i.e. dirty areas) have been delineated. They include the shaft areas, plant areas, TSFs, RWDs and PCDs. Due to the mine's historic operations, the majority of the required stormwater management infrastructure is already in place. This includes the channels and PCD managing the Twin Shaft and South Shaft Areas. However, in the case of the South Shaft, the PCD is functionally an attenuation dam, receiving dirty water inflows and directing them to the South Shaft RWD (upgraded).

At present, routing is via an open channel; however, this is poorly suited given its placement through a clean area (as it will intercept clean water). A culvert is consequently proposed to route the dirty water to the RWD.

North of the South Shaft, the previously dirty area has been divided into clean and dirty areas, with the Refrigeration Plant retained as a dirty area.

At the Twin Shaft, the primary change has been the addition of clean-water diversions to the west to prevent runoff from entering dirty areas. This includes runoff generated over a portion of the solar plant. Dirty water management at the Twin Shaft includes the Gold Plant PCD, oil separator and Twin Shaft PCD (the primary storage of relevance to the Twin Shaft area). At the Cascade Dams (interchangeably referred to as the reclamation pond) (refer to Figure 36), the dirty area has been tied into the toe drain of the South Shaft TSFs (Phase 1) to prevent the addition of a new PCD at this location. The recommended diversions (channels) have been conceptually positioned and sized.

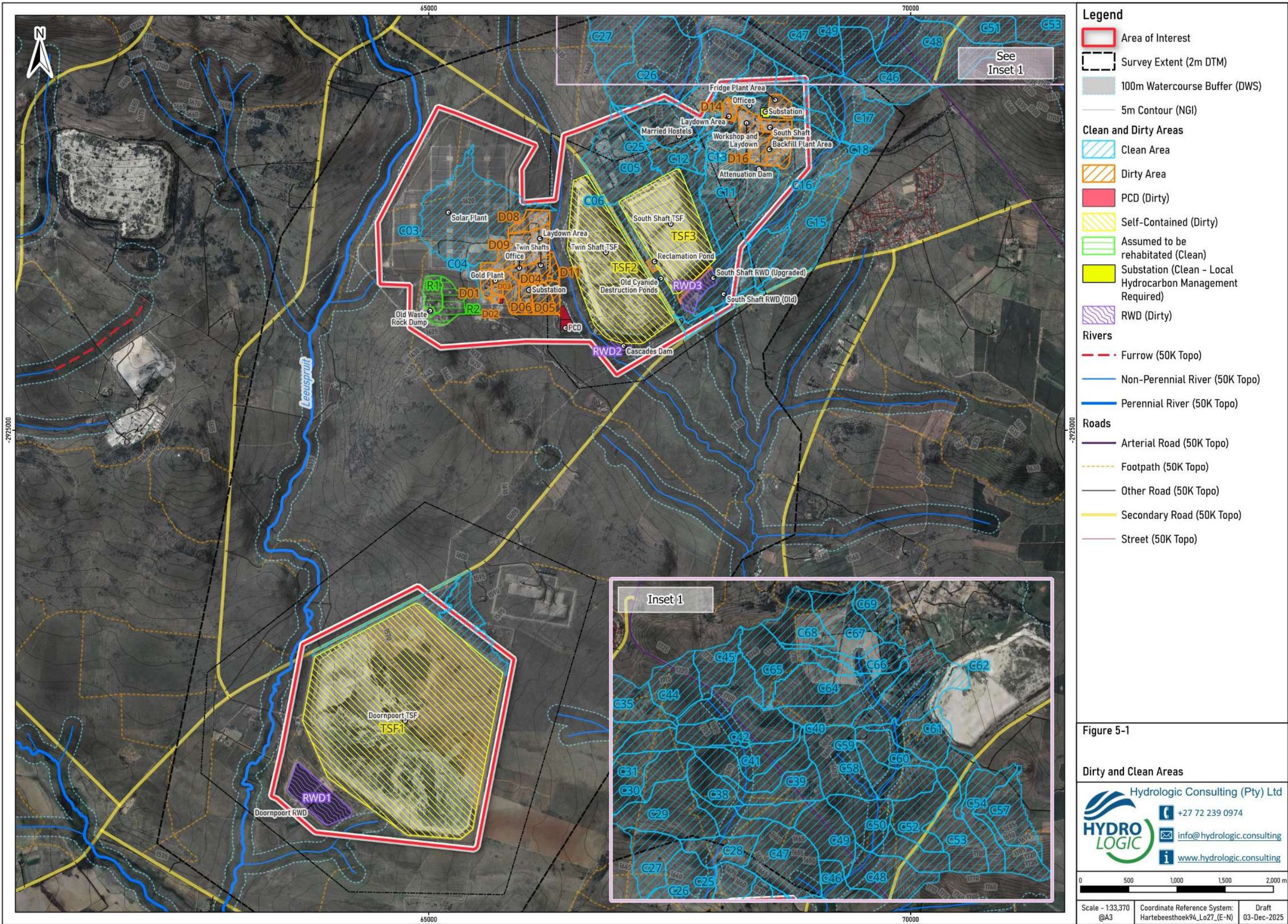


Figure 36: Dirty and Clean Water Areas

The Twin Shaft WRD area appears partially rehabilitated. This WRD has consequently been considered as rehabilitation is progress in the SWMP. It is recommended that the operations prioritise this process in order to avoid the construction of lined channels and an additional PCD.

A non-perennial river passes between the married hostels and the workers' hostels. This watercourse has the potential to produce significant flooding, which current stormwater management does not adequately manage. As such, proposed channels have been put in place to route the 1:50 year design event downstream without flooding the hostels.

At Doornpoort TSF, clean area management is proposed. This is the same for all TSFs over the mine. Various clean areas have been defined. Where no definition of clean or dirty areas is present, the implication is that the area is irrelevant to the management of dirty areas on the mine.

Overall, the SWMP aims to minimise dirty water areas to limit the containment of dirty runoff. This benefits the mining operation by reducing the size of the dirty water diversions and any PCDs required to store dirty water generated on-site, as well as minimising the impact on the receiving water environment due to the reduction in natural runoff.

6-2.1.1 Fuels, Lubricants and Chemicals

The storage/handling of fuel, lubricants and chemicals requires special attention due to their hazardous nature as is the case with the diesel and oil bay. These areas must be managed on impermeable floors with appropriate bunding, sumps, and roofing.

6-2.2 Stormwater Management Infrastructure

There is a significant amount of stormwater management-related infrastructure already designed and constructed on site, including numerous concrete-lined channels and PCDs.

Figure 38 and Figure 39 illustrate the conceptual SWMP.

6-2.2.1 Clean Water System – Diversions

Figure 37 represents a typical clean area diversion consisting of a containment berm and channel. The purpose of the channel section is to divert upstream/upslope clean water that would otherwise flow into the dirty area, while the berm section ensures containment of dirty water within the dirty areas.

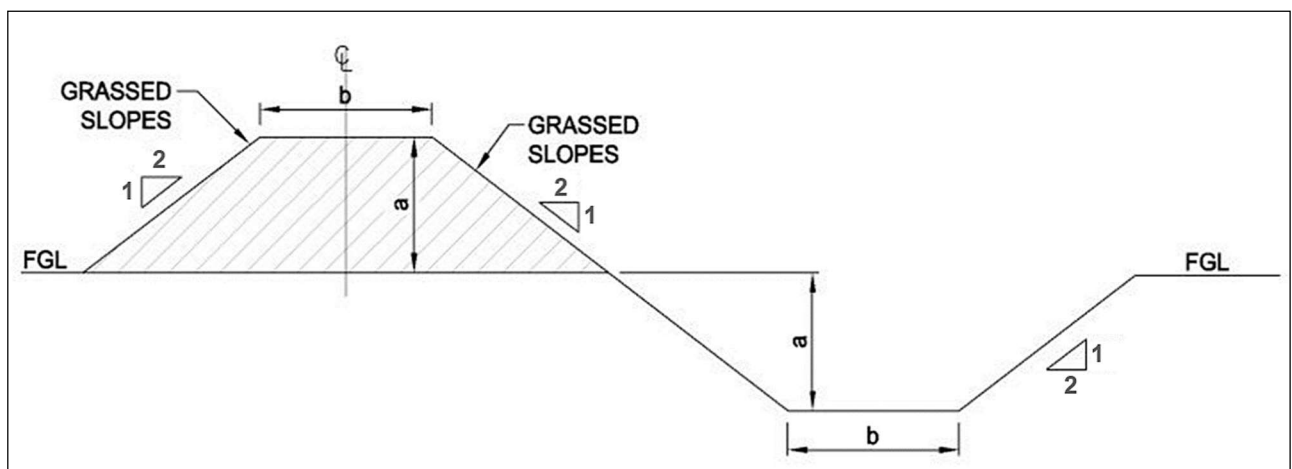


Figure 37: Typical berm and channel for stormwater diversion system

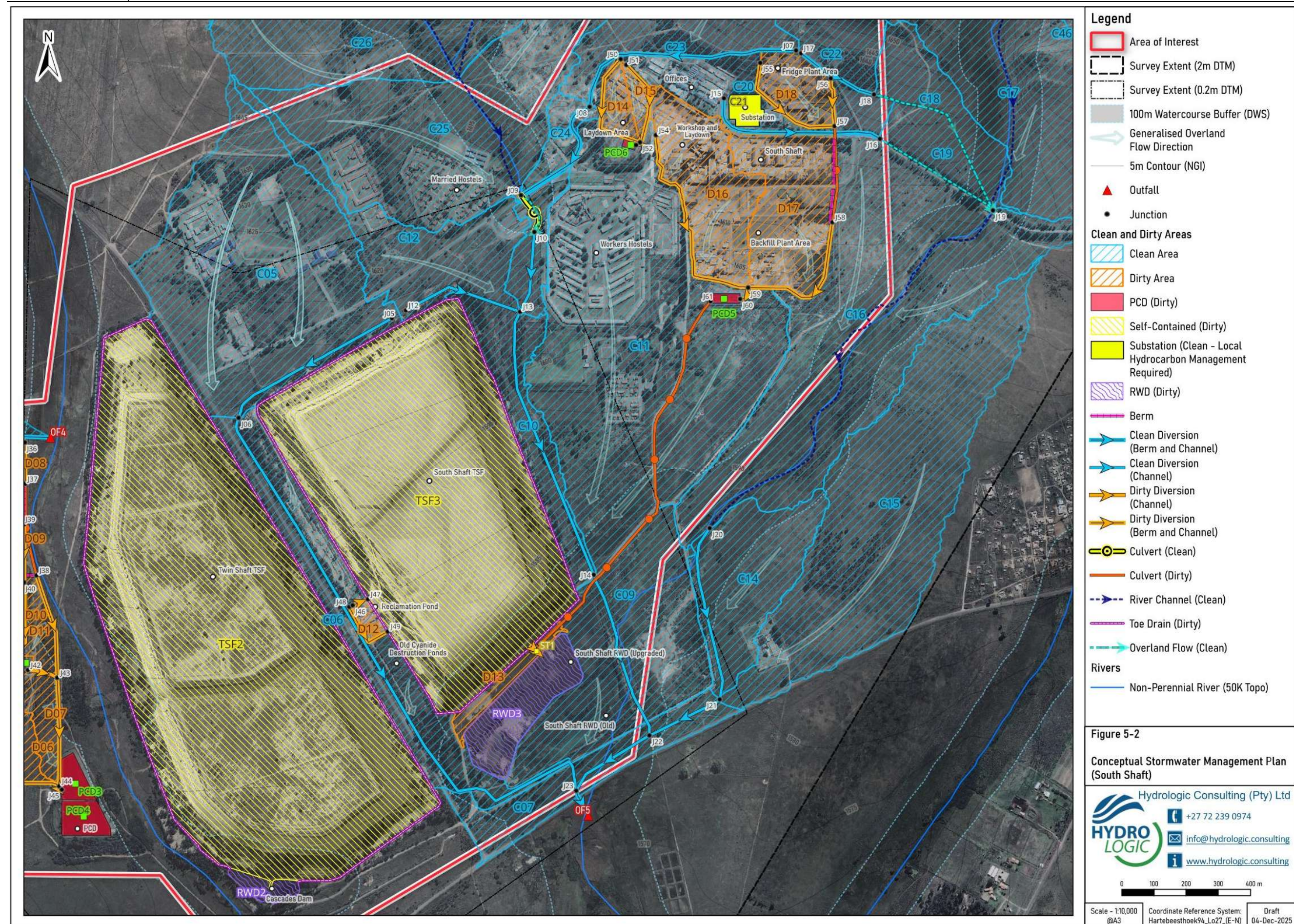


Figure 38: Stormwater Management Plan (South Shaft)

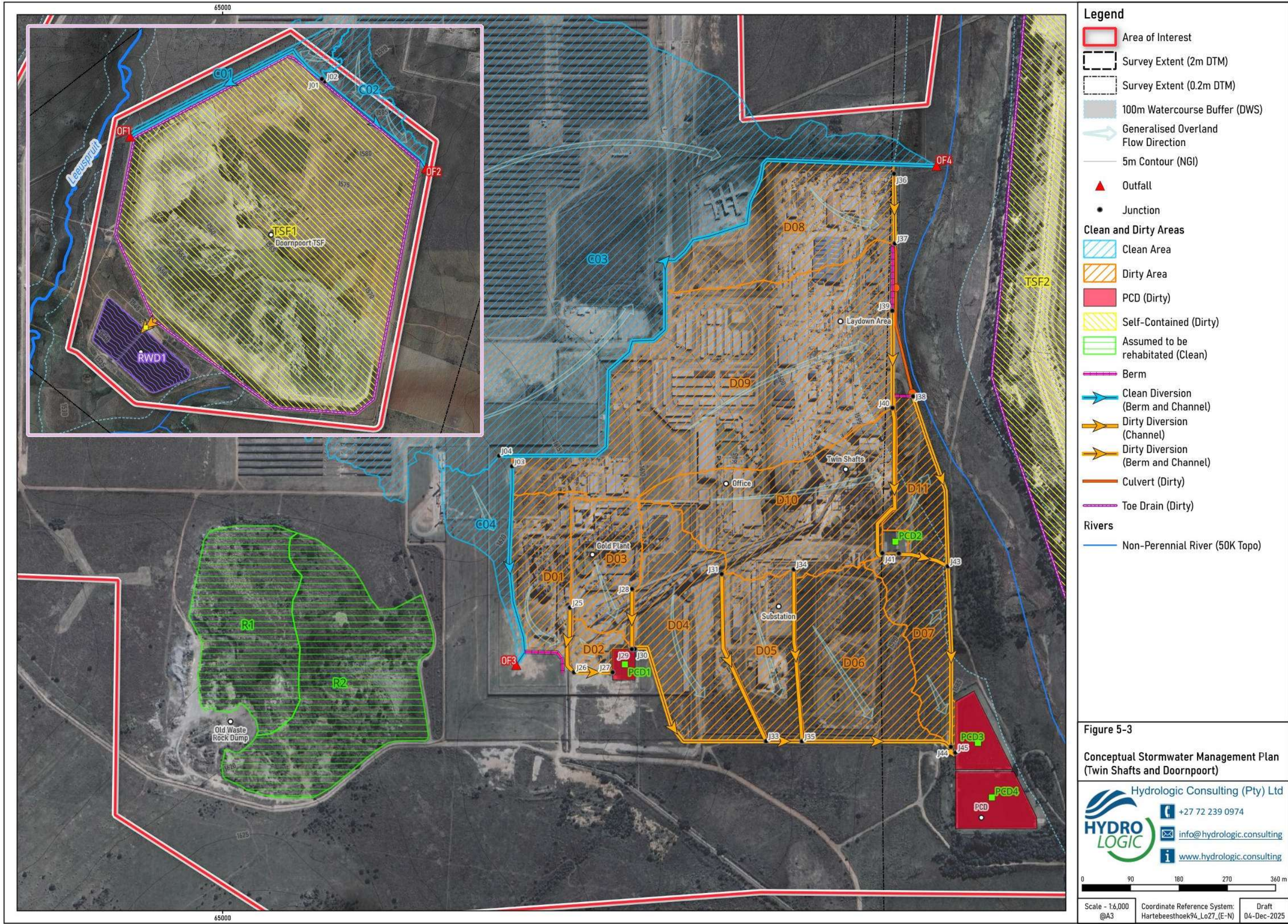


Figure 39: Stormwater Management Plan (Twin Shaft and Doornpoort)

6-2.2.2 Dirty Water System – Diversions

Berm and channel component have been designed to accommodate the 1:50 year recurrence interval (RI) storm event and serve two main purposes:

- Diverting upstream clean water which would otherwise flow into the identified dirty areas.
- Contain dirty water in the identified dirty areas and direct towards the appropriate dirty water containment facility.

Figure 37 represents a typical dirty water containment berm and channel.

6-2.3 Energy Dissipation at Diversion Outlets and Outfalls

Velocities exceeding 2 m/s risk eroding grass-lined channels, while those surpassing 2.5 m/s can compromise concrete-lined channels at joints or cracks. Given the identified peak flows, outlet velocities may exceed these safety thresholds, necessitating potential energy dissipation structures such as rock aprons, gabion mattresses, or stilling basins.

6-2.4 Dirty Water System – Pollution Control Dams

Condition 6 of GN704 states that clean and dirty water systems must be kept separate and designed, constructed, maintained, and operated so that they do not spill into each other as a result of storm events below and including the 1:50-year event. A minimum freeboard of 0.8 m above the full supply level (FSL) must also be maintained, as required by GN704.

Figure 38 and Figure 39 illustrate the position of the South Shaft's stormwater separation system (attenuation pond) plus its overflow to the upgraded RWD (via a culvert). At the Twin Shaft, the PCDs remain as current.

6-2.5 Disturbed watercourses and Crossings

The following streams in the vicinity of the mine have been disturbed:

- Kariegaspruit – A flow meter has been installed downstream of the South Shaft TSFs (Phase 1) RWD.
- Leeuspruit – the establishment of the upgraded RWD resulted in a stream diversion of the Leeuspruit around the RWD complex. The stream diversion included the installation of a flow meter in the diversion channel.

The mine's haul and access roads cross the Leeuspruit and the Kariegaspruit. At the Leeuspruit crossing, a culvert system was established. It is assumed that this access road and culvert system was established approximately 54 years ago when mining began in the area and it is unlikely that the design of the bridge was regulated. Pipelines (tailings, mine water and return water) cross the Kariegaspruit. These pipelines were established for the Twin Shaft and Gold Plant.

Specific measures implemented for the stream crossings include:

- The mine will ensure that any stream crossings do not obstruct the flow of water in the watercourse. If necessary, culverts will be upgraded (or if no culverts are present these will be established) so that they do not alter flow in the stream. Stream crossings will be inspected regularly – particularly, during and after floods. Blockages will be cleared and damaged areas will be repaired immediately.
- Specific conditions specified by DWS –
 - the crossings will not impact detrimentally on any other persons' water use, property or land;
 - natural migration patterns of aquatic biota will not be interfered with;

- the total or cumulative diversion/altering length will not exceed 100m in length, measures from the beginning to the end of the crossings;
- the rate of flow will not be reduced except for natural evaporative losses;
- the water quality is not affected; and
- all necessary measures are taken to stabilise the structure and surrounding area.

Any deviations from these conditions will require a license from DWS.

6-3 WATER BALANCE

The mine water reticulation included in the model is shown in Figure 40, and the main infrastructure's location is shown in Figure 2. The ore from the underground workings and the remining of the old TSFs (Phase 1) is processed at the Gold Plant at Twin Shaft. Some tailings are used for backfilling underground, with the balance disposed of on the Doornpoort TSF.

The main components of the mine water reticulation include:

- The South Shaft, Twin Shaft, the Doornpoort TSF and the old TSFs [Phase 1 (TSF1 and 2) and Phase 2 (TSF 3 and 4)].
- The backfill (semi-classified tailings) and Refrigeration Plants are located at South Shaft. Excess underground water is brought to the surface at the shaft, and cooled water is sent underground.
- The water brought to the surface from the workings and abstracted from the South Shaft boreholes is used in the Refrigeration Plant and the semi-classified tailings (SCT) plants. The Refrigeration and SCT plants use potable water supplied by Rand Water. Tailings from the Gold Plant are sent to the SCT plant to produce backfill.
- A RO plant operates at the SCT plant to treat excess water on site for use as potable water. Two additional RO plants have recently been added at the SCT plant to treat water abstracted from the upgraded RWD. The brine from the RO plants is disposed of with the tailings at the Doornpoort TSF. Any excess water from the South Shaft area and stormwater runoff reports to the upgraded RWD.
- Return water from the RWD at the Doornpoort TSF and water abstracted from the upgraded RWD is used as make-up water for the Gold Plant. The make-up water is first drawn from the Doornpoort RWD and then the upgraded RWD.
- The runoff from the Gold Plant catchment area reports to the Gold Plant PCD. Water can be abstracted from the PCD for use in the Gold Plant, with spills from the PCD reporting to the Twin Shaft PCD. The Twin Shaft PCD also receives stormwater runoff from the Twin Shaft catchment area, and water abstracted from the Twin Shaft boreholes. Water is abstracted from the PCD for irrigation at the old TSFs (Phase 2), dust suppression (Phase 1 and Phase 2), and water can be pumped to the upgraded RWD.
- The old TSFs 1 and 2 (Phase 1) are being remined hydraulically. Water for the remining is supplied from the upgraded RWD. The remined tailings are pumped to the Gold Plant as a slurry after thickening at the remining site. The overflow from the thickener is returned to the upgraded RWD.
- The seepage, penstock return and runoff from TSFs 1 and 2 (Phase 1) report to the upgraded RWD. The seepage, penstock return and runoff from TSFs 3 and 4 (Phase 2) report to the Cascade Dams, from where it is sent to the upgraded RWD.
- The upgraded RWD receives runoff and excess water from the South Shaft area, seepage and runoff from the Old TSFs, water from Cascade Dams, treated sewage effluent and water pumped from the Twin Shaft PCD. Water can be pumped between the Doornpoort RWD and the upgraded RWD in a bi-directional pipeline.
- The tailings are deposited into the unlined Doornpoort TSF. The decant water from the TSF pool is discharged via a penstock system to the RWD. The runoff from the TSF side slopes discharges to the toe paddocks, which drain into the outer perimeter concrete lined stormwater collection trench which

currently discharges to the RWD. Seepage water from the Doornpoort TSF cut off, toe and blanket drains discharge into a buried perimeter seepage collection pipe which flows into the RWD.

- The water from the outer perimeter concrete lined storm water collection trench drains either into the RWD or into the environment via two control gates. In the event of the RWD being full, the clean water in the outer perimeter concrete lined stormwater collection trench can be discharged to the environment.
- Water is returned from the Doornpoort RWD to the Gold Plant or sent to the upgraded RWD. Water is also be pumped from the upgraded RWD to the Doornpoort RWD. Boreholes downstream of the Doornpoort RWD are used to lower the groundwater table under the Doornpoort RWD. The water from the boreholes is pumped into the Doornpoort RWD or into the perimeter concrete lined storm water collection trench which drains into the Doornpoort RWD.

6-3.1 Underground Mine

The water balance for the underground mine is presented in Table 50 for the period January 2022 to September 2024. Potable water is sent underground for domestic use, and sewage effluent is brought to the surface for disposal off site. The water sent underground in the backfill material remains bound or entrained in the backfill and does not report to the underground water management system. The backfill flush water sent underground does report to the underground water management system and is available to be pumped to the surface. The fissure water or groundwater ingress is calculated as the difference between the outflows and inflows to the underground workings.

The difference between the water pumped to the surface and the water sent underground from the Refrigeration Plant is water that can be used on the surface to meet mine water requirements or treated to produce potable water to replace the Rand Water supply. The average volume available for use to meet mine water requirements is 4 027 m³/d.

Table 50: Summary Water Balance for the Underground Workings (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Moisture in air	Estimated	51	Estimated by the ventilation team
Fissure water	Simulated	5 258	Simulated as the difference between the outflows and inflows to the underground workings
Backfill flush water	Estimated	30	
Water in backfill	Calculated	605	Calculated from measured tailings volumes and density of the backfill material
Refrigeration Plant	Measured	1 995	
Total inflows		7 939	
Outflows			
Moisture in air at vent fans	Estimated	518	Estimated by the ventilation team
Entrained backfill	Calculated	605	Taken as the water volume in the backfill.
Mud to tails tank	Estimated	794	Supplied by the underground mining team
Pumped to MWT	Measured	6 022	
Total Outflows		7 939	
Balance Check		0%	

6-3.2 Refrigeration Plant and Mine Water Tank

The water balance for the Refrigeration Plant and Mine Water Tank is presented in Table 51.

Table 51: Summary Water Balance for Refrigeration Plant and Mine Water Tank (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
South Shaft Boreholes	Measured	657	Metered flows input to the make-up dam to supply compressor and condensers

Water from Underground to MWT	Measured	6 022	
Potable Water	Measured	48	
Total inflows	Measured	6 727	
Outflows			
Compressor Blowdown	Estimated	2.5	Volume estimated by operators of the compressor station. Input to model from input spreadsheet.
FP to underground	Measured	1 995	Cooled water sent underground
FP Evaporation	Estimated	2.0	Volume estimated by operators of the Refrigeration Plant. Input to model from input spreadsheet.
Evap/losses at cond/comp	Simulated	259	Simulated as the difference between the metered inflows to the comp/condenser and the estimates of blowdown
Excess make-up dam to upgraded RWD	Simulated	437	Simulated as the difference between the potable and South Shaft borehole volumes and the metered compressor/condenser water requirements
Excess water MWT to thickener at the Backfill Plant	Simulated	4 065	Simulated as the difference between the total inflow volumes to MWT (pumped from underground, condenser blowdown) and total outflow volume (cooled water sent underground and FP evaporation).
Total Outflows		6 760	
Balance check		0.5%	

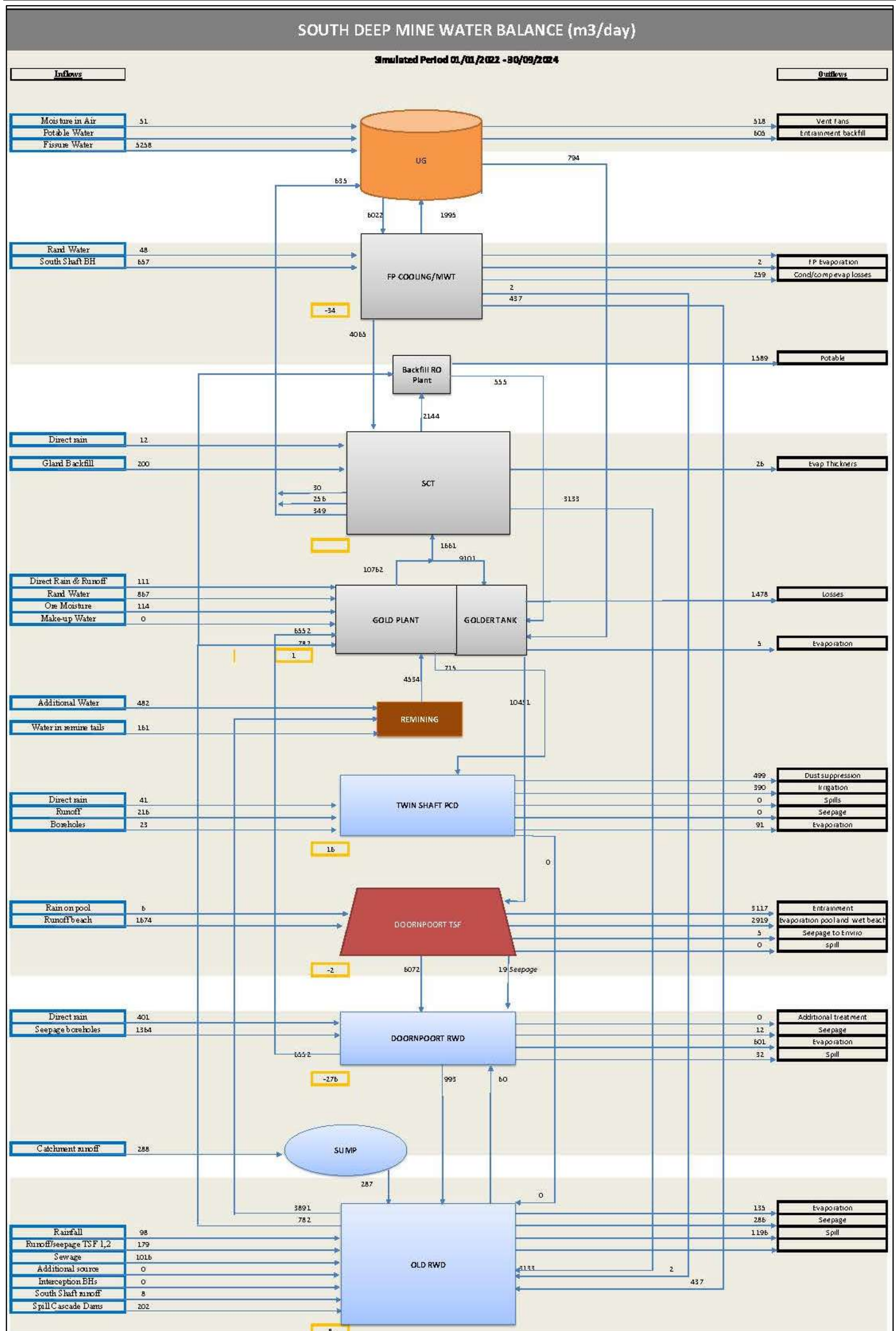


Figure 40: Schematic Water Reticulation/ Water Balance

6-3.3 Remining

South Deep JV: South Deep Gold Mine is remining tailings at TSFs 1 and 2 (Phase 1) hydraulically. Water for the remining process is abstracted from the upgraded RWD. The remined tailings slurry is passed through a thickener at the remining site, and the thickened tailings are pumped to a thickener at the Gold Plant for processing. The overflow from the thickener at the remining site is returned to the upgraded RWD.

The flow to the remining is not directly measured. The flow abstracted from the upgraded RWD is measured, but the water is used to supply the remining, Gold Plant and some water is pumped to the SCT for treatment. Not all the flows are measured to be able to calculate the water supplied to the remining. The approach agreed upon with South Deep JV: South Deep Gold Mine is to estimate the density of the thickened remined tailings, and the mass of tailings remined to calculate the water in the remined tailings slurry sent to the Gold Plant. This approach estimates the net water abstracted from the upgraded RWD as the thickener overflow is returned to the upgraded RWD. In calculating the water required for remining, the assumption is made that the tailings to be remined have some interstitial moisture. A 5% moisture content (m/m) was used to estimate the volume of water in the tailings being remined. The volume required to be supplied for remining is then calculated as the difference in the water in the remined slurry and the interstitial water in the remined tailings.

The water balance for the remining is summarised in Table 52.

Table 52: Summary water balance for remining (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Water from upgraded RWD	Simulated	3 891	Calculated as the difference between the water in the slurry sent to the Gold Plant and the interstitial water in the tailings
Interstitial water in tails	Calculated	161	
Additional water	Simulated	482	Water is required to make up for shortfalls in supply.
Total Inflow		4 534	
Outflows			
Water in the slurry to Gold Plant	Calculated	4 534	Volume estimated by operators of the compressor station. Input to model from input spreadsheet.
Total Outflows		4 534	
Balance check		0.0%	

6-3.4 Gold Plant Area

6-3.4.1 Gold Plant

The Gold Plant receives water in the ore from underground and the remined tailings. Potable water is supplied to the Gold Plant, and the main outflow from the Gold Plant is water in the tailings' slurry. The net plant demand (water in tailings slurry, less water in ore, less water in remining slurry and potable water) is supplied by return water from the Doornpoort RWD, the upgraded RWD, and water abstracted from the Gold Plant PCD. The return from Doornpoort RWD and the upgraded RWD to the Gold Plant are measured. The supply from the Gold Plant PCD has not been measured. A rule is built into the model where the net plant demand is less than the measured flows from Doornpoort RWD, and the upgraded RWD is supplied from the Gold Plant PCD if water is available in the PCD.

The water balance is summarised in Table 53. The water balance shows an imbalance of 17% over the simulation period. The simulations showed an average excess water at the Gold Plant of 2 154 m³/d. Some of the excess may be due to losses in the plant; however, losses of 2 154 m³/d at the plant are excessive. Excess water could be discharged to the Gold Plant PCD or the Twin Shaft PCD in the drainage system. These flows are not measured.

The parameters with the largest impact on the balance are the masses and the densities of the tailings and remining slurries. The monitoring systems should be reviewed, and the calibration of the meters should be checked.

Table 53: Summary of Gold Plant water balance (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Water in ore	Calculated	114	Calculated as the mass of ore and the moisture content of the ore.
Water in remined tailings	Calculated	4 534	Calculated as described in Table 52
Potable water Rand Water	Measured	867	
Return water Doornpoort RWD	Measured at Gold Plant	6 552	
Water returned upgraded RWD	Measured at Gold Plant	782	
Water from Gold Plant PCD	Simulated	67	The water pumped from the Gold Plant PCD to the Gold Plant has not been measured. The shortfall in supply after the net Gold Plant demand is supplied from Doornpoort RWD and the upgraded RWD is assumed to be supplied from the PCD if water is available in the PCD.
Total Inflow		12 916	
Outflows			
Water in the slurry	Calculated	10 762	Calculated based on the density of the tailings' slurry and the mass of the tailings.
Total Outflows		10 762	
Balance check		17%	

6-3.4.2 Gold Plant Pollution Control Dam

The Gold Plant PCD receives runoff water and spills in the plant. The water collected in the PCD is re-used in the plant and spills from the PCD report to the Twin Shaft PCD. The abstractions and the inflows to the PCD are not measured. The water levels in the PCD are measured, and the simulated water volumes in the PCD are compared to the measured values in Figure 41. The summary of the water balance is presented in Table 42.

The simulated volumes in the PCD do not compare well to the measured volumes. The inflows and abstractions from the PCD need to be measured to improve the calibration.

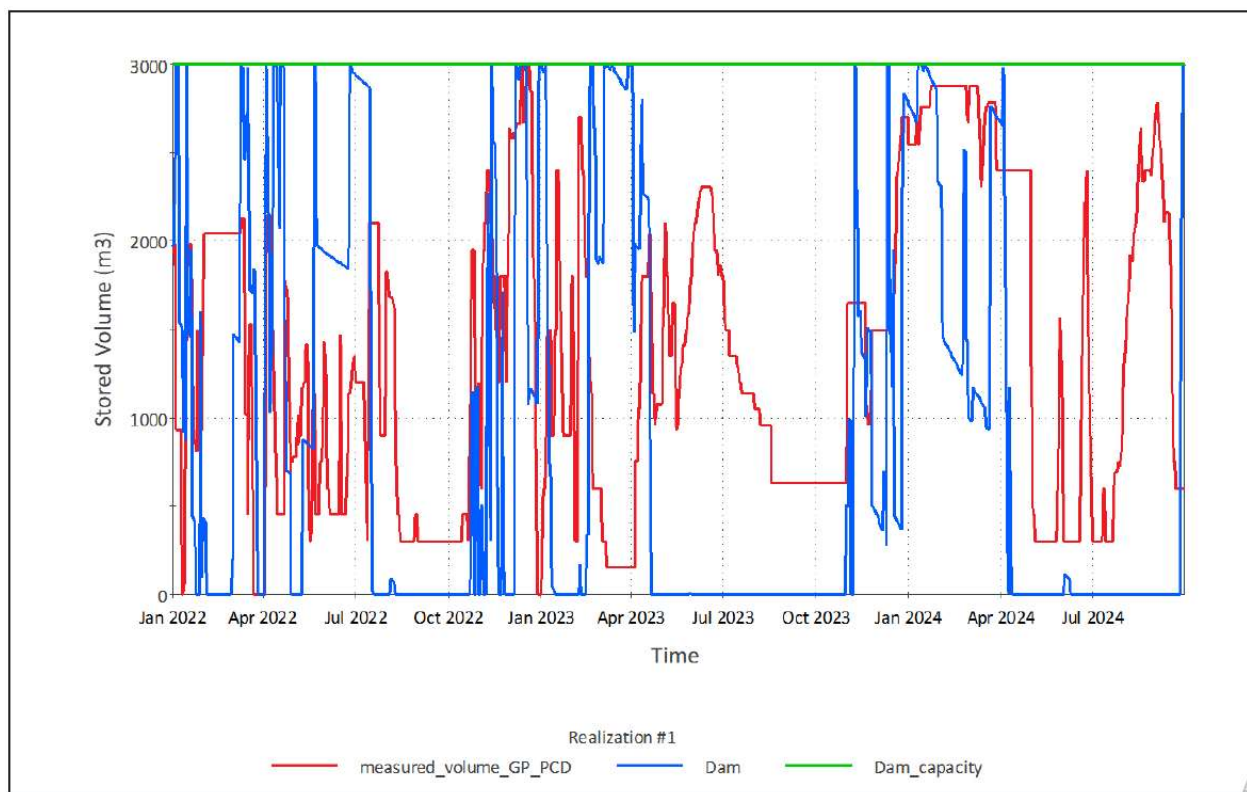
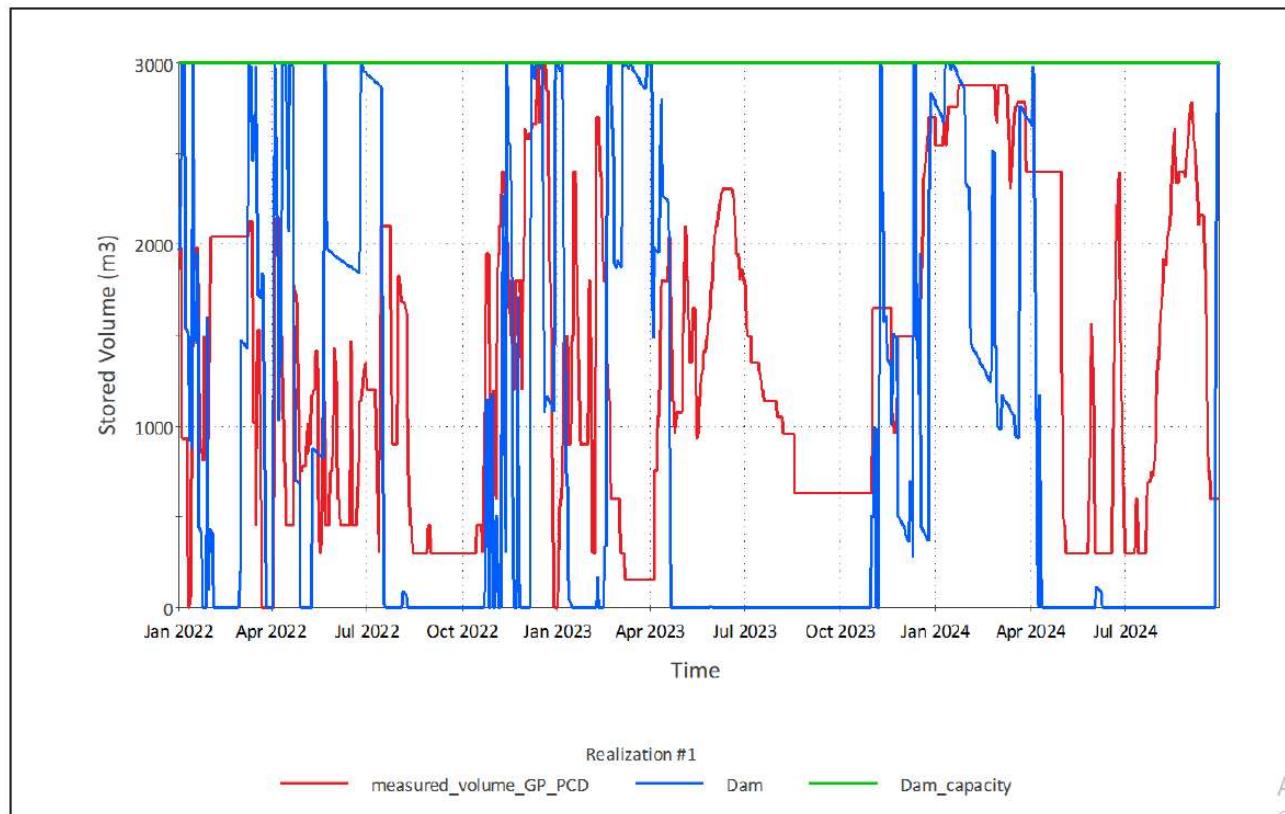
**Figure 41: Comparison of simulated and measured volumes in Gold Plant PCD**

Table 54: Summary of Gold Plant PCD Water Balance (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Runoff Gold Plant PCD	Simulated	107	Estimated using rainfall, and SCS curve number approach and catchment area
Rain	Simulated	4	Estimated using rainfall and surface area of PCD.
Total Inflow		111	
Outflows			
Evaporation	Simulated	5	Simulated using lake evaporation and surface area of PCD
Seepage	Simulated	1	Calculated using the area of the storage tanks and the evaporation depth
Supply Gold Plant	Simulated	67	Calculated using the operating rule based on the measured water pumped from the upgraded RWD and Doornpoort RWD
Spills	Simulated	38	Simulated in the model
Total Outflows		111	
Volume Variation		1	
Balance check		0.0%	

**Figure 42: Comparison of simulated and measured volumes in Gold Plant PCD**

6-3.4.3 Twin Shaft Pollution Control Dam

The Twin Shaft PCD receives runoff from the Twin Shaft PCD catchment area, spills from the Gold Plant PCD and water pumped from the Twin Shaft boreholes. Water is abstracted for dust suppression irrigation of the old TSFs and water and can be pumped to the upgraded RWD. The water volumes abstracted for irrigation, pumped from the boreholes and the volumes stored in the PCD are measured. The dust suppression demand is estimated based on tankers and the number of trips entered in the input spreadsheet.

The volumes stored in the PCD were simulated for different values of the key inputs of the dust suppression demand and runoff curve number. No pumping to the upgraded RWD was assumed, and the diversion of some

of the Gold Plant excess water to the PCD was simulated. The volume diverted was calculated to maintain the water volume in the PCD at 60% full. The results of the runs are shown in Table 55.

The results highlight the following:

- The spills from the Gold Plant PCD, the catchment runoff and the boreholes are insufficient to supply the measured irrigation and estimated dust suppression (Run 1, 2, 3 and 4).
- There must be an additional source of water supplying the PCD other than runoff.
- The calibration is improved by diverting some excess water simulated at the Gold Plant to the PCD.

Further simulations were undertaken using a curve number of 88, dust suppression as estimated on site of 500 m³/d and excess water diverted to the PCD to maintain the water volume stored in the PCD at 60% full. The water balance for this case is summarised in Table 56.

The calibration can be improved by measuring the volumes pumped to the upgraded RWD and the inflows to the PCD.

Table 55: Summary of calibration results on Twin Shaft PCD (Period January 2022 to September 2024)

Run	Dust Suppression (m ³ /d)	Curve Number	Excess Water Gold Plant	Results
3	500	95	No	
4	150	95	No	
5	500	95	Yes	

Run	Dust Suppression (m ³ /d)	Curve Number	Excess Water Gold Plant	Results
6	500	88	Yes	

Table 56: Summary of Twin Shaft PCD water balance (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Gold Plant PCD spills	Simulated	38	
Rain	Simulated	41	Estimated using rainfall and surface area of PCD.
Runoff	Simulated	216	Estimated using rainfall, and SCS curve number approach and catchment area
Boreholes	Measured	23	
Excess Gold Plant top-up	Simulated	677	Estimated using the operating rule to keep PCD 60% full.
Total Inflow		995	
Outflows			
Evaporation	Simulated	91	Simulated using lake evaporation and surface area of PCD
Supply Gold upgraded RWD	Simulated	0	The pumping was switched off for calibration
Dust Suppression	Estimated	500	
Irrigation	Measured	390	
Spills	Simulated	0	Simulated in the model
Total Outflows		980	
Volume Variation		16	
Balance check		0.0%	

6-3.4.4 Semi Classified Tailings Plant (Backfill)

The tailings slurry required to make backfill is pumped to the SCT Plant at the South Shaft from the Twin Shaft Gold Plant. The excess water, after thickening the tailings to produce the backfill material, is sent to concrete dams (old thickeners) for storage, where it is available for treatment in the Backfill RO plant with any excess water drained in the stormwater channels to the upgraded RWD. The water balance is summarised in Table 57.

Table 57: Summary Water Balance for SCT plant (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Excess from the MWT	Simulated	4 065	Calculated in MWT balance
Gland Seal Water	Estimated	200	Volume estimated by operators of the SCT plant. Input to model from input spreadsheet.
Water in tailings slurry to SCT plant	Calculated	10 762	Water in tailings slurry leaving the Gold Plant. Calculate using the mass, solids density and density of tailings slurry. The measured backfill volumes are converted to mass using the backfill and tailings solids densities. The calculated backfill mass is taken off the slurry mass in the tailings' slurry from the Gold Plant.

Route	Data Source	Average (m ³ /d)	Comment
			The tailings mass and Slurry water balance are sent to the Golder Tank for pumping to Doornpoort TSF.
Direct rain on concrete storage tanks	Simulated	12	Calculated using the area of the storage tank and the rainfall depth
Total Inflow		15 038	
Outflows			
Supply RO plant	Measured	2 143	
Evaporation from concrete storage tanks	Simulated	26	Calculated using the area of the storage tanks and the evaporation depth
Backfill to underground	Calculated	605	The measured volumes and densities are used to calculate the mass and volume of water in the underground backfill.
Flush water	Simulated	30	Volume estimated by operators of the SCT plant. Input to model from input spreadsheet.
Water in Tailings slurry to Golder Tank	Calculated	9 101	Calculated as the difference between the water volume in the slurry leaving the Gold Plant and the water volume taken into the SCT plant.
Excess Water to upgraded RWD	Simulated	3 132	Calculated as the difference between the water volumes into and out of the SCT plant
Total Outflows		15 038	
Balance check		0.0%	

6-3.4.5 Backfill Reverse Osmosis Plants

The RO plants at the SCT plant treat excess water at the SCT plant. The treated water is put into the potable network, reducing the water required from Rand Water. The brine is mixed into the tailings slurry and sent to Doornpoort TSF. The RO plants also treat water from the upgraded RWD. The measured treated water volumes for the plants are currently entered as part of the backfill RO plant inputs. The data for the two plants is available, and the inputs should be separated in the input sheet in future developments of the model.

The inflows and outflows from the backfill RO plant are shown in Figure 43. The plant has not been operating since April 2024. The RO plant operates at an average of 74% recovery. The average daily inflows, potable product water and brine volumes over the simulation period are given in Table 58.

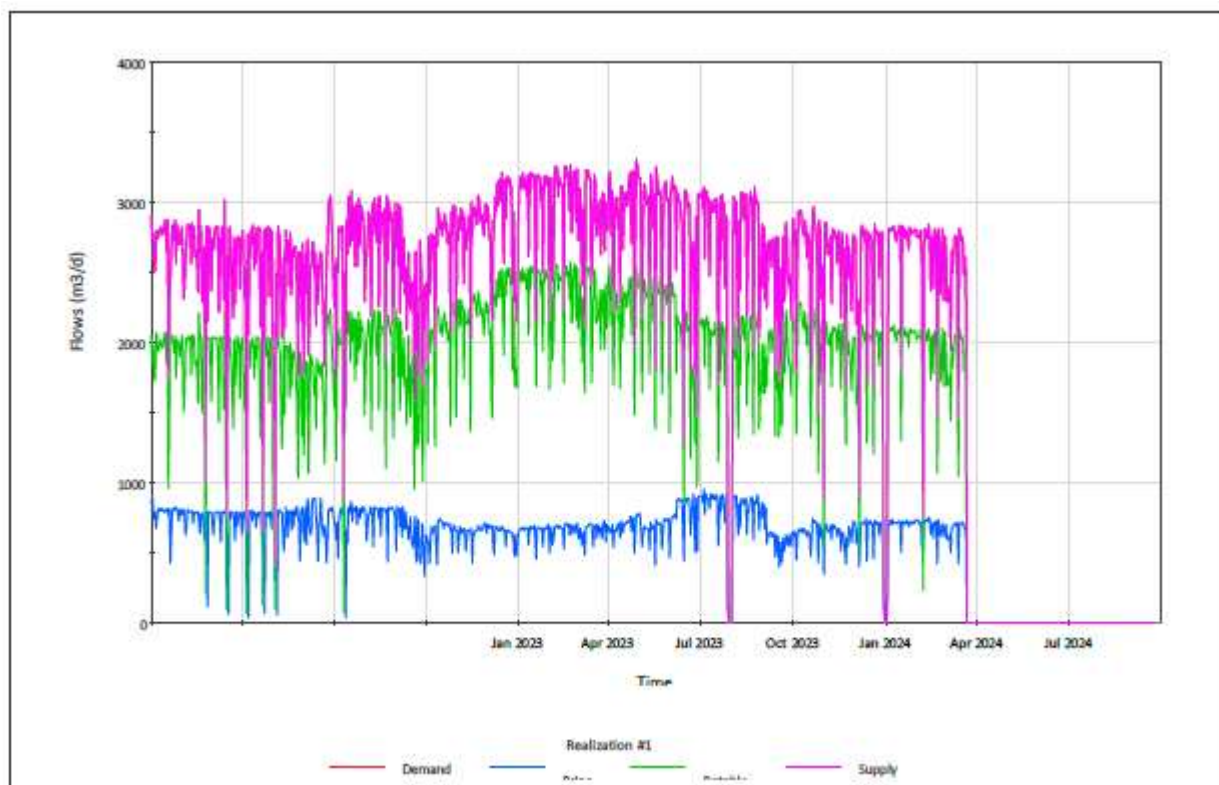


Figure 43: Plot of Backfill RO plant supply, potable product and brine volumes**Table 58: Summary Water Balance for Backfill RO plant (Period January 2022 to September 2024)**

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Feed to Plant	Calculated (sum of product water and brine)	2 144	Excess water at the SCT plant is treated. Water is also pumped from the upgraded RWD for treatment.
Outflows			
Product water	Measured	1 589	
Brine	Measured	555	

6-3.4.6 Doornpoort Tailings Storage Facility and Return Water Dam

The Doornpoort TSF receives the tailings from the Gold Plant after the tailings required to make backfill has been supplied. The brine from the backfill RO plants and the mud from underground are added to the tailings and deposited on the Doornpoort TSF. After entrainment in the deposited tailings, the excess water reports to a pond, which is drained to the Doornpoort RWD via a gravity penstock inlet and outfall system. The TSF is not lined, but seepage is collected in an underdrainage system, which delivers the seepage water captured in the drains to the Doornpoort RWD. The seepages entering the Doornpoort RWD are measured.

The runoff from the TSF side slopes discharges to the toe paddocks, which drain into the outer perimeter concrete lined storm water collection trench which discharges to the Doornpoort RWD. Seepage water from the Doornpoort TSF cut off, toe and blanket drains discharge to a buried perimeter seepage collection pipe which flows into the Doornpoort RWD.

The outer perimeter concrete lined storm water collection trench accepts water from:

- the catchment paddocks (as is currently the case); or
- clean storm water runoff from the sides of the TSF as part of ongoing rehabilitation; or
- both of the above.

The water from the outer perimeter concrete lined storm water collection trench drains either into the Doornpoort RWD or into the environment via two control gates. In the event of the Doornpoort RWD being full, the clean water in the outer perimeter concrete lined stormwater collection trench can be discharged to the environment.

The lined Doornpoort RWD has two interconnected compartments. Boreholes are located downstream of the Doornpoort RWD to lower the water table below the Doornpoort RWD. Boreholes downstream of the Doornpoort RWD are used to lower the groundwater table under the Doornpoort RWD. The Doornpoort RWD receives water pumped from the upgraded RWD. The pipeline between the Doornpoort RWD and the upgraded RWD is used to pump water either to the Doornpoort RWD from the upgraded RWD or the upgraded RWD to the Doornpoort RWD.

The flow data for the water pumped between the upgraded RWD and the Doornpoort RWD is available from May 2023. The water pumped to the Gold Plant from Doornpoort RWD is measured at the Gold Plant, and the water pumped from the boreholes into the Doornpoort RWD is measured. The water levels in the Doornpoort RWD compartments are measured and reported as a percentage full. The return of water from the Doornpoort TSF via the penstocks to the Doornpoort RWD is not measured, as is the volume of water stored in the Doornpoort TSF pool.

The model of the Doornpoort TSF and RWD was calibrated against the measured levels in the Doornpoort RWD. The measured pump volumes into and out of the Doornpoort RWD were used where they were available. A pumping rule estimated the volume pumped to and from the upgraded RWD if flows were not measured. The Doornpoort TSF runoff parameters, seepage rates and percent wet beach were adjusted within acceptable limits for the Doornpoort TSF to improve the calibration.

The plot comparing the simulated and measured volumes in the Doornpoort RWD is shown in Figure 44, and the average water balance for the TSF and the Doornpoort RWD is shown in Table 59.

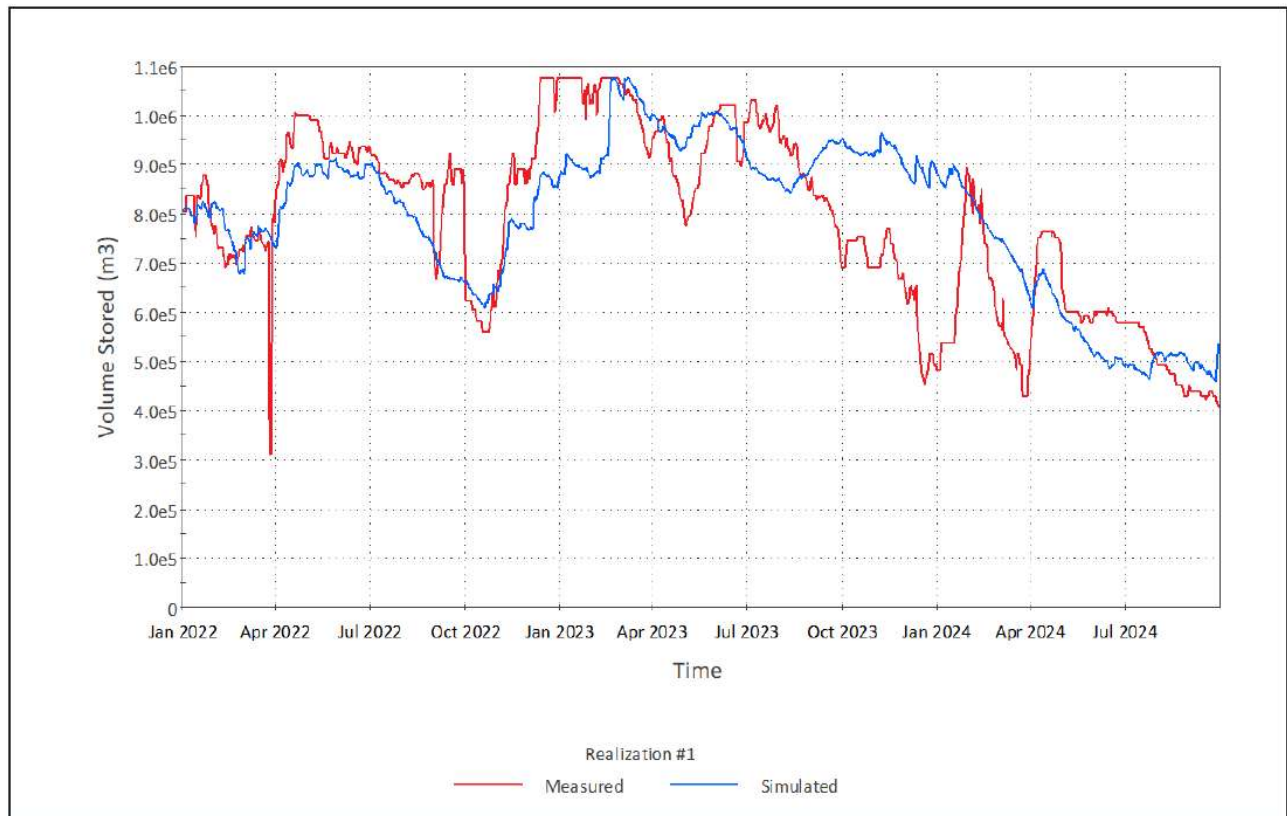


Figure 44: Plot of simulated and measured volumes in the Doornpoort RWD

Table 59: Summary of Doornpoort TSF and RWD Water Balance (Period January 2022 to September 2024)

Route	Data Source	Average (m³/d)	Comment
Doornpoort TSF			
Inflows			
Water in tailings slurry	Calculated	10 450	Water in tailings slurry is calculated as in Table 53 plus the measured volume of brine from the RO plant and an estimate of the water in the mud from underground.
Rain on pool	Simulated	6	Calculated as the product of the rain depth measured at Doornpoort and the pool surface area estimate.
Runoff from the dry and wet beach and upstream catchment area.	Simulated	1 674	The SCS curve number (CN) method is used to estimate the runoff from the dry beach. A CN of 88 was used for the dry beach. Runoff from the wet beach is calculated as the wet beach area,
			measured Doornpoort rainfall and a runoff factor of 0.9. An SCS curve number of 67 and the upstream catchment area were used to calculate the runoff from the upstream catchment at the TSF.
Total Inflow		12 130	
Outflows			
Entrainment	Calculated	3 117	Calculated using a void ratio of 1, a solids density of 2.7 tonne/m³ and the mass of the tailings.
Evaporation from pool and beach	Simulated	2 919	Calculated using the area of the wet beach and pool and the monthly average potential evaporation rate.
Seepage	Simulated	23	Product of the area of the pool and the hydraulic conductivity of the tailings. Hydraulic conductivity of the tailings of 2e-7 m/s was used.
Penstock to RWD	Simulated	6 072	Calculated as the difference between the ins and outs of the pool.
Total Outflows		12 131	

Route	Data Source	Average (m ³ /d)	Comment
Doornpoort TSF			
Volume Variation		-1.9	
Balance Check		0.0%	
Doornpoort Return Water Dam			
Inflows			
Rain	Simulated	401	Calculated as the product of the Doornpoort rainfall and the area of the Doornpoort RWD compartments.
Return from TSF – penstocks.	Simulated	6 071	Calculated as described above
Seepage collection TSF	Simulated	19	80% of the seepage volume calculated as described above is assumed to be caught in the drains with 20% reporting to the environment.
Boreholes (Scavenger wells)	Measured	1 364	
Pump from upgraded RWD	Measured/calculated	60	Measured flows available from 1 May 2023 Operating rule used to estimate inflows from Jan 2022 to May 2023
Total Inflow		7 915	
Outflows			
Evaporation	Simulated	601	
Seepage	Simulated	12	Product of water surface area and leakage rate through the liner of 1e-9 m/s
Pump to Gold Plant	Measured	6 552	
Pump to upgraded RWD	Measured/Simulated	993	Measured flows available from 1 May 2023 Operating rule used to estimate inflows from Jan 2022 to May 2023
Spill	Simulated	32	
Total Outflows		8 191	
Volume Variation		-396	Difference between the measured start and end volumes stored in the RWD
Balance Check		3%	

6-3.4.7 Old TSFs (TSF 1,2 ,3 and 4)

The seepage and runoff from the old TSFs are managed in the Cascade Dams and the upgraded RWD. The seepage and runoff from TSF 3 and 4 (Phase 2) reports via toe paddocks to the Cascade Dams. The Cascade Dams spill to the upgraded RWD. The seepage from TSF 1 and 2 (Phase 1) reports to the upgraded RWD via toe paddocks. Water is abstracted from the Twin Shaft PCD to irrigate the TSF 3 and 4 (Phase 2). TSF 1 and 2 (Phase 1) are being remined. There are no measurements of seepage flows, or water transferred from the Cascade Dams to the upgraded RWD. The only measured flow is the irrigation water applied to TSF 3 and 4 (Phase 2). The water balance for the old TSFs is simulated.

The water balance for the old TSFs is summarised in Table 60.

Table 60: Summary of TSF 3 and 4 as well as TSF 1 and 2 water balance (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
TSFs 3 and 4			
Inflows			
Direct Rain pool	Simulated	6	
Rain Beach		1 250	
Irrigation	Measured	0	
Total Inflows		1 256	
Outflows			
Evaporation	Simulated	1 034	
Seepage and return to PCD.	Simulated	209	
Seepage Environment	Simulated	15	
Total Outflows		1 260	
Volume Variation in Storage		-4	

Route	Data Source	Average (m ³ /d)	Comment
TSFs 3 and 4			
Balance Check		0%	
TSFs 1 and 2			
Inflows			
Direct Rain pool	Simulated	5	
Rain Beach	Simulated	791	
Irrigation	Measured	390	
Total Inflows		1 186	
Outflows			
Evaporation	Simulated	981	
Seepage and return to PCD.	Simulated	178	
Seepage Environment	Simulated	15	
Total Outflows		1 173	
Volume Variation in Storage	Simulated	12	
Balance Check		0%	

6-3.4.8 Old TSFs Upgraded Return Water Dam

The simulated and measured volumes stored in the upgraded RWD are plotted in Figure 45. The plot shows a poor calibration. The sedimentation and the unknown stage storage curve made comparing the measured and simulated volumes in the upgraded RWD difficult. In addition, key inflows, such as the excess water and runoff from the South Shaft area, are not measured. The data for the pumping between the upgraded RWD and the Doornpoort RWD became available in May 2023. Before May, the operating rule was used to simulate the pumping between the dams.

The water balance is summarised in Table 47.

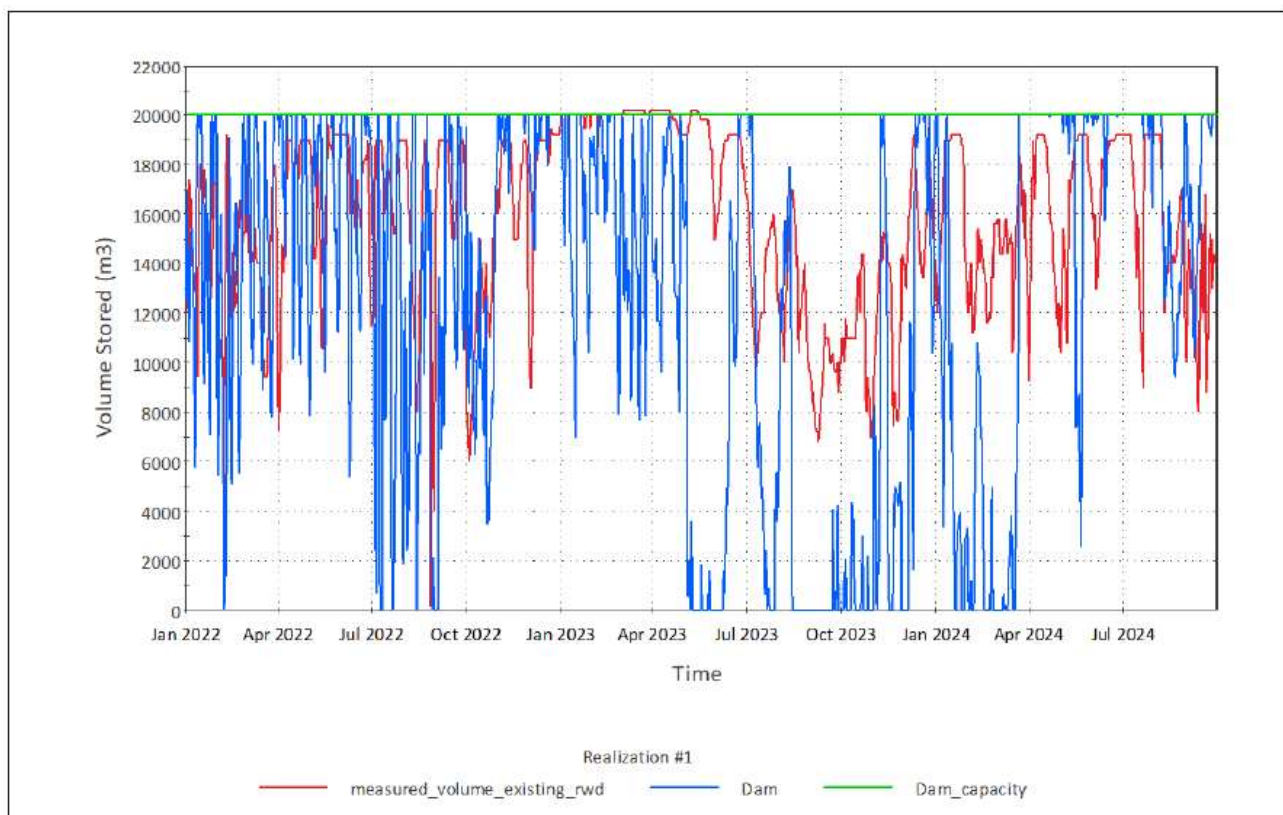


Figure 45: Plot comparing measured and simulated water volumes stored in the upgraded RWD

Figure 46: Summary water balance for the upgraded RWD (Period January 2022 to September 2024)

Route	Data Source	Average (m ³ /d)	Comment
Inflows			
Rainfall	Simulated	98	Estimated using rainfall and surface area of PCD
Runoff and seepage TSF 1 and 2	Simulated	381	
Sewage Inflow	Measured	1 016	
Excess SCT/FP	Simulated	3 570	
Blowdown	Estimated	2	
Pump from Doornpoort	Measured/ Simulated	993	Measured flows available from 1 May 2023 Operating rule used to estimate inflows from Jan 2022 to May 2023
Runoff South Shaft	Simulated	2 96	Calculated using the curve number, catchment area and measured rainfall.
Total Inflows		6 356	
Outflows			
Evaporation	Simulated	135	Simulated using lake evaporation and surface area of PCD
Seepage	Simulated	286	
Pump to Gold Plant	Measured	782	
Pump to remining	Calculated	3 891	Calculated as the difference between the water in the slurry sent to the Gold Plant and the interstitial water in the tailings
Pump to Doornpoort RWD	Measured/ Simulated	60	Measured flows available from 1 May 2023 Operating rule used to estimate inflows from Jan 2022 to May 2023
Spills	Simulated	1 196	Simulated in the model
Total Outflows		6 349	
Volume Variation		8	
Balance Check		0.0%	

6-3.4.9 Average Water Balance

The average water balance over the simulation period is shown in Figure 40.

6-4 GROUNDWATER MODEL

6-4.1 Numerical Modelling Scenarios

The following numerical scenarios were simulated from the calibrated model:

- Scenario 1: Abstraction from scavenger wells (Dewatering impact).
- Scenario 2: Abstraction from future/conceptual scavenger wells (Dewatering impact).
- Scenario 3: Contaminant plume without scavenger wells (no mitigation).
- Scenario 4: Contaminant plume with scavenger wells (with mitigation).

6-4.1.1 Scenario 1 – Abstraction from existing scavenger wells (Dewatering impact)

Abstraction from the scavenger wells (refer to Figure 47):

- South deep scavenger wells – 2 513 m³/day to 3000 m³/day.
- Doornpoort tailings scavenger wells – 3 344 m³/day to 4000 m³/day.

Total 5 857 m³/day (min) to 7000 m³/day (max).

The model indicates the predicted cones of depression, resulting from the scavenger wells. The scavenger wells are effectively dewatering the shallow aquifer below the tailings facilities creating a hydraulic barrier. The unnamed tributary below the tailings in the north could experience baseflow reduction of between 2 to 3 m³/day and is deemed negligible.

6-4.1.2 Scenario 2 – Abstraction from future/conceptual scavenger wells (Dewatering impact)

Abstraction from the scavenger wells (refer to Figure 48):

- South deep scavenger wells – 2 513 m³/day to 3000 m³/day.
- Doornpoort tailings scavenger wells – 3 344 m³/day to 4 000 m³/day.
- Future scavenger well abstraction at 3 100 m³/day.

Total abstraction from all boreholes at 10 100 m³/day.

The model indicates the predicted cones of depression, resulting from the scavenger wells. The scavenger wells are effectively dewatering the shallow aquifer below the tailings facilities creating a hydraulic barrier. The unnamed tributary below the tailings in the north could experience baseflow reduction of between 3 to 4 m³/day and is deemed negligible.

6-4.1.3 Scenario 3 – Contaminant plume without scavenger wells

This scenario simulated unmitigated plume movement of seepages from tailings likely to be ARD, high in total dissolved solids (2 000 – 4 000 mg/L), sulphate (800 – 2 800 mg/L), with sulphate use as conservative tracer. The plume expands at a rate of 20 to 30 m a year and dilutes at the plume front due to dilution with uncontaminated groundwater.

The average sulphate concentration entering the Leeuspruit is also expected to increase over time from approximately 500 mg/l during 2025 to 2800 mg/l in year 2050 (refer to Figure 49, Figure 50 and Figure 51).

6-4.1.4 Scenario 4 – Contaminant plume with scavenger wells

This scenario simulated the plume with drilled scavenger wells as mitigation through hydraulic containment. It follows that there is a significant reduction in plume expansion with more than 40% of the plume captured as can be seen in Figure 52 to Figure 53 below.

The average sulphate concentration entering the Leeuspruit is expected to decrease from approximately 2800 to 500mg/l in 2050. This confirms monitoring results in which scavenger wells are effective in abstracting contaminated groundwater from the aquifers, while the numerical groundwater flow and contaminant transport model show that the scavenger wells will be effective in containing the spread of the plume.

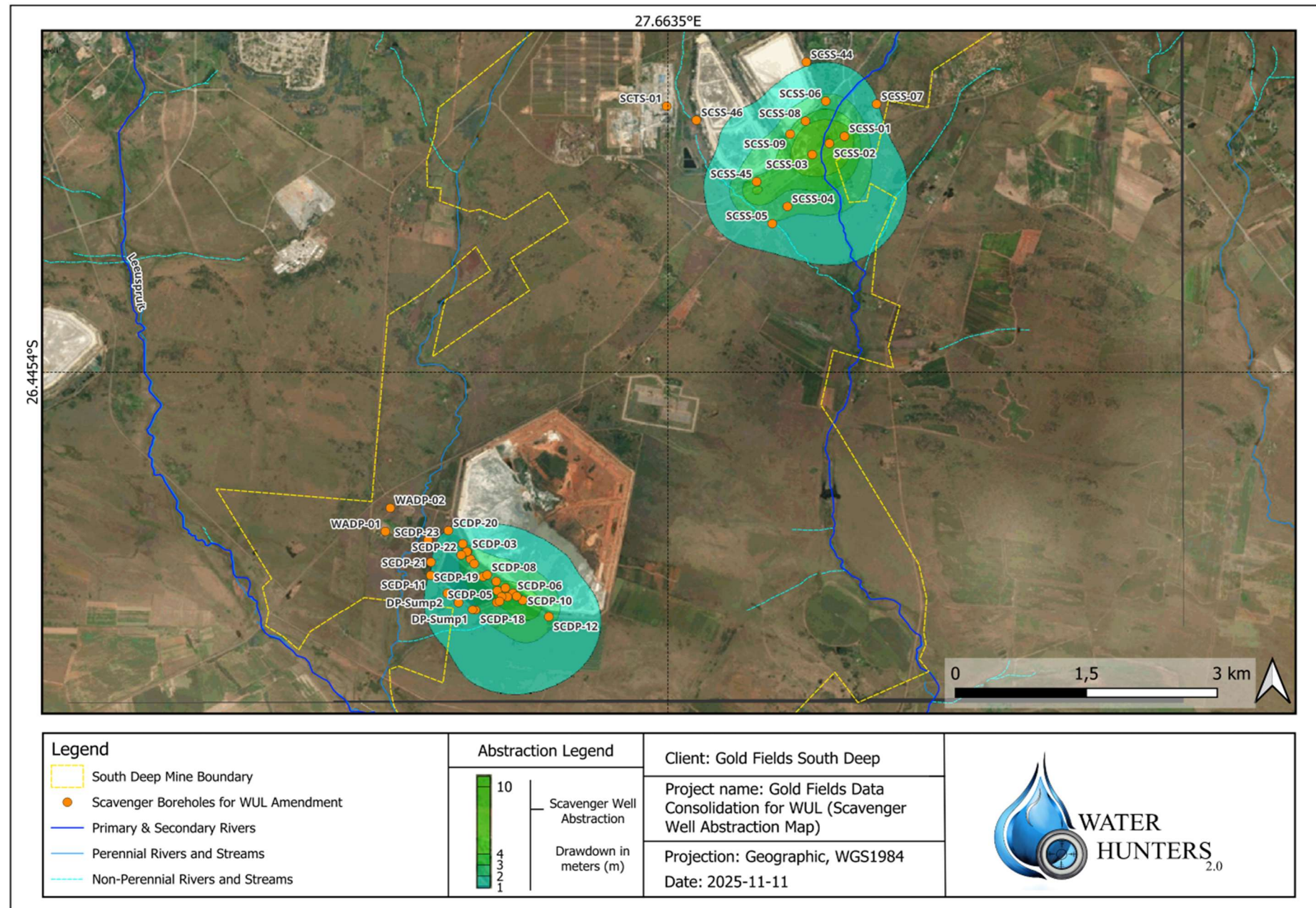


Figure 47: Dewatering scenario (Existing scavenger wells)

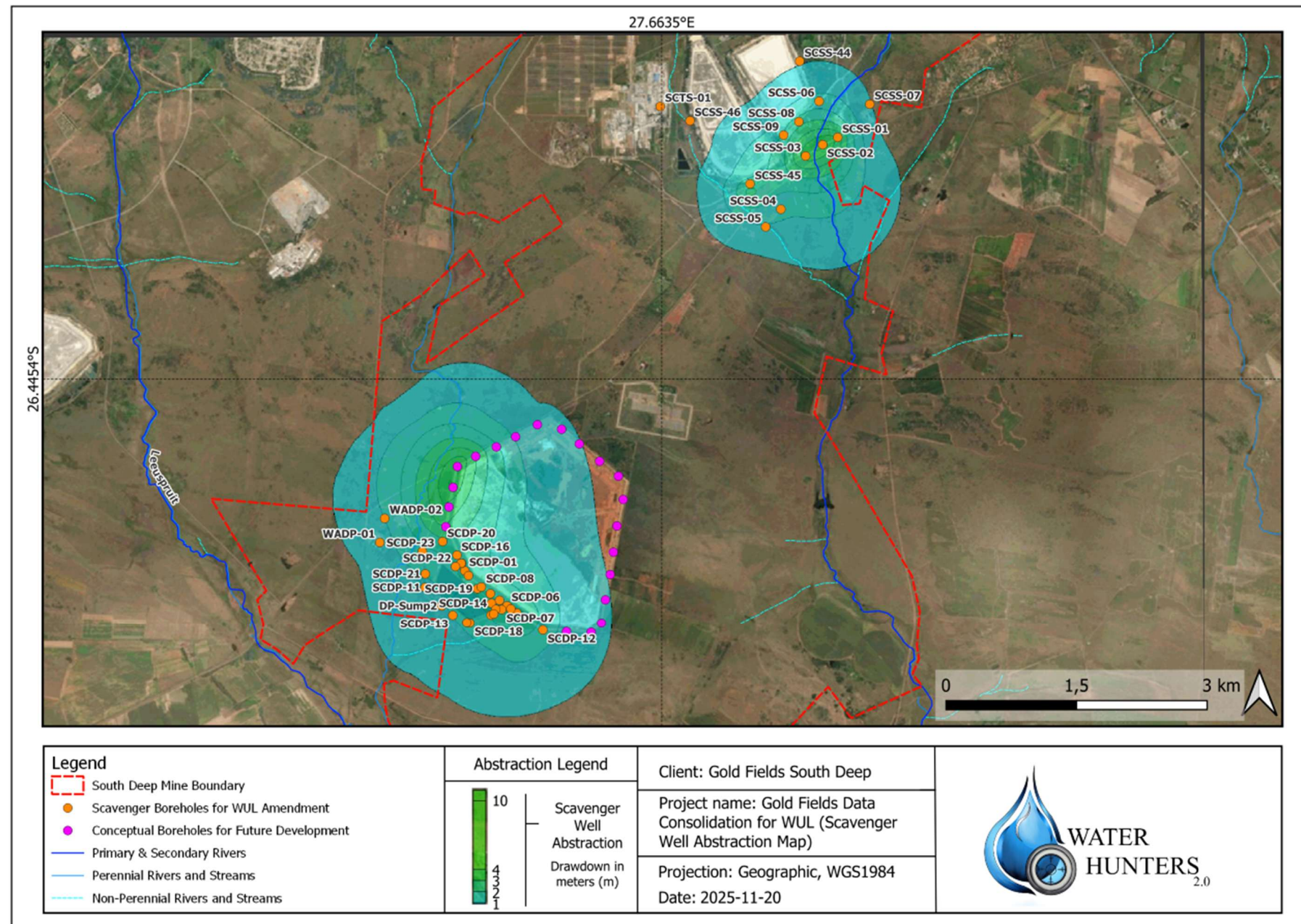


Figure 48: Dewatering scenario (Existing + Future scavenger wells)

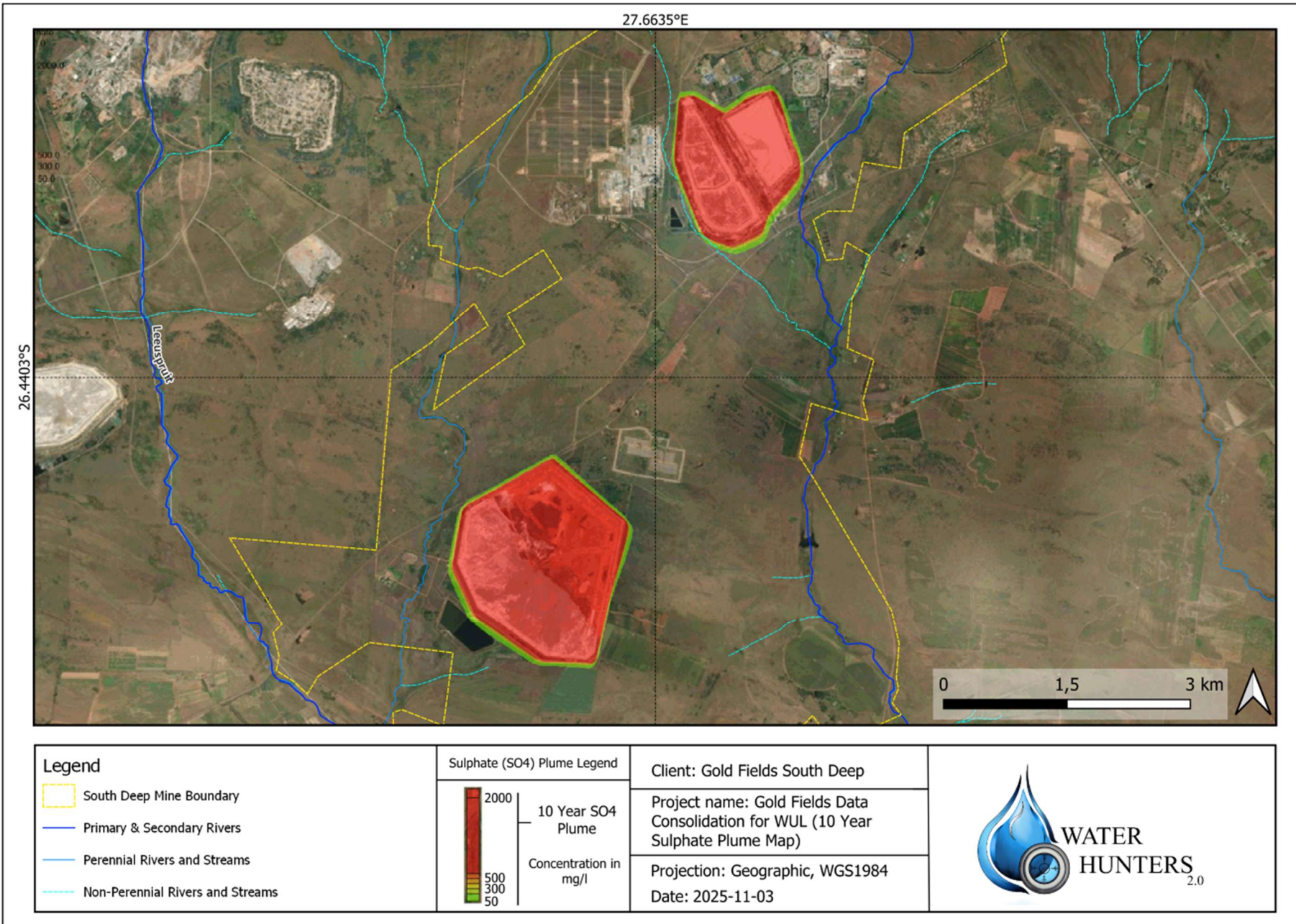


Figure 49: Unmitigated plume – 10 years

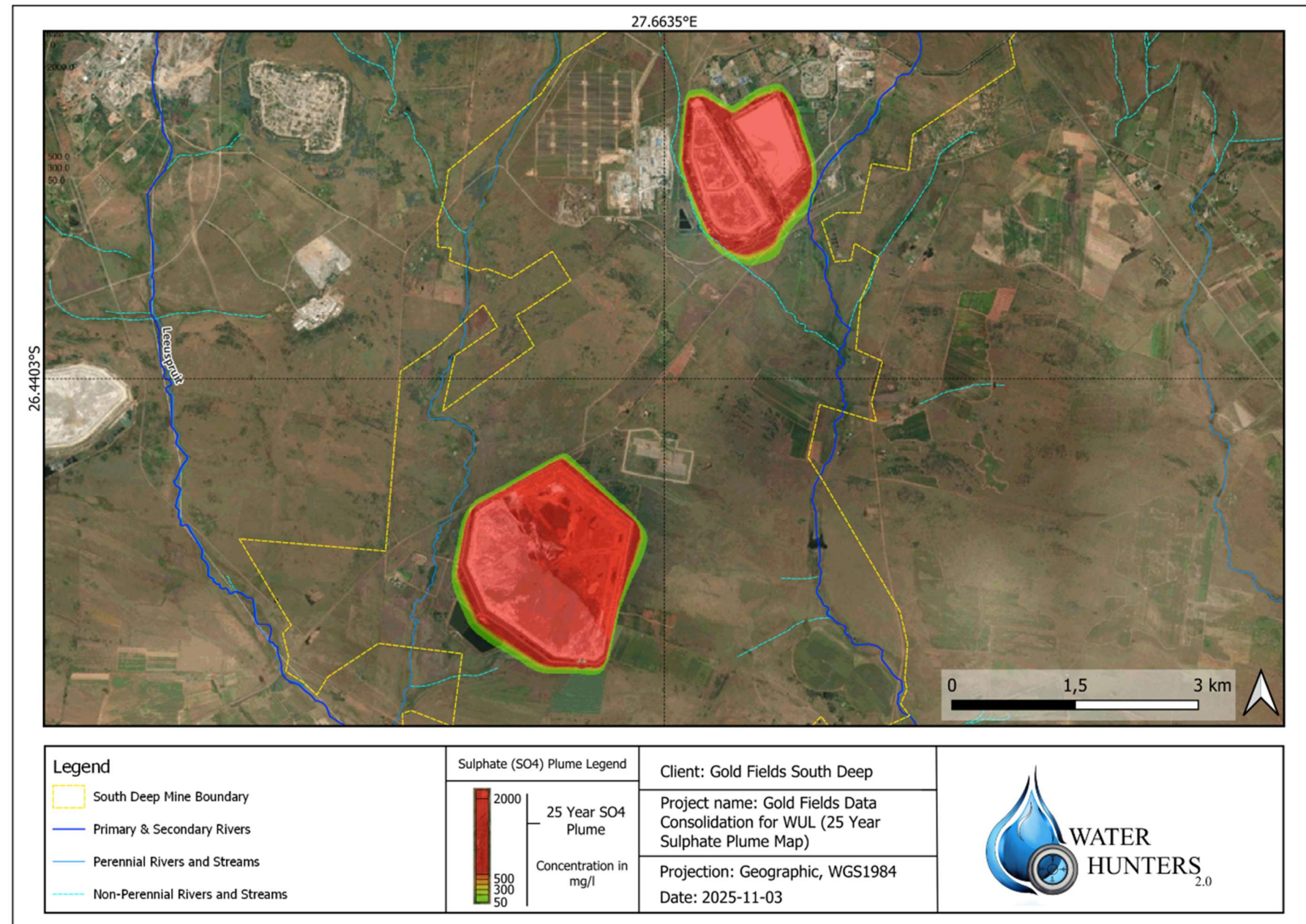


Figure 50: Unmitigated plume – 25 years

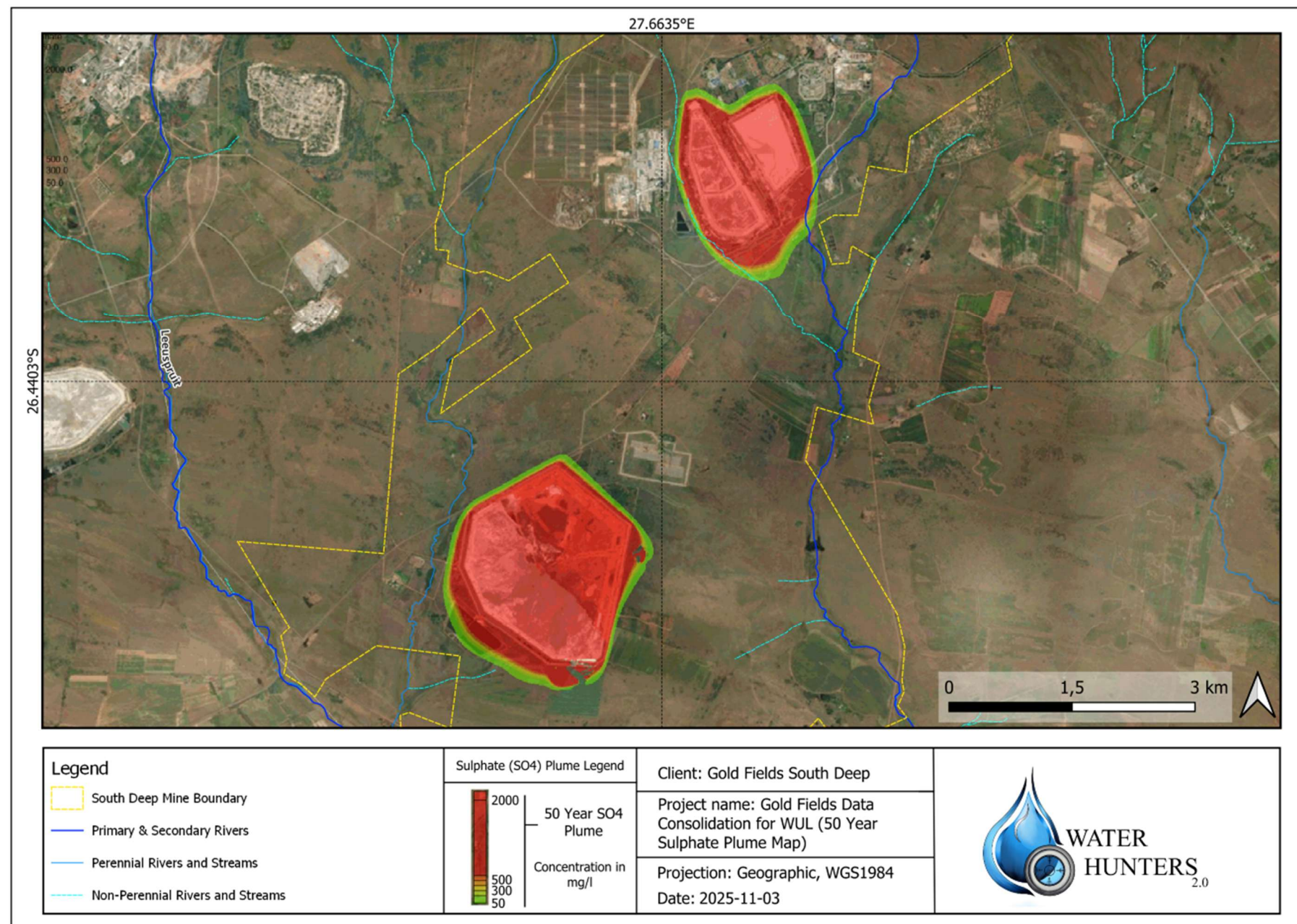


Figure 51: Unmitigated plume – 50 years

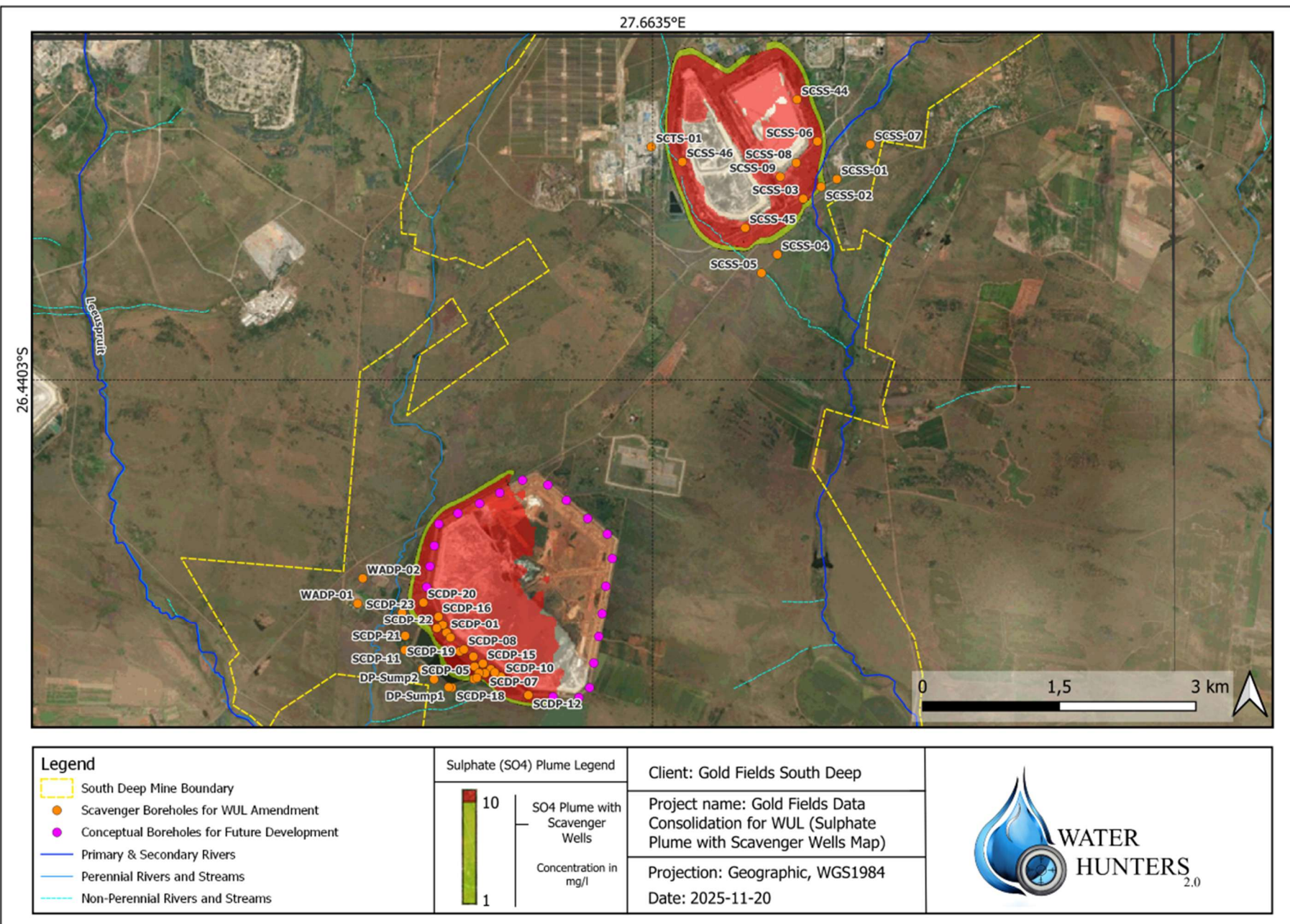


Figure 52: Mitigated plumes after 10 years with scavenger wells

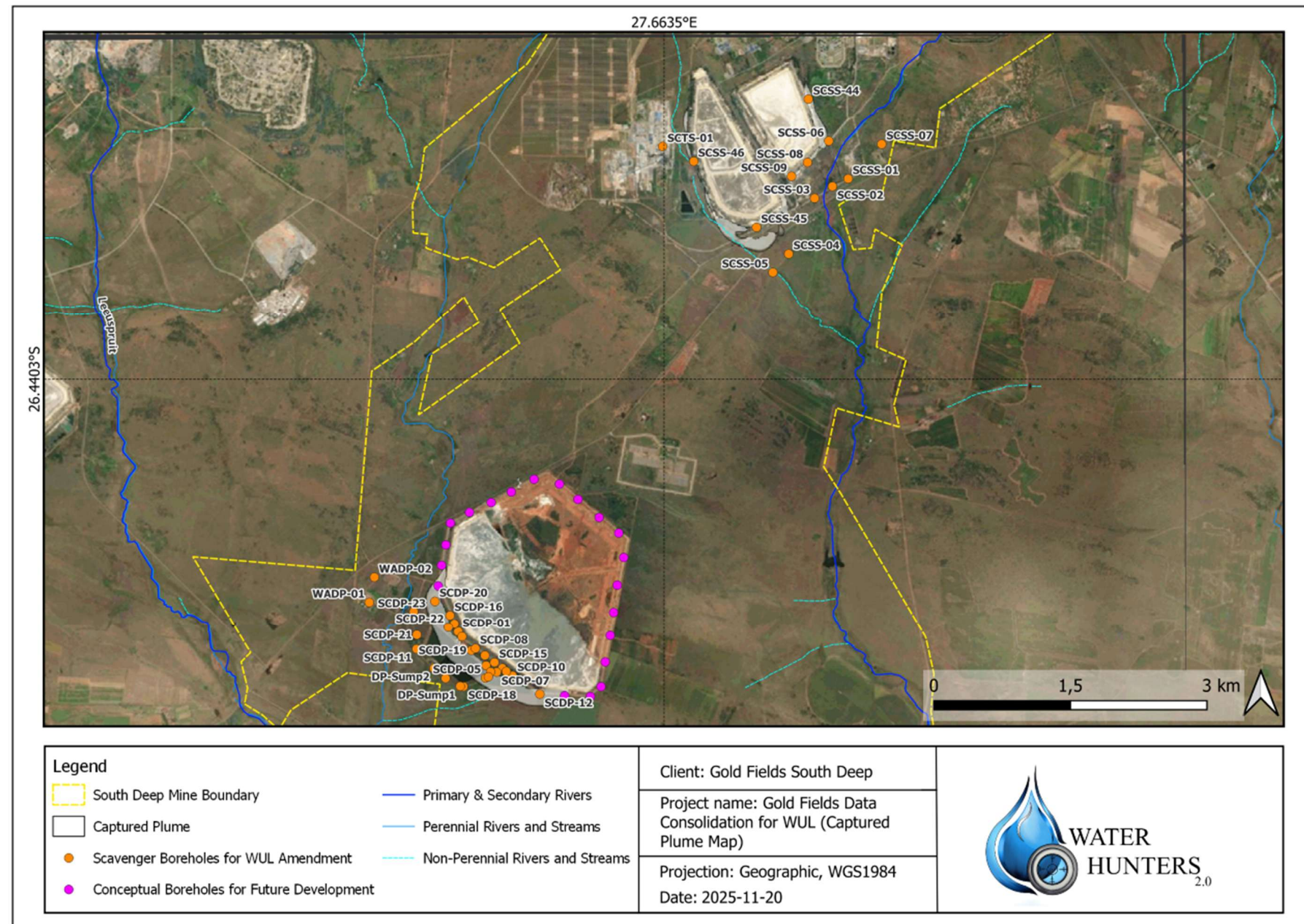


Figure 53: Mitigated plumes after 10 years with scavenger wells

6-4.2 Recommendations

The following recommendations are put forward:

- Authorised abstraction volume of 3 686 544 m³/annum to align with modelled containment requirements. This is motivated as it is Category B medium scale abstraction operation.
- Maintain existing scavenger borehole network and pumping regime to ensure continued plume containment.
- Physical monthly groundwater level measurements of abstraction boreholes. It is crucial to monitor the groundwater levels and volumes in response to abstraction. This is to ensure successful dewatering and collection of contact water moving through the subsurface.
- It is recommended to do a comprehensive quarterly analysis at an accredited laboratory for parameters pH, EC, total dissolved solids, major anions and cations (Ca, Mg, Na, NO₃, Cl, SO₄,) and metals Al, Fe, and Mn.
- It is recommended that proposed abstraction boreholes are pumped according to the recommended sustainable yield, and at the proposed pumping schedule of 24 hours of pumping per day.
- Reassess abstraction rates periodically based on observed drawdown and recharge trends.

6-5 WASTE

A waste inventory of general and industrial solid (hazardous) wastes generated by the South Deep Gold Mine is summarised in Table 61 and with where available, an estimate of the amount of each waste produced is also stipulated. Sections below further summarise types of waste generated in South Deep Gold Mine.

6-5.1 Domestic Waste Disposal

Domestic waste at the mine is collected in dedicated bins located throughout the mine property. From the bins, the waste is transported for temporary storage to containers located at the mine's industrial waste site where recyclable waste is sorted by a local contractor. The sorted waste is then removed to a permitted general waste disposal facility site in Westonaria.

6-5.2 Industrial Waste Disposal – Industrial Waste Site

Industrial waste is transported to the respective salvage yard where it is sorted by a private contractor. Recyclable waste is either sold or returned to the mining process while unusable waste is removed by hazardous waste contractors and disposed of offsite at approved waste disposal sites. The industrial waste site has been operational for approximately 34 years but is no longer being used.

6-5.3 Tailings Material

Based on the static and kinetic geochemical testing undertaken for the Doornpoort TSF (SLR, 2025), the tailings are classified as potentially acid generating (PAG). The static geochemical assessment found that the fresh outlet slurry, mature tailings and plant slurry samples generally have elevated sulphide content, low Neutralisation Potential Ratios and insufficient neutralisation capacity relative to their acid potential. The tailings exhibit short-term neutralising capacity but are expected to become PAG over the intermediate to long term.

The results of the 20-week humidity-cell testing show that the readily available carbonate neutralisation minerals are progressively depleted, while acid-generating sulphide minerals remain. Following the humidity-cell testing, the top, middle and bottom tailings composites were classified as acid generating, while the current plant slurry composite remained classified as PAG.

Although the tailings and associated seepage waters currently generally exhibit neutral to alkaline conditions, this is attributed to short-term mineral buffering and alkalinity introduced through the plant process. The current neutral or alkaline conditions should therefore not be interpreted as evidence that the tailings are non-acid generating. The study concluded that the tailings have the potential to become net acid generating over the longer term as the available neutralisation capacity is depleted.

6-5.4 Water from Underground Workings

As the mine is situated in the Witwatersrand Basin, underground water seeping in from the fissures could be contaminated by acid generating material. This water is contained and used in the mine water circuit.

Table 61: Types of domestic and industrial waste generated by South Deep Gold Mine

Waste produced	Weekly quantity estimate	Handling	Storage	Applicability of the integrated waste management steps			
				Avoid	Use	Minimise	Disposal
General Waste							
Domestic waste (including office waste and organic matter)	2.5 tons at waste site 50 x 85 ℓ drums	Dustbins and designated bins throughout the mine	Storage bins, removed weekly to a recycling station		Recycling by local Small, Medium, and Micro Enterprises (SMME)	Sorting of waste and compaction of similar wastes where possible	Non-recyclable waste – by local municipality to general waste site on a weekly basis
Garden waste	1 ton	Collected in bins	Stored in demarcated skip		Composting for re-use in gardens		Unusable material collected by local municipality to general waste site on a weekly basis
Building rubble	Unknown	Collected in specifically demarcated containers	Stored at salvage yards	Avoid contamination with other waste			Normally in a general waste site
Hazardous waste							
Cleaning agents	Unknown	Dustbins at hostels	Dedicated storage bins, removed weekly to a recycling station			Sorting of waste and compaction of similar wastes where possible	Disposed at appropriately permitted waste disposal site
Medical waste	3 bins (sharps) 4 boxes (general) 250 out patients (linen)	Collected in specially demarcated medical waste bins	In medical station in containers, removed weekly or daily (contaminated linen)				Removed by Steiner Services for incineration
Sewage sludge	110 kg/day (dry sludge)	From treatment plant – dried in drying beds	Stockpiled at treatment plant		Potential beneficial use in mine areas such as reclamation and mine gardens		Dependent on classification – possible disposal on tailings dams
	Unknown	From French drains – drains maintained by local municipality	None				Disposal by local municipality every two weeks
Screenings and grit from wastewater	1 black bag	6m³ lidded skip	None				Disposed through Enviroserv

Waste produced	Weekly quantity estimate	Handling	Storage	Applicability of the integrated waste management steps			
				Avoid	Use	Minimise	Disposal
treatment work/pump stations							
Plastic containers (chemicals and oil)	2 tons	Collected in specifically demarcated containers	Removed weekly to salvage yards – stored in demarcated bins/areas underlain by impermeable substrate		Containers could be returned to suppliers	Empty hazardous substances containers will be rinsed and then crushed so that they are rendered useless	Supplier or hazardous waste site
Old oil, grease and oil rags	11 x 210 ℓ drums	Collected in specifically demarcated drums within a bunded area	Removed weekly to salvage yards – stored in demarcated bins/areas underlain by impermeable substrate		Can be cleaned and reused Sold to recycling contractor		Sold to used-oil contractor for recycling (usually Oilkol)
Wastes from offices (fluorescent lights and computer parts)	Unknown	Collected in specifically demarcated containers	Removed weekly to salvage yards – stored in demarcated bins/areas		Computer parts can be recycled		
Used materials from shafts and Gold Plant including fluorescent lights, asbestos, plastics, electrical cable, batteries, tyres, wire mesh, trapping wire, wood and cable and scrap metal.	2-3 210 ℓ drums 33 tons (1 750 tons/year)	Collected into specifically demarcated containers and screened for radioactivity	Clean material stored at salvage yards stored in demarcated bins/areas underlain by impermeable substrate	Avoid contamination with other waste	Sold to public	Sorting of waste and compaction of similar wastes where possible	Disposed at appropriately permitted waste disposal site

Waste produced	Weekly quantity estimate	Handling	Storage	Applicability of the integrated waste management steps			
				Avoid	Use	Minimise	Disposal
Used explosives boxes	Unknown	Collected on daily basis at shaft complexes	Taken to industrial waste site daily Taken to planned detonation bay near Twin Shaft daily			Detonation to render safe	To be collected by supplier
Contaminated soils	Unknown	In-situ if possible, otherwise collected in specifically demarcated container	Stored at soil clinic	Engineering controls and good housekeeping		Treat to render inflammable	To be determined by classification
Used chemicals from Gold Plant (hydrochloric acid and lime)	Unknown	Collected in containers in Gold Plant			Returned to suppliers		Returned to suppliers
Spills of materials in Gold Plant	Unknown	Drained into sump	Reprocessed		Recycled back into the process		

6-6 ORGANISATIONAL STRUCTURE

The organisational structure that will implement the IWWMP in accordance with the management plan is set out in Section 3-6 and presented in Figure 7. The implementation of the IWWMP will require the continued involvement of several key managers as well as requiring the co-operation of all mine employees and contractors.

6-7 RESOURCES AND COMPETENCE

South Deep JV: South Deep Gold Mine currently comprises underground mining, engineering, process, technical, administration and the surface infrastructure-related operations that are undertaken during the operational phase. The management, operational and monitoring procedures have been compiled to manage the significant aspects and impacts of the activities, products, and services of South Deep JV: South Deep Gold Mine. All environmental aspects are handled by the Environmental Department.

Management and Administration are currently under the General Manager, who is suitably qualified and legally appointed. His responsibilities include, *inter alia*, overall management and control of the South Deep Gold Mine operation. This comprises of policy making, daily key decisions, controls, as well as all the necessary administration responsibilities.

The Human Resources Department is responsible for all personnel and community related matters. The Technical Department, under a suitably qualified Technical Manager and respective Head of Departments, some of whom are legal appointments, are responsible for the management and control of the survey, geological, environmental and occupational health aspects of the mine. The operations are under the management and control of a suitably qualified and legally appointed manager and operational staff. They are responsible for all the relevant Health, Safety, Environment and Community (HSEC) and production aspects of the mine.

6-8 EDUCATION AND TRAINING

6-8.1 The South Deep JV: South Deep Gold Mine Enduleni Human Resources Development Campus

The South Deep JV: South Deep Gold Mine Enduleni Training Centre is located on the mine's property and typically provides education and training for the higher volume, medium to lower complexity skills required, exclusively to Gold Fields' employees (inclusive of contractors rendering services to South Deep JV: South Deep Gold Mine). The centre offers Human Resources Development interventions/courses of varying duration in the following principal skills fields:

- Induction and refresher training;
- First Aid training;
- Skills training;
- Learnerships (practical);
- Skills programme training;
- Portable skills training;
- Adult Basic Education and Training (ABET);
- Diversity and life skills training; and
- Leadership development.

6-8.2 Management Development

An important outcome of the management review process is the scheduling of a number of learning interventions for supervisors and managers. These extend from relatively routine educational, experiential

learning and coaching/mentoring interventions, many of which are provided in-house by South Deep JV: South Deep Gold Mine or through GFBLA, to advanced managerial courses provided by external service providers. The mine has determined that there are management and leadership skills requirements at three levels:

- First line/ supervisory management;
- Middle management; and
- Executive management.

Consequently, Supervisory Development Programme, Middle Management Development Programme and Executive Development Programmes have been identified as appropriate interventions to address the competency gaps.

6-8.3 Portable Skills

Skills development planning at South Deep JV: South Deep Gold Mine encompasses training and development that support the current position requirements. However, many of the skills that will be provided to employees as a core business competence will be transferable to other mining operations and beyond the mining industry.

The focus of these skills is to meet some or all of the following objectives:

- Enhance employee potential that will lead to placement in alternative employments.
- Support income generating activities beyond South Deep JV: South Deep Gold Mine.
- Provide skills that can be utilised not only in the formal sector but in the informal sector as well (this will especially become the focus of the mine closer the end of the LoM).

6-9 INTERNAL AND EXTERNAL COMMUNICATION

Stakeholders are broadly defined as people or entities that have an interest in or that are affected by the operation. Structures are in place to meet the representatives of the surrounding communities and other key stakeholders on a regular basis. Internal communication is done through meetings, bulletin boards, e-mail, memorandums, intranet, screen display and reports. External communication is done through catchment forums; internal communication bulletins; safety notice boards; and e-mails, memorandums and intranet.

6-10 AWARENESS RAISING

Part of South Deep JV: South Deep Gold Mine's approach to environmental management is the development of an Environmental Awareness that aims to raise awareness of environmental issues amongst all staff. Methods of awareness include monthly environmental articles/topics, regular community meetings, induction, bulletin, environmental campaign, environmental policy as well as commemorating environmental calendar days such as arbour week, earth day, world environmental day, water saving week etc.

External communication and awareness raising is conducted through newsletters, telephone calls, e-mails, and periodic meetings. Information is distributed in the following manner:

- Open days and public meetings;
- Local newspaper advertisements; and
- Via the Gold Fields web site.

In addition, all employees, contractors and directors are made aware of company policies and standards as well as environmental obligations directly related to their job. It is every employee's and contractor's

responsibility to comply with the policies and standards relating to their work and to seek assistance from a manager or supervisor, or other source of advice listed if they do not fully understand their legal or company obligations or the application thereof.

Awareness will continue to be provided for the proposed WUL and its addendum amendments, and consolidation project.

6-11 MONITORING AND CONTROL

The key to the success of environmental management lies in the effective implementation of the proposed mitigation and management measures. Monitoring provides qualitative and quantitative information pertaining to the possible impacts of the development on the environment and enables the measurement of the effectiveness of environmental management measures. The proposed water and biomonitoring programme at South Deep Gold Mine will be executed by the appointed service providers. South Deep JV: South Deep Gold Mine currently uses the services of Envass. The monitoring programme will allow the mine to monitor its compliance in terms of the NWA for its mining operations.

In terms of NWA, South Deep JV: South Deep Gold Mine is required to comply with all the monitoring requirements as set out in the WUL that was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705), and the addendum to the issued WUL which was issued on 29 July 2021.

6-11.1 Surface Water Monitoring

A monitoring programme is essential as a tool to identify any risks of potential impacts as they arise and to assist in impact management plans by assessing if mitigation measures are operating effectively. Monitoring should continue to be implemented throughout the LoM. The water quality monitoring should continue for the duration of the mining at South Deep Gold Mine as presented in Table 62 and Figure 54.

Table 62: Surface Water Quality Monitoring Location

ID No	Description	Coordinates
S11B	Upstream of mine in Leeuspruit at Vereeniging Road (R28).	26°23'45"S; 27°42'1"E
S11A	Upstream of mine in Leeuspruit in access road to mine.	26°24'17"S; 27°41'42"E
S13	Tributary as Delta.	26°24'54"S; 27°41'6"E
S6	Downstream of mine in Leeuspruit.	26°25'18"S; 27°40'54"E
S10	Downstream of mine in Kariegaspruit.	26°25'36"S; 27°40'24"E

As per the issued 2018 WUL, the quality of water containing waste to be irrigated with must not exceed the limits as per Table 63. Where applicable, the analysis results are compared to relevant water quality standards.

Table 63: Water quality parameters relevant for sampling

Variable	WUL Water Quality Limits
pH	6-9
Electrical Conductivity (EC)	150
Sodium Absorption Ratio (SAR)	5
Chemical Oxygen Demand (COD)	75
Faecal Coliforms per 100ml	500
E-Coli per 100ml	0
Suspended Solids (mg/l)	25
PO ₄ (mg/l)	10
NO ₃ / NO ₂ (as N) (mg/l)	5

According to the WUL, the quality of wastewater discharged into the Leeuspruit must not exceed the limits as given in Table 64.

Table 64: Quality of wastewater to be discharged

Variable	Unit	Limit
pH		5-9.7
Electrical conductivity (EC)	mS/m	170
Chemical Oxygen Demand (COD)	mg/l	75
Nitrate/ Nitrite as Nitrogen (NO ₃ /NO ₂ as N)	mg/l	1
Ortho-Phosphate as Phosphorous (PO ₄ as P)	mg/l	1
Total Dissolved Solids (TDS)	mg/l	1 200
Sulphate (as SO ₄)	mg/l	500
Total Cyanide (as CN)	µg/l	200
Magnesium (as Mg)	mg/l	70
Sodium (as Na)	mg/l	200
Aluminium (Al)	µg/l	300
Cadmium (Cd)	µg/l	3
Copper (as Cu)	µg/l	2000
Iron (as Fe)	µg/l	2000
Manganese	µg/l	400
Uranium (U)	µg/l	30
Zinc (Zn)	mg/l	5
Calcium (as Ca)	mg/l	100
Arsenic (As)	µg/l	10

6-11.2 Ground Water Monitoring

Groundwater monitoring as per the WUL 08/C22J/GCEFIJA/8705 of 19 November 2018 states the following:

- The Licensee shall monitor on quarterly basis the water resources at groundwater monitoring points to determine the impact of the facility and other mining activities on the water quality by taking samples at the monitoring points given in Table 65; and
- The date, time, and monitoring point in respect of each sample taken shall be recorded together with the results of the analysis.

A summary of the borehole information is presented in Table 65. The groundwater monitoring borehole distribution is presented in Figure 55.

Table 65: Current Groundwater monitoring points for South Deep Gold Mine

Monitoring Point ID	New Monitoring Point ID	Purpose	Coordinates
SD1	MCSS- 01	Up-gradient of old tailings dams	26°24'28"S; 27°40'40"E
SD2	MCSS- 02	Monitor industrial waste site	26°24'11"S; 27°40'41"E
SD3	MCSS- 03	Up-gradient of waste industrial site	26°24'2"S; 27°40'50"E
SD4	MCSS- 04	Up-gradient of South Shaft WRD	26°24'11"S; 27°41'26"E
SD5	MCSS- 05	Up-gradient of cascade pond	26°24'54"S; 27°40'28"E
SD6	MCTS-01	Up-gradient of new tailings dam	26°24'32"S; 27°39'59"E
SD7	MCTS-02	Determine the extent impacts from new tailings dam	26°24'56"S; 27°39'56 "E
SD9	MCSS- 06	Monitor impact from the evaporation and cascade	26°25'18"S; 27°40'46"E
SD10	MCTS-04	Down-gradient from the new tailings dams	26°25'25"S; 27°40'40"E
SD12	MCSS- 06	Down-gradient from the old Gold Plant, close to the wetland	26°24'50"S; 27°41'5"E
SD13	MCOA-01	Down-gradient from south shaft WRD	26°24'2"S; 27°41'21"E
SD14	MCTS-06	Potential impacts at South Deep waste	26°25'20"S; 27°39'25"E

It should be noted that South Deep JV: South Deep Gold Mine has additional monitoring boreholes as part of their monitoring programme. These boreholes are not listed in the issued 2018 WUL. Refer to Table 66 and Figure 56 below for the additional boreholes which must be included in the monitoring programme.

Table 66: Proposed Additional boreholes to be included in the groundwater monitoring programme

Old Monitoring Point ID	New Monitoring Point ID	Purpose	Coordinates
SD30S	MCSS-07	Monitoring Compliance	26°27'56,4840"S 27°38'6,5760"E
SD33	MCSS-08	Monitoring Compliance	26°28'5,2320"S 27°39'25,9200"E
SD37	MCSS-09	Monitoring Compliance	26°26'59,3880"S 27°39'16,2720"E
SD46S	MCSS-10	Monitoring Compliance	26°27'16,5240"S 27°39'36,2520"E
SD46D	MCSS-11	Monitoring Compliance	26°27'16,7400"S 27°39'36,2520"E
H2	MCSS-12	Monitoring Compliance	26°25'37,9560"S 27°40'47,9280"E
SRK3	MCSS-13	Monitoring Compliance	26°25'36,7320"S 27°40'20,4600"E
SRK4A	MCSS-14	Monitoring Compliance	26°24'47,9880"S 27°39'56,2320"E
FBH1	MIF-01	Monitoring Compliance	26°24'5,364"S 27°38'49,128"E
FBH2	MIF-02	Monitoring Compliance	26°23'33,576"S 27°38'13,596"E
FBH3A	MIF-03	Monitoring Compliance	26°29'9,672"S 27°41'21,516"E
FBH3B	MIF-04	Monitoring Compliance	26°29'33,144"S 27°41'11,148"E
FBH4	MIF-05	Monitoring Compliance	26°27'13,86"S 27°38'6,54"E
FBH5	MIF-06	Monitoring Compliance	26°25'30,612"S 27°38'1,428"E
FBH6	MIF-07	Monitoring Compliance	26°25'36,732"S 27°40'48,144"E
FBH7	MIF-20	Monitoring Compliance	26°23'24,936"S 27°38'11,832"E
FBH8	MIF-08	Monitoring Compliance	26°26'54,276"S 27°41'26,268"E
FBH9	MIF-21	Monitoring Compliance	26°28'29,172"S 27°41'34,476"E
FBH10	MIF-09	Monitoring Compliance	26°23'54,168"S 27°38'33,612"E
FBH11	MIF-22	Monitoring Compliance	26°26'35,268"S 27°40'53,292"E
FBH12	MIF-10	Monitoring Compliance	26°23'53,664"S 27°38'36,528"E
FBH13	MIF-23	Monitoring Compliance	26°28'30,972"S 27°41'6,864"E
FBH14	MIF-12	Monitoring Compliance	26°28'53,616"S 27°42'3,564"E
FBH15	MIF-13	Monitoring Compliance	26°26'40,488"S 27°41'33,504"
FBH16	MIF-14	Monitoring Compliance	26°26'27,492"S 27°41'33,324"E
FBH17	MIF-15	Monitoring Compliance	26°25'28,524"S 27°41'40,632"E
FBH18	MIF-16	Monitoring Compliance	26°25'17,508"S 27°41'44,628"E
FERRIERA	MIF-18	Monitoring Compliance	26°25'47,388"S 27°41'26,916"E
THUSANANG	MIF-19	Monitoring Compliance	26°24'53,856"S 27°42'6,51"E

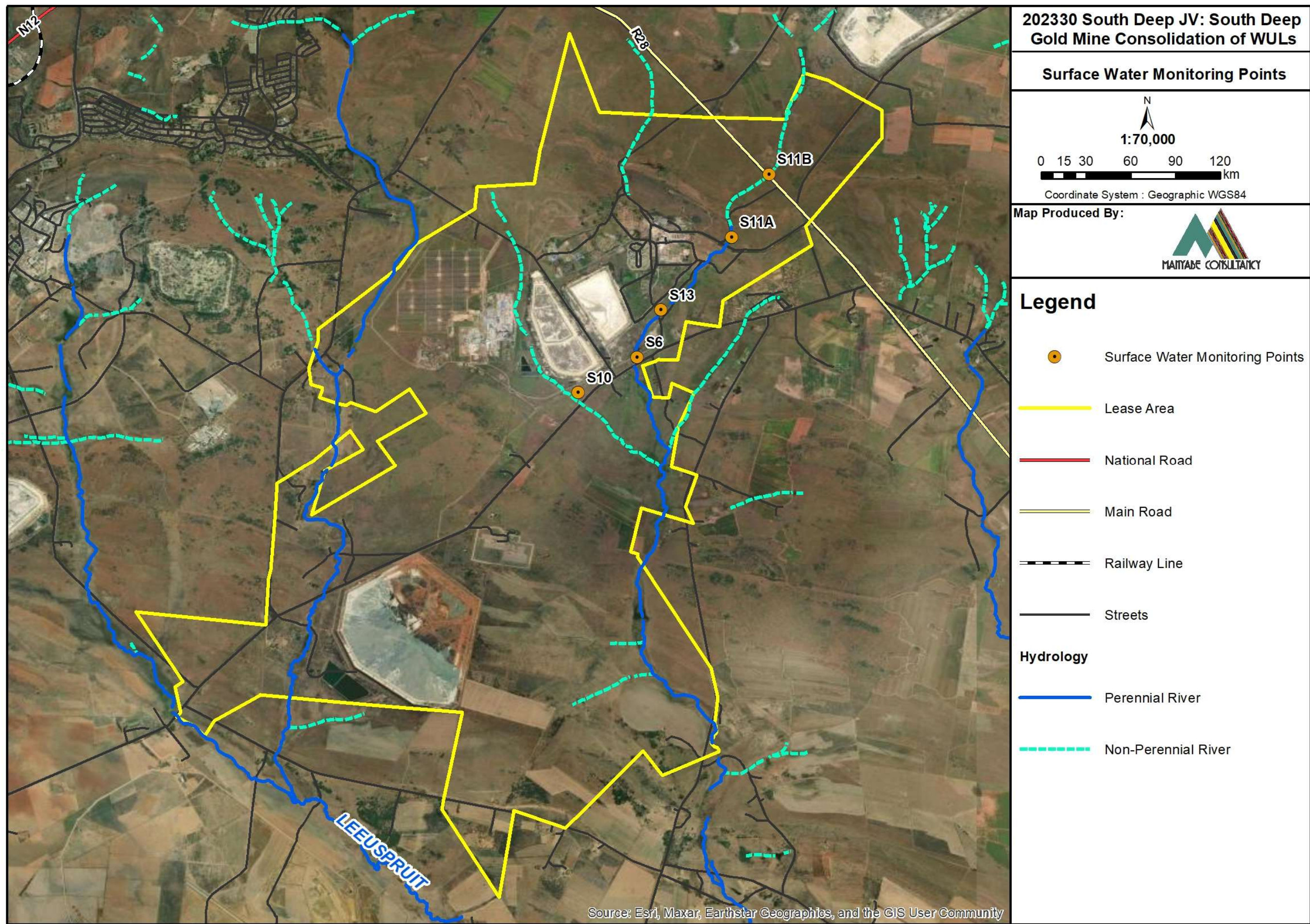


Figure 54: Surface Water Monitoring Localities

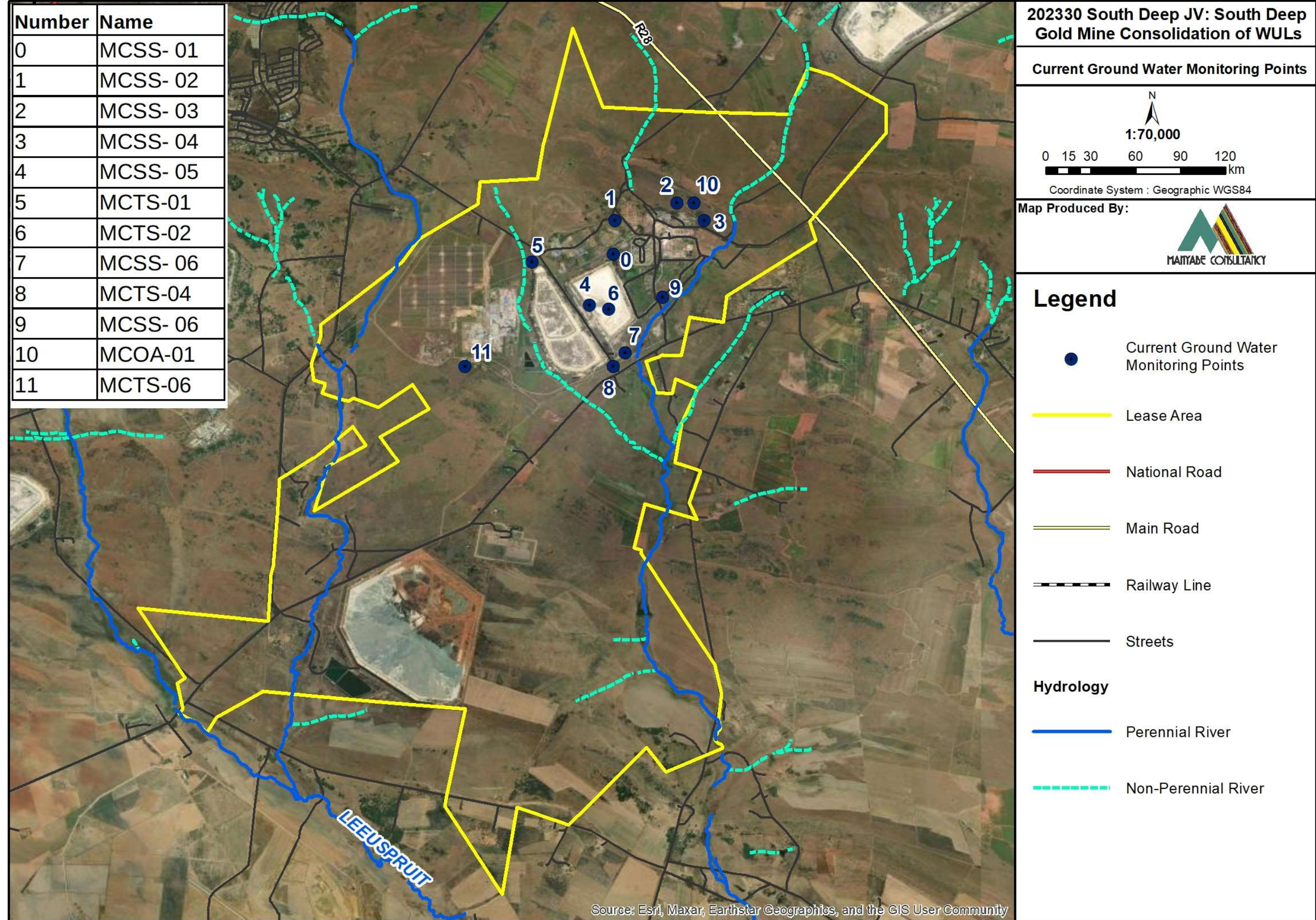


Figure 55: Locality of Ground Water Monitoring boreholes at South Deep Gold Mine

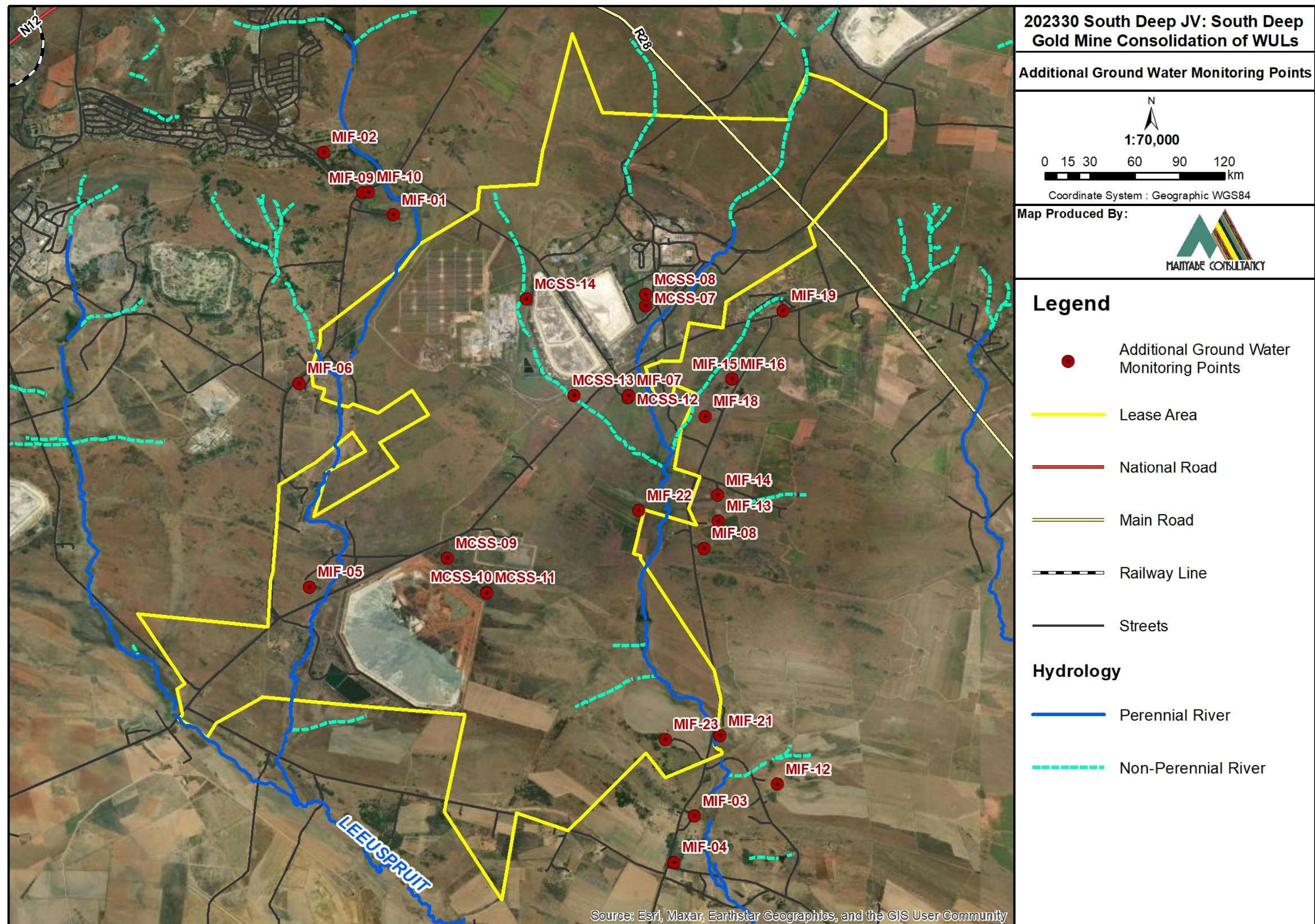


Figure 56: Additional Ground Water Monitoring Boreholes consolidation for WUL amendment

6-11.3 Biomonitoring

The biomonitoring programme is in place, and monitoring is conducted bi-annually, once during the wet season and once during the dry season. Locations of biomonitoring are presented in Table 38 and Figure 34 in Section 5-12 above.

The objectives the biomonitoring are to monitor any changes to the aquatic environment and the associated biota at identified sites within the mine:

To achieve this, the objectives of biomonitoring include the following:

- Characterise the biotic integrity of aquatic ecosystems;
- Evaluate the extent of site-related effects in terms of selected ecological indicators;
- Compare results to previous survey results with the aim to detect environmental trends in biotic integrity;
- Identify potential impacts and recommend suitable mitigation measures; and
- Identify listed aquatic biota based on the latest International Union for Conservation of Nature (IUCN) rankings, or other pertinent conservation ranking bodies.

The biomonitoring points are given in

6-11.4 Waste monitoring

The objective of waste monitoring is to ensure the following:

- Minimisation of general waste;
- Minimising the consumption of natural resources;
- Reduction, recycling and recovery of waste;
- Preventing pollution and ecological degradation; and
- Meeting regulatory requirements.

Waste monitoring will be conducted as required and the volumes generated and disposed of for the different waste streams will be recorded.

6-12 RISK ASSESSMENT/BEST PRACTICE ASSESSMENT

The BPGs that apply to the operations and where the requirements are addressed in this IWWMP are presented in Table 67.

Table 67: BPGs applicable to this IWWMP

BPG	Section reference in this IWWMP
All applicable BPGs	68SECTION 5:
A2: Water Management for Mine Residue Deposits	SECTION 6:
A4: PCDs	Sections 6-1.3 and 6-1.6.1
G1: Stormwater Management	Sections 5-9 and 6-2
G2: Water and Salt Balances	Section 6-3
G3: Water Monitoring Systems	Section 6-11
G4: Impact Prediction	Sections 6-12
H1: Integrated Mine Water Management	This IWWMP
H2: Pollution Prevention and Minimisation of Impacts	SECTION 7:
H3: Water Reuse and Reclamation	SECTION 7:

In assessing the risks posed by South Deep JV: South Deep Gold Mine, it is important to consider that the mine has been operational for over 50 years, and as the regulatory requirements have been developed, South Deep JV: South Deep Gold Mine has implemented appropriate management measures. Many of the current and potential impacts can be, and in some cases have been, successfully mitigated and risks reduced

through the implementation of these measures. These management measures are described in this IWWMP under the relevant sections and additional measures that may be required are presented in SECTION 7:.

The extent to which the identified potential impacts on the water resources at the mine have or may still occur is assessed in the environmental monitoring reports and other specialist studies undertaken as appropriate, taking into consideration the requirements of BPG G4: Impact Prediction. The assessed impacts are reviewed in this section.

6-12.1 Risk Assessment Methodology

Risks were identified based on the review of available information supplied by South Deep JV: South Deep Gold Mine, and the specialist studies compiled in support of the WULA for the proposed project.

The methodology used as part of the Risk Assessment can be summarised as follows:

- Conducting a risk assessment to quantify all possible risks that could be applicable.
- Developing corrective and/or mitigation measures.
- Developing and scoping the work required for a full understanding of the risks and addressing these by scheduling the required work for execution.

6-12.1.1 Project Initiation

The best way of expressing the cost-benefit implications for decision-making is to present them as risks. Risk is defined as the consequence (implication) of an event multiplied by the probability (likelihood) of that event. Many risks are accepted or tolerated on a daily basis, because even if the consequence of the event is serious, the likelihood that the event will occur is low. A practical example is the consequence of a parachute not opening, which is potentially death, but the likelihood of such an event happening is so low that parachutists are prepared to take that risk. The risk is low because the likelihood of the consequence is low even if the consequence is potentially severe.

It is also necessary to distinguish between the event itself (as the cause) and the consequence. Again, using the parachute example, the consequence of concern in the event that the parachute does not open is serious injury or death, but it does not necessarily follow that if a parachute does not open that the parachutist will die. Various contingencies are provided to minimise the likelihood of the consequence (serious injury or death) in the event of the parachute not opening, such as a reserve parachute. In risk terms, this means distinguishing between the inherent risk (the risk that a parachutist will die if the parachute does not open) and the residual risk (the risk that the parachutist will die if the parachute does not open, but with the contingency of a reserve parachute) i.e. the risk before and after mitigation.

6-12.1.2 Consequence

The ascription of significance for decision-making becomes then relatively simple. It requires the consequences to be ranked (Table 68) and a likelihood to be defined of that consequence occurring. It should be noted that there is no equivalent 'high' score in respect of benefits as there is for the costs. This high negative score serves to give expression to the potential for a fatal flaw where a fatal flaw would be defined as an impact that cannot be mitigated effectively and where the associated risk is accordingly untenable. Stated differently, the high score on the costs, which is not matched on the benefits side, highlights that such a fatal flaw cannot be 'traded off' by a benefit and would render the proposed project to be unacceptable.

Table 68: Summary of Project Activities

Environmental Costs	Inherent Risk
Human health, faunal populations, loss of livelihoods, individual economic loss and – morbidity/mortality. Loss of species	Fatally Flawed
Human health – morbidity/mortality. Loss of species	High (negative).
Reduced faunal populations, loss of livelihoods, individual economic loss	Moderate-high
Reduction in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance	Moderate-low

Environmental Costs	Inherent Risk
Negative change	Low-moderate
Negative change – with no other consequences	Low
Positive change	High (positive)
No consequences	Negligible
Environmental Benefits	Inherent Benefit
Net improvement in human welfare	Moderate-high
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic development	Moderate-low
Positive change – with no other consequences	Low

6-12.1.3 Likelihood

Although the principle is one of probability, the term ‘likelihood’ is used to give expression to a qualitative rather than quantitative assessment, because the term ‘probability’ tends to denote a mathematical/ empirical expression. A key point here is that likelihood of the consequence occurring must de facto take into account the good international industry best practice that is ‘intrinsically built-in’ to activities or methods.

For example, an electricity transformer will never be constructed without bunding and stones to contain any oil spills due to potential failure of the transformer. To highlight bunding as a specific mitigation measure to reduce the consequence of a spill is simply inappropriate. Likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring are presented in Table 69 below.

Table 69: Likelihood descriptors and definitions

Likelihood Descriptors	Definition
Highly unlikely	The possibility of the consequence occurring is negligible.
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely.
Likely	The consequence may not occur, but a balance of probability suggests it will.
Highly likely	The consequence may still not occur, but it is most likely that it will.
Definite	The consequence will definitely occur.

6-12.1.4 Residual risk

The residual risk is then determined as a function of the consequence together with the likelihood of that consequence. The residual risk categories are shown in Table 70. Additional mitigation to manage (and potentially further reduce) and monitor the residual risk may also be defined. What is important is that the residual risk is what decision-makers must accept if they decide to authorise the proposed activity even if that residual risk is ‘high’. The residual risk cannot and will not be artificially reduced within the assessment to ‘low’ to facilitate decision-making.

Table 70: Residual risk categories

Rating	Nature of implication for Decision – Making
Negligible	Project can be authorised with no risk of environmental degradation
High (positive)	Project can be authorised with little to no risk of environmental degradation
Low	Project can be authorised with low risk of environmental degradation
Low-moderate	Project can be authorised with low to moderate risk of environmental degradation
Moderate-low	Project can be authorised with moderate to low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High (negative)	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised

From the Table 70 above, it is recommended in terms of the “Responsible Party, Table 71 below” to ensure that mitigation measures against the life of the activities.

Table 71: Levels of Risk

Rating	Description	Responsible Party
Negligible	Negligible consequence, definitely unlikely, mitigation not necessary. The risk is of negligible importance. Requires no management action.	Supervisor
High (positive)	No risk and does not require any mitigation action.	Supervisor

Rating	Description	Responsible Party
Low	Low consequence, probably, very minimal mitigation may be required. Requires enhanced management action.	Director
Low-moderate	Low consequence, probably, mitigation may be required. Requires enhanced management action.	Divisional Head
Moderate-low	The risk is not substantial and does require mitigation action.	CEO
Moderate	The risk is not substantial and does not require any mitigation action. Ensure levels of control.	CEO
Moderate- high	The risk is substantial and does require mitigation action.	CEO
High (negative)	High consequence, very probable, mitigation is necessary. The risk is of major importance but through the implementation of the correct mitigation measures, the risks will be reduced to acceptable levels. Requires short-term management action.	CEO
Fatally Flawed	Extreme consequence, extremely probable. The project should not be approved.	CEO

6-12.1.5 *A note on cumulative impacts*

Impacts cannot be assessed in isolation, and an integrated approach requires that cumulative impacts will be included in the assessment of individual impacts. The nature of the impact will be described in such a way as to detail the potential cumulative impact of the activity, if there is indeed a cumulative impact. For example, dust and air emissions cannot be assessed in isolation of the potential cumulative impact of increased emissions into the atmosphere. Similarly, if water quality is improved within the immediate surroundings of the proposed activities, this will most certainly have a ripple effect/ cumulative impact on the greater water quality in the area.

Once all the impacts have been assessed and significance ratings allocated, the EAP will assess the project on a holistic basis to determine the overall project impact on the receiving environment. This will be a function of the individual impacts as well as the cumulative nature of combining all those impacts within a single context/ project.

6-12.1.6 *Describing the impact*

In addition to consequence, likelihood and significance (as described above), nature, extent, duration, reversibility and irreplaceable loss of a resource must also be highlighted for identified impacts.

6-12.1.7 *Nature of the impact*

The nature of an impact refers to a description of the inherent features, characteristics and/ or qualities of the impact.

6-12.1.8 *Scale/ extent of the impact*

Extent refers to the impact footprint or stated differently, the spatial area over which the impact would manifest. Note that if a species were to be lost, then the extent would be global because that species would be lost to the world.

Table 72: Listing of descriptors and associated definitions to determine the extent of an impact.

Extent Descriptors	Definitions
Site	The impact footprint remains within the cadastral boundary of the site
Local	The impact footprint extends beyond the cadastral boundary of the site, to include the immediately adjacent and surrounding areas
Regional	The impact footprint includes the greater surrounding area within which the site is located
National	The scale/ extent of the impact is applicable to the Republic of South Africa
Global	The scale / extent of the impact is global (or world-wide)

6-12.1.9 *Duration of the impact*

Duration is the period of time for which the impact would be manifest. Importantly, the concept of reversibility is reflected in the duration scoring. In other words, the longer the impact endures, the less likely is the

reversibility of the impact.

Table 73: Listing of descriptors and associated definitions to determine the duration of an impact.

Duration Descriptors	Definitions
Construction/ rehabilitation period only	The impact endures for only as long as the construction/ rehabilitation period of the proposed activity. This implies the impact is fully reversible. Like noise and dust.
Short term	The impact continues to manifest for a period of between 3 – 10 years. The impact is reversible.
Medium term	The impact continues to manifest for a period of 10-30 years. The impact is reversible with relevant and applicable mitigation and management actions.
Long term	The impact continues for a period in excess of 30 years. However, the impact is still reversible with relevant and applicable mitigation and management actions.
Permanent	The impact will continue indefinitely and is irreversible.

6-12.1.10 Irreplaceable loss of resources

Irreplaceable loss of resources refers to the degree to which the impact will result in the loss of a resource that is impossible to replace.

Extent Descriptors	Definitions
High	The impact is most likely to or will result in the irreplaceable loss of a resource/s.
Medium	The impact may result in the irreplaceable loss of a resource/s, however applicable mitigation or management interventions may prevent complete loss or provide a suitable substitute/"offset".
Low	The impact will not result in the irreplaceable loss of a resource/s.

The potential impacts and mitigation measures that are expected from the proposed activities are presented in Table 74.

Table 74: Summary of impacts and mitigation measures

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
CONSTRUCTION PHASE						
Section 21 (c) and (i)	- The activities are located within the regulated area of two (2) watercourses, namely UVB01 and CVB01. - No construction/ rehabilitation activities are expected to take place within CVB01. - Construction/ rehabilitation activities within UVB01 will likely disturb the current habitat structure and functionality and may result in the proliferation of AIPS encroaching into the disturbed area if not managed appropriately, which presents a risk of reduced biodiversity and ecosystem functionality.	Direct disturbance of aquatic habitat and ecological structure within the catchment area of the at-risk watercourses associated with the proposed activities.	Aquatic Habitat and Ecological Connectivity	Moderate	- All construction/ rehabilitation activities should take place within the dry season for the region (Mid-April to September). - For every indigenous woody tree species cut down from within watercourses, specifically riparian habitat, three (3) indigenous tree species relevant to the region should be planted in the same vicinity to compensate for the loss of biodiversity. No Threatened and/or Protected Species (TOPS) should be cut or disturbed without a permit being granted from the DFFE. - Sediment netting or similar should be erected around all open excavations to avoid sediment travelling into the surrounding environment. These should be inspected by the Environmental Control Officer (ECO) on a daily basis to ensure that they are fit for purpose. - Concurrent rehabilitation of the construction/ rehabilitation footprint should be conducted. All disturbed areas should be tilled and revegetated with a mixture of indigenous grass species subsequent to backfilling. - All excavation of hydric soil within the outer boundaries of watercourses must be done by hand using spades and picks as far as possible to avoid unnecessary disturbance of the watercourse by heavy machinery. The hydric soil removed must be placed in a designated spoil site in sequence and replaced in inverted sequence directly after each section has been laid. - All hydrophilic plant species within the direct path of the proposed development must be dug up at the roots and placed within a designated storage area and watered on a daily basis using commercially sourced water (unless an existing abstraction WUL has been obtained) until the species are transplanted back post-construction/ rehabilitation.	Low
Section 21 (c) and (i)	- Excess bare soil and sedimentation created from construction/ rehabilitation activities may enter the adjacent watercourses and deteriorate the water quality in comparison to the baseline conditions presented herein. - The introduction of hydrocarbon sources and concrete mix poses a risk of contamination occurring if mitigation measures are not implemented.	Indirect alteration of the water quality within the at-risk and downstream watercourses.	Water Quality	Moderate	- Where possible, construction/ rehabilitation activities, particularly within watercourses, must be undertaken during the dry months to avoid erosion and sedimentation. - Existing vegetation cover surrounding the proposed activities site should be maintained during the construction/ rehabilitation phase. The unnecessary removal of groundcover from slopes must be prevented, especially on steep slopes which will not be developed. - Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. - Sediment barriers (e.g. silt fences/sandbags/hay bales) must be installed immediately downstream of active work areas (including soil stockpiles) as necessary to trap any excessive sediments generated during construction/ rehabilitation. - All bare slopes and surfaces to be exposed to the elements during clearing and earthworks must be protected against erosion using rows of hay-bales, sandbags and/or silt fences aligned along the contours and spaced at regular intervals (e.g. every 2 m) to break the energy of surface flows. - Once shaped, all exposed/bare surfaces and embankments must be landscaped and revegetated immediately. - If revegetation of exposed surfaces cannot be established immediately due to phasing issues, temporary erosion and sediment control measures must be maintained until such a time that revegetation can commence. - All temporary erosion and sediment control measures must be monitored for the duration of the construction/ rehabilitation phase and repaired immediately when damaged. All temporary erosion and sediment control structures must only be removed once vegetation cover has successfully recolonised the affected areas (i.e. >75 % coverage). - After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. Erosion rills and gullies must be filled in with appropriate material and silt fences, or fascine work must be established along the gully for additional protection until vegetation has re-colonised the rehabilitated area. - The proper storage and handling of hazardous substances (e.g. fuel, oil, cement, etc.) needs to be administered. - Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or an impermeable surface and must be protected from the ingress and egress of stormwater. - Drip trays should be utilised at all dispensing areas. - No refuelling, servicing or chemical storage should occur within 30m of any watercourse. - No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site. - Vehicle maintenance should not take place on-site unless a specific bunded area is constructed for such a purpose. - Hazardous storage and refuelling areas must be bunded prior to their use on-site during the construction/ rehabilitation period following the appropriate SANS codes. The bund wall should be high enough to contain at least 110% of any stored volume. The surface of the bunded surface should be graded to the centre so that spillage may be collected and satisfactorily disposed of. - All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. - Contaminated water containing fuel, oil or other hazardous substances must never be released into the environment. It must be disposed of at a registered hazardous waste disposal facility site. - All alien invasive vegetation that colonises the construction/ rehabilitation site must be removed, preferably by uprooting. The contractor should consult the ECO regarding the method of removal. - All bare surfaces across the construction/ rehabilitation site must be checked for AIPs every two weeks and AIPs removed by hand pulling/uprooting and adequately disposed of. - Herbicides should be utilised where hand pulling/uprooting is not possible. ONLY herbicides which have been certified safe for use in wetlands by independent testing authorities are to be used. The ECO must be consulted in this regard. The herbicide	Low

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
					contractor must be certified to apply/utilise the herbicide in question. • The handling and/or killing of any animal species present is strictly prohibited and all staff/personnel must be notified of such incidents. • Wetland fauna (e.g. snakes, frogs, small mammals) that are encountered during the construction/ rehabilitation phase must be relocated to other parts of the wetland under the guidance of the EO or ECO. • Poaching/snaring is strictly prohibited.	
Section 21 (c) and (i) Section 21 (f)	• The hardened surfaces created by the construction/ rehabilitation of the proposed activities will reduce the area of vegetation and infiltration surface, as well as alter the current hydrological flow regime within the catchment area. • This could lead to erosion features developing downslope of the structures if adequate flow management systems are not integrated into the overall design of the proposed activities.	• Direct alteration of the catchment landscape and hydrological flows.	• Catchment Landscape and Hydrological Flows	• Moderate	• All site personnel must undergo environmental induction prior to construction/ rehabilitation commencing. The watercourse delineation and associated buffer zones should be presented therein, and it should be communicated that these areas should be considered no-go, aside from when within the pegged out footprint. • A pre-construction/ rehabilitation walkthrough should be conducted by a suitably qualified botanist to mark any TOPS within the pegged out construction/ rehabilitation footprint. These species should be translocated if possible. • Excess dust observed in the vicinity of the proposed activities must be noted and the appropriate dust suppression techniques implemented to ensure no excess sediment input into the surrounding freshwater resources. • The digging of pit latrines is not allowed under any circumstances. • None of the open areas or the surrounding environment may be used as ablution facilities. • No open fires are permitted on site. • Adequate waste receptacles which are both wind and scavenger proof must be placed throughout the site	• Low
Section 21 (c) and (i)	• The disturbance of freshwater ecosystems as a result of construction/ rehabilitation activities and associated infrastructure may alter the ability of the freshwater ecosystems to provide valuable regulating and supporting, as well as cultural and provisioning, benefits to the surrounding anthropogenic and natural environments.	• Indirect alteration of the ecosystem services provided by freshwater ecosystems within the study area.	• Ecosystem Service Provision	• Low	• All construction/ rehabilitation activities should take place within the dry season for the region (Mid-April to September). • For every indigenous woody tree species cut down from within watercourses, specifically riparian habitat, three (3) indigenous tree species relevant to the region should be planted in the same vicinity to compensate for the loss of biodiversity. No TOPS should be cut or disturbed without a permit being granted from the DFFE. • Sediment netting or similar should be erected around all open excavations to avoid sediment travelling into the surrounding environment. These should be inspected by the ECO on a daily basis to ensure that they are fit for purpose. • Concurrent rehabilitation of the construction/ rehabilitation footprint should be conducted. All disturbed areas should be tilled and revegetated with a mixture of indigenous grass species subsequent to backfilling. • All excavation of hydric soil within the outer boundaries of watercourses must be done by hand using spades and picks as far as possible to avoid unnecessary disturbance of the watercourse by heavy machinery. The hydric soil removed must be placed in a designated spoil site in sequence and replaced in inverted sequence directly after each section has been laid. • All hydrophilic plant species within the direct path of the proposed development must be dug up at the roots and placed within a designated storage area and watered on a daily basis using commercially sourced water (unless an existing abstraction WUL has been obtained) until the species are transplanted back post-construction/ rehabilitation.	• Low
Section 21 (c) and (i) Section 21 (f)	• Discharging activities.	• Impacts on Hillslopes • Soil erosion and bank instability due to increase in water flow. • Contamination of soil and water due to leaks from the infrastructure and from water being discharged.	• Hydropedological Cycle	• Low	• Investigate engineering options to improve bank instability and prevent soil erosion associated with the discharge points and watercourses (i.e. gabions); • Regular monitoring the quality of the water being discharged; • Rip and revegetate compacted areas over the general operational area. This will improve filtration into the soil; • Ensure that stormwater infrastructure is maintained to prevent contaminated water from entering the clean environment; • Exposed soils must be protected by revegetating it to prevent erosion and allow water to infiltrate (grass can be donated to community members, which will also assist in reducing sedimentation runoff); • TSFs to be covered, with vegetation, to minimise windblown dust and prevent contaminated dust deposition onto the surrounding clean environment; • Regular inspections of the area to ensure mitigation measures are correctly implemented and remain effective; • Remove AIPS; • All infrastructure that are not in use is to be removed and disposed of at a licensed facility; • Contaminated soil must be removed and disposed of correctly; and • Rip and revegetate all rehabilitated areas. Regular inspections must be carried out to identify possible erosion and remediation to take place as soon as possible.	• Low
OPERATIONAL PHASE						
Section 21 (f)	• The discharge of treated wastewater into the receiving watercourse may result in deteriorated water quality if appropriate mitigation and monitoring measures are not implemented.	• Direct alteration of the water quality within the at-risk and downstream watercourses.	• Water Quality	• Moderate	• A Maintenance and Monitoring Programme should be composed for all infrastructure and implemented by a suitably qualified professional to ensure that all defects or leakages are identified timeously. • Monitoring for erosion and AIPS encroachment within watercourses should be conducted during routine monitoring of the infrastructure components. Any erosion features observed to have been created as a result of the proposed development should be stabilised and revegetated in consultation with a suitably qualified environmental scientist or engineer (if required).	• Low
Section 21 (c) and (i) Section 21 (f) Section 21 (g)	• The hardened surfaces created by the proposed activities may result in altered land cover and the discharge of treated wastewater may result in additional alteration of the hydrological regime.	• Direct alteration of the catchment landscape and hydrological flows.	• Catchment Landscape and Hydrological Flows	• Moderate	• The control of AIPS should be guided by an AIPS control plan to ensure compliance with the NEMBA. This act states that all landowners must control listed AIPS on their property according to the NEMBA Alien and Invasive Regulations (2014, as amended) and associated Alien Species List (2020). • A contractor must be appointed by the landowner to control all AIPS within the proposed development site. The clearing should take place in a phased manner, starting with the initial clearing and then follow-up and lastly maintenance clearing. The clearing processes typically take 3 years with annual updates of the site-specific AIPS control plan.	• Moderate

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
Section 21 (a) Section 21 (c) and (i) Section 21 (f) Section 21 (g) Section 21 (j)	- Underground fissure water and scavenger well abstraction poses no tangible impact on either the Leeuspruit system. This is evident from long term water level monitoring data, and from current and previous modelling studies indicating no loss of the baseflow component. ✓ Dewatering from the underground does not extend to surface, with deeper aquifer dewatering limited to fissure water that does not extend to the baseflow component of the regolith (unsaturated) and weathered aquifer. ✓ Scavenger well abstraction cones of depression are limited to within 100 m of the positions of these wells, and do not extend to beyond the mining rights.	Loss of flow to aquatic systems due to dewatering, and potential contaminant contributions.	Aquatic biodiversity of the Leeuspruit.	Low	- Authorised abstraction volume of 3 686 544 m³/annum to align with modelled containment requirements. This is motivated as it is Category B medium scale abstraction operation. - Maintain existing scavenger borehole network and pumping regime to ensure continued plume containment. - Physical monthly groundwater level measurements of abstraction boreholes. It is crucial to monitor the groundwater levels and volumes in response to abstraction. This is to ensure successful dewatering and collection of contact water moving through the subsurface. - It is recommended to do a comprehensive quarterly analysis at an accredited laboratory for parameters pH, Electrical conductivity, total dissolved solids, major anions and cations (Ca, Mg, Na, NO₃, Cl, SO₄) and metals Al, Fe, and Mn. - It is recommended that proposed abstraction boreholes are pumped according to the recommended sustainable yield, and at the proposed pumping schedule of 24 hours of pumping per day. - Reassess abstraction rates periodically based on observed drawdown and recharge trends. - Update the model every second to evaluate dewatering impacts.	Low
Section 21 (a) Section 21 (c) and (i) Section 21 (e) Section 21 (f) Section 21 (g) Section 21 (j)	- As in the case of aquatic systems, dewatering and scavenger wells has no tangible impact on privately used boreholes. This is evident from long-term water level monitoring data, and from current and previous modelling studies. ✓ Dewatering from the underground does not extend to surface, with deeper aquifer dewatering limited to fissure water that does not extend to the baseflow component of the regolith (unsaturated) and weathered aquifer. ✓ Scavenger well abstraction cones of depression are limited to within 100 m of the positions of these wells, and do not extend to beyond the mining rights.		Privately boreholes used for potable, livestock, and irrigation usage.	Low		Low
REHABILITATION PHASE						
Section 21 (c) and (i)	- Subsequent to the end of the construction/ rehabilitation phase, the disturbed areas around the proposed activities footprint will be rehabilitated to pre-construction/ rehabilitation (or better) conditions. - This may result in an improvement of the condition of the downstream watercourses if all mitigation measures presented herein are strictly implemented and subsequently monitored.	Improvement of the aquatic habitat and ecosystem structure adjacent to the proposed activities site.	Aquatic Habitat and Ecological Structure	Low	- Concurrent rehabilitation should be implemented. All disturbed areas must be rehabilitation within 30 days of the end of each construction/ rehabilitation activity. - It is the responsibility of the developer to appoint a suitably experienced wetland/aquatic/rehabilitation specialist to compose and implement an approved Watercourse Rehabilitation and Monitoring Plan. The specialist must have a sound knowledge of the watercourses and vegetation within the study area, and his/her appointment must be approved by the ECO. The plan shall include (but not limited to): ✓ Rehabilitation goals and objectives within the at-risk watercourses; ✓ Detailed rehabilitation methodology; ✓ Details for potential structures proposed within watercourses to assist with the prevention of erosion and improve the throughflow of watercourses; ✓ Methods for the removal and control of AIPS within the wetland and riparian areas; ✓ List of proposed plant species to be used during the rehabilitation of watercourses; and ✓ Monitoring requirements to assess how successful the rehabilitation techniques are within the systems. - All post-construction/ rehabilitation building material and waste must be cleared in accordance with the GA/WUL before revegetation of the disturbed footprints takes place. - Erosion features that have developed as a result of construction/ rehabilitation related disturbances are required to be stabilised. This may also include the need to deactivate any erosion head cuts/rills/gullies that may have developed by either compacted soil infill, rock plugs, gabions or any other suitable measures. - Slopes that have been altered due to construction/ rehabilitation/operation must be reshaped to replicate the original condition and contours. - If the gradient of the banks is greater than 1:1.75, the banks must be stabilised with a biodegradable cover such as Geojute which must be secured to the steep slope with wooden (biodegradable) pegs. This will reduce soil erosion potential. - Any areas, which fall outside the site, that have been compacted are required to be ripped to allow for the establishment of vegetation. This ripping must not result in the mixing of sub- and topsoil. - No imported soil material may be utilised for rehabilitation unless it can be ensured that it is free of any alien vegetation seeds. In situ earthen material is preferred. - Additional stabilisation of cleared areas to prevent and control erosion must be actively managed. The method of stabilisation should be determined in consultation with the ECO and engineer. The following methods (or a combination) may be considered, depending on the specific conditions of the site: ✓ Brush packing	Low

Water Use activity	Discussion	Possible Impacts to the water resource and other water users	Aspects Affected	Significance Before Mitigation	Mitigation Measures	Significance After Mitigation
					✓ Mulch or chip cover ✓ Terracing ✓ Straw stabilising (at the rate of one bale/m² and rotated into the top 100mm of the completed earthworks) ✓ Watering ✓ Planting/sodding ✓ Hand-seeding / Hydro-seeding ✓ Mechanical cover or packing structures (Geofabric, Hessian cover, Armourflex, Log/pole fencing) • A suitably qualified ECO/botanist/horticulturist must supervise the handling, maintenance and planting of the plant/trees. No AIPS may be utilised during the rehabilitation process. • Rapidly germinating indigenous species (e.g. fast growing, deep rooting, rhizomatous, stoloniferous) known to bind soils in terrestrial, riparian and/or wetland areas must be utilised where there is a strong motivation for stabilisation over reinstating similar plant communities to that being disturbed. This should be informed by a suitably qualified specialist. • Exposure of plant root systems to drying winds, high temperatures or waterlogging must be avoided. • Where possible, revegetation must take place at the start of the spring rains to maximise water availability and minimise the need for irrigation. This will ensure optimal conditions for germination and rapid vegetation establishment. • If this is not possible, watering of planted areas may be necessary during dry periods (external sources of water must be utilised e.g. Jo-Jo tanks). • Water utilised for irrigation must be free of any chlorine or contaminants that may negatively affect the plant species. • All alternative roads, tracks and footpaths created during the construction/ rehabilitation phase should be appropriately rehabilitated (e.g. tillage and revegetation of the affected areas). This rehabilitation should result in improved surface roughness and increased infiltration along with reduced stormwater flow and consequently reduced rill erosion. • All construction/ rehabilitation waste materials must be removed, and temporary structures (e.g. offices, workshops, storage containers, ablution facilities) dismantled, from the site and the surrounding environment, this will need to be checked by the ECO and the various contractors. • All banks where there is exposed soil, with the potential for rill/gully erosion to take place, must be stabilised. Gabion structures or geotextiles must be implemented upslope of the proposed development. • The watercourse delineation and associated no-go buffer zones presented herein should be included in the environmental induction and all site personnel and contractors must be made aware of these zones. These areas should ideally be pegged out and protected against from future mining or infrastructure. • An AIPS plan should incorporate aquatic habitats with input from a suitably qualified aquatic ecologist. Subsequent revegetation using indigenous hydrophytic species should be undertaken. • Erosion control measures, particularly within UVB01 at geographic coordinates 26°24'23.08"S; 27°41'38.27"E, must be implemented. This should be informed through a system specific Watercourse Rehabilitation Strategy. • A trench was observed through UVB02 at approximate coordinates 26°25'35.95"S; 27°40'16.18"E. This trench should be backfilled in the same sequence it was excavated and revegetated using an indigenous grass mixture.	

6-13 ISSUES AND RESPONSES FROM PUBLIC CONSULTATION PROCESSES

PPP is being undertaken to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to provide input on the proposed project. The PPP process is being undertaken in terms of GNR. No. 267 in Government Gazette No. 40713 (24 March 2017) of the NWA.

The Protection of Personal Information Act, 2013 (Act No. 4 of 2013) (POPI), which aims to promote protection of personal information, came into effect on 01 July 2021. The EIA Regulations, 2014, as amended, require, inter alia, transparent disclosure of registered stakeholders and their comments. In terms of the EIA Regulations, 2014, as amended, stakeholders who submit comments, attend a meeting or request registration in writing are deemed registered stakeholders who must be added to the project stakeholder database. By registering, stakeholders are deemed to give their consent for relevant information (including contact details) to be processed and disclosed, in fulfilment of the requirements of the EIA Regulations, 2014, as amended and the National Appeal Regulations, 2014.

Notices will be given to all potential I&APs to participate in the project, as follows:

6-13.1 Legal Requirements of the PPP as required by GNR. No. 267 of 24 March 2017

Procedure for public participation

17. (1) A procedure for public participation must be conducted as contemplated in section 41(4) of the Act, as part of the IWULA process.
- (2) Where a PPP has already been undertaken through the EIA processes or any other public consultation process, and that PPP contains and covers all issues pertaining to water use activities, then that PPP report may, subject to approval by the responsible authority, be submitted for the requirements of the IWULA.
- (3) Notice of the application must be provided to I&APs by:
 - (a) fixing a written notice board at a visible and accessible place to the public at the boundary or on the fence of:
 - (i) the site where the water use activity to which the application relates is or is to be undertaken; or
 - (ii) any alternative site mentioned in the application.
 - (b) giving written notice to:
 - (i) the owner or person in control of that land, if the applicant is not the owner or person in control of that land;
 - (ii) the occupiers of the site where the water use is or is to be undertaken or an alternative site where the water use is to be undertaken;
 - (iii) owners and occupiers of land adjacent to the site where the water use is or is to be undertaken or an alternative site where the water use is to be undertaken;
 - (iv) the municipal councillor of the ward in which the water use is or is to be undertaken or an alternative site where the water use is to be undertaken and any organization of ratepayers that represent the community in the area;
 - (v) any organ of state having jurisdiction in respect of any aspect of the water use activity,
 - (vi) any person who has submitted a valid land claim in respect of the area in which the water use activity will be conducted; or
 - (vii) any other interested and affected party as required by the responsible authority.
 - (c) placing an advertisement in -
 - (i) one local newspaper, or
 - (ii) any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these regulations.
 - (d) placing an advertisement in at least one provincial newspaper or national newspaper, if the water use has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality in which it is undertaken; provided that this paragraph need not be complied with in an advertisement has been placed in an official Gazette referred to in sub -regulation (3)(c)(ii); and

- (e) using reasonable alternative methods, as agreed to by the responsible authority, in those instances where a person is desirous of but is unable to participate in the process due to -
 - (i) illiteracy, or
 - (ii) disability.
- (4) A notice, notice board or advertisement referred to in sub -regulation (3) must -
- (a) give adequate details of the application which is subject to public participation; and
 - (b) state the following -
 - (i) that the application has been submitted to the responsible authority in terms of these Regulations as the case may be;
 - (ii) the nature and locality of the water uses to which the application refers;
 - (iii) the water uses;
 - (iv) where further information on the application or water uses may be obtained;
 - (v) the manner in which and the person to whom representations in respect of the application can be made;
 - (vi) a specified date, no more than 60days after the last publication of a notice, before which written comments or objection may be lodged; and
 - (vii) an address to which written objections may be lodged.
- (5) A notice board referred to in sub -regulation (3) must, -
- (a) be of a size at least 60 cm by 42 cm; and
 - (b) display the required information in a font size of not less than 48.

Register of I&APs

18. The applicant must open and maintain a register which contains the names and contact details and addresses of all persons referred to in regulation 17(3)(b), who took part in the PPP, during the period the IWULA was considered and two years after the licence is granted.

Public Participation Report

19. (1) The applicant must compile and submit a public participation report to the authority responsible containing the following -
- (a) written comments or objections of I&APs;
 - (b) records of meetings; and
 - (c) register of I&APs as contemplated in regulation 18.
- (2) Where a person is desirous but unable to access written comments as contemplated in sub -regulation (1) due to –
- (a) illiteracy; or
 - (b) disability,

reasonable alternative methods of recording comments must be provided for.

The PPP is therefore being undertaken as follows:

6-13.2 Announcement of the project and the Draft Integrated Water and Waste Management Plan Availability

This Draft IWWMP is being made available for a 60-day review and comment period from **Friday, 10 July 2026 to Thursday, 10 September 2026**.

The following processes are being undertaken to announce the project and the Draft IWWMP:

- An I&APs database has been opened and is being maintained, and it includes all potential I&APs in respect of the application in accordance with Regulation 18 of GNR. 267 of 24 March 2017.
- Letters are being sent to all I&APs, written in any of the manners provided for in Regulation 27(3)(b) of GNR. 267 of 24 March 2017.

- Affected parties who cannot be reached via mail, fax or e-mail of the proposed project are being visited for delivery of the letters. The letters have attached a sheet which allows I&APs to register and/ or /comment.
- Sixteen (16) site notice boards are being fixed at a place conspicuous to and accessible by the public at the boundary of the site where the activities to which the applications relate (i.e. x8 in English and x8 in Setswana).
- One (1) advertisement has been placed in the Randfontein Herald Local newspaper to announce the project.
- Hundred (100) Background Information Documents (BIDs) are being distributed to I&APs i.e. x50 in English, and x50 in Setswana.
- Four (4) focus group meetings will be convened at venues detailed in 6-13.3 below.
- The Draft IWWMP will be made available for review and comment for a period of 60 calendar days (excluding public holidays) on the MC website (www.manyabeconsultancy.com). A hard copy of the Draft IWWMP will also be placed at the Thusanang Public Library.
- Subsequent to the 60 days' period, all comments and representations received from I&APs will be considered and recorded in the Comments and Responses Reports (CRRs). All I&APs who would have participated in the PPP will be thanked, and their comments acknowledged.

6-13.3 Invitation to public meetings, for the review of the Draft IWWMP

Two (2) public meetings are proposed to be hosted as follows:

Venue	Date	Times
Lido Lodge along R28	22 July 2026	10:00 - 12:00
Westonaria Public Library	22 July 2026	14:00 - 16:00

The proceedings of the public meetings, as well as all comments submitted will be captured in a CRR. The CRR will be attached to the Final IWWMP when submitted to the DWS for decision-making. I&APs will also be given an opportunity to verify that all their comments have been captured correctly.

Two (2) focus group meetings will be convened online (via MS Teams) for the following groups of stakeholders, in order to facilitate active and timeous engagement:

Venue	Date	Times
Service Providers Industry and Government Non-Governmental Organisations	24 July 2026	10:00 - 12:00

Refer to Appendix O Public Participation Process Information.

6-14 MATTERS REQUIRING ATTENTION/NPROBLEM STATEMENT

Findings from the specialist studies that have been undertaken have been incorporated into this IWWMP. Mitigation measures which need to be complied with during all phases of the proposed project have been prescribed. Conclusions/ Environmental Statements/ Opinions by the specialists have been provided. The project can be authorised, provided that the prescribed mitigation measures are complied with.

Summaries of the pertinent studies to this IWWMP have been provided below:

6-14.1 Summary of the Findings and Recommendations of the Groundwater Assessment and Numerical Model Update for the existing and newly drilled scavenger boreholes at South Deep and the Doornpoort TSF

6-14.1.1 *Current Groundwater Conditions*

From the obtained information, it is concluded that there are at least two aquifers in the study area. These are a weathered aquifer, formed within the uppermost 15 metres of the subsurface, and a fractured aquifer associated with the secondary porosity formed from faults, fractures and the contact zones of fresh bedrock and the weathered zone.

Aquifer testing was conducted on 28 existing boreholes (25 existing scavenger boreholes and 3 existing monitoring boreholes) and 4 newly drilled boreholes.

Groundwater quality from the tested scavenger boreholes is poor with elevated Sulphate (SO_4) and TDS concentration values across the study area. The high SO_4 concentrations render the water, if untreated, unfit for human consumption.

6-14.1.2 *Proposed abstraction*

The proposed groundwater abstraction is 3 686 544 m^3/a (10 100 m^3/day) and falls under the DWS classification of " Medium-scale abstractions (60 - 100% Recharge)".

6-14.1.3 *Numerical Flow and Transport Model*

The following numerical scenarios were simulated from the calibrated groundwater model:

- Scenario 1: Abstraction from scavenger wells (Dewatering impact)
- Scenario 2: Abstraction from future/conceptual scavenger wells (Dewatering impact)
- Scenario 3: Contaminant plume without scavenger wells (no mitigation)
- Scenario 4: Contaminant plume with scavenger wells (with mitigation)

Scenario 1 – Abstraction from scavenger wells (Dewatering impact)

Abstraction from the scavenger wells:

- South deep scavenger wells – 2 513 m^3/day to 3000 m^3/day .
- Doornpoort tailings scavenger wells – 3 344 m^3/day to 4000 m^3/day .

Total 5 857 m^3/day (min) to 7000 m^3/day (max).

The model indicates the predicted cones of depression, resulting from the scavenger wells. The scavenger wells are effectively dewatering the shallow aquifer below the tailings facilities creating a hydraulic barrier. The unnamed tributary below the tailings in the north could experience baseflow reduction of between 2 to 3 m^3/day and is deemed negligible.

Scenario 2 – Abstraction from future/conceptual scavenger wells (Dewatering impact)

Abstraction from the scavenger wells:

- South deep scavenger wells – 2 513 m^3/day to 3000 m^3/day .
- Doornpoort tailings scavenger wells – 3 344 m^3/day to 4 000 m^3/day .
- Future scavenger well abstraction at 3 100 m^3/day .

Total abstraction from all boreholes at 10 100 m^3/day .

The model indicates the predicted cones of depression, resulting from the scavenger wells. The scavenger wells are effectively dewatering the shallow aquifer below the tailing's facilities creating a hydraulic barrier.

The unnamed tributary below the tailings in the north could experience baseflow reduction of between 3 to 4 m^3/day and is deemed negligible.

Scenario 3 – Contaminant plume without scavenger wells

This scenario simulated unmitigated plume movement of seepages from tailings likely to be ARD, high in total dissolved solids (2 000 - 4 000 mg/L), sulphate (800 - 2 800 mg/L), with sulphate use as conservative tracer. The plume expands at a rate of 20 to 30 m a year and dilutes at the plume front due to dilution with uncontaminated groundwater.

The average sulphate concentration entering the Leeuspruit is also expected to increase over time from approximately 500 mg/l during 2025 to 2800 mg/l in year 2050.

Scenario 4 – Contaminant plume with scavenger wells

This scenario simulated the plume with drilled scavenger wells as mitigation through hydraulic containment. It follows that there is a significant reduction in plume expansion with more than 40% of the plume captured through scavenger wells.

The average sulphate concentration entering the Leeuspruit is expected to decrease from approximately 2800 to 500mg/l in 2050. This confirms monitoring results in which scavenger wells are effective in abstracting contaminated groundwater from the aquifers, while the numerical groundwater flow and contaminant transport model show that the scavenger wells will be effective in containing the spread of the plume.

6-14.1.4 *Recommendations*

The following recommendations are put forward:

- Authorised abstraction volume of 3 686 544 m³/a to align with modelled containment requirements. This is motivated as it is Category B medium scale abstraction operation.
- Maintain existing scavenger borehole network and pumping regime to ensure continued plume containment.
- Physical monthly groundwater level measurements of abstraction boreholes. It is crucial to monitor the groundwater levels and volumes in response to abstraction. This is to ensure successful dewatering and collection of contact water moving through the subsurface.
- It is recommended to do a comprehensive quarterly analysis at an accredited laboratory for parameters pH, Electrical conductivity, total dissolved solids, major anions and cations (Ca, Mg, Na, NO₃, Cl, SO₄) and metals Al, Fe, and Mn.
- It is recommended that proposed abstraction boreholes are pumped according to the recommended sustainable yield,
- Reassess abstraction rates periodically based on observed drawdown and recharge trends.

6-14.2 Summary of the Findings and Recommendations of the Flood Hydrological Assessment and Conceptual Stormwater Management Plan**6-14.2.1 *Flood Assessment***

The overall results of the flood modelling illustrate both the 1:50 and 1:100 RI flood-lines. In addition to this, a 100m watercourse buffer [defined according to the NGI's 1:50,000 topographical map dataset] was also presented. Maximum flood depths and maximum flood velocities associated with the 1:100 RI flood event were also presented.

While the 1:50 and 1:100-year RI flood-lines show a strong correlation to each other. The 1:100 RI flood line, as expected, extends slightly further due to the larger flood surge. Maximum flood depths were noted to exceed 2.0 m along the perennial Leeuspruit River and at the entrance to culverts which throttle flows and cause the backup (deepening) of flood waters. The larger maximum flood velocities were noticeable along the perennial Leeuspruit River and in the channel to the East of South Shaft TSF.

In reviewing the greater event (the 1:100 RI), flooding results demonstrate that the perennial Leeuspruit River to the west does not affect the mining operation, with flooding contained by a well-defined river channel. A similar situation is present with the Kariëga River between the Twin Shaft Main Shaft and the Twin Shaft TSF; however, floodwaters do come in close proximity to operational areas, specifically the Twin Shaft TSF toe paddocks and the Cascades Dam. Further to the east, the unnamed non-perennial river between the South Shaft TSF and South Shaft, is characterised by a poorly defined river channel (per the available Lidar data). This results in a spread of flooding which affects residences before joining flows from the Leeuspruit East River. The Leeuspruit East River is notable for not affecting the operational area of the mine until it joins with the unnamed non-perennial river, whereupon the combination of flows results in the South Shaft Old RWD becoming submerged.

More significantly, however, is the upgraded South Shaft RWD, which also receives flood waters – an occurrence which is no doubt undesirable (the pathway of flooding into the RWD occurring from a low point on the eastern crest of the RWD). The flooding into the old RWD and into the upgraded RWD occurs due to the route of the original river, which passes through this area, and the absence of a well-defined river diversion to route floodwaters towards the large (double) culvert passing beneath the secondary road. When comparing the flood results to the 100m river buffer, the modelled flooding is mostly contained within the 100m buffer, with some exceptions particularly in the case of the unnamed non-perennial river and the Leeuspruit East River (near the old and upgraded RWDs). It is noted that the limitations in the terrain data affect the accuracy of the flood model, particularly with regard to the coarser 2m DTM data.

6-14.2.2 Conceptual Stormwater Management Plan Assessment

A conceptual SWMP has been developed for the existing South Deep Gold Mine operation using PCSWMM modelling software. Cognisance was taken of previous work related to the management of storm water; in particular the 2025 SLR Gold fields Flood Risk Study. The combination of the infrastructure layout, site examination as well as aerial imagery allowed for the delineation of clean and dirty water generating areas. Dirty water producing areas were subsequently isolated by diverting upstream clean water around them via clean water diversions. Dirty water produced within dirty areas has been routed to PCDs. All berms and channels (clean and dirty) have been sized to effectively route the 1:50 year rainfall event. Dirty water runoff volumes for both the minimum and recommended storage volumes have been calculated for all PCDs. This approach was taken to meet the requirements of GN704 and best practice guidance.

The Old WRD area appears partially rehabilitated. This WRD has consequently been considered as rehabilitation in progress in the SWMP. It is recommended that the operation prioritise this process in order to avoid the construction of lined channels and an additional PCD.

It is recommended that, where relevant, the conceptual designs presented in the report be assessed and confirmed during the detailed design phase prior to construction/ rehabilitation.

6-14.3 Summary of Findings and Recommendations of the Consolidated Aquatic Biodiversity Assessment

Several watercourses were delineated and verified infield. These include two (2) CVB (CVB01 and CVB02) wetlands, three (3) UVB (UVB01 to UVB03) wetlands, and one (1) Artificial Watercourse (Arti01) associated with the study area. Of these, Arti01 and CVB01 were determined to be at high risk of impact by the proposed discharge point (Option 1) of treated water into the watercourse; and the existing Doornpoort discharge point. However, the functionality of all watercourses was assessed in order to satisfy the requirements of the updated Aquatic Biodiversity Assessment.

The PES of the assessed watercourses ranged from Class C (Moderately Modified) to Class E (Seriously Modified). Significant alterations to the bed and channels have occurred due to road, powerline, and pipeline crossings, along with illegal mining activities and ongoing construction/ rehabilitation within the stream channels. Wetlands have been adversely affected by the deposition of infill materials, waste rock dumping, trenching, and channelling, leading to diverted water systems and diminished flow, which have altered the

natural vegetation. Soil disturbances have facilitated the spread of AIPs within the marginal and riparian zones. Notable species include *Eucalyptus* spp. *Acacia* sp. (wattle), scattered *Agave sisalana* (sisal), and *Cortaderia selloana* (Pampas grass) infestations. Some of these plants, initially introduced for rehabilitation, are now encroaching upon the wetland systems. The watercourse has been rerouted around the old TSF; however, ongoing soil excavation and dumping continue to impact the diverted areas. Additionally, litter and waste disposal from upstream informal communities have degraded downstream regions. Leaks from WWTWs and seepage from mining activities have further compromised downstream water quality.

Following the undertaking of the Risk Assessment Matrix (RAM) (DWS, 2023) for the activities associated with the discharge of wastewater and treated water from the RO plants at Option 1 (preferred option) into the receiving watercourses were determined to present a low risk of impact in a post-mitigation scenario. The most significant impacts to the receiving watercourses were determined to be alteration of hydrological flows and water quality impacts.

3. This Notice does not apply-(c) in instances where an application must be made for a WUL for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity.

Considering the above, it is the specialist's opinion, substantiated by the project-specific RAM and GN4167, that the activity applies for Sections 21(c) and (i) water use authorisation via a IWULA process. However, this is subject to discussion with the DWS case officer, who will provide finality on the authorisation path to be followed by the client.

It is important to note that the RAM was undertaken with the assumption that all mitigation and rehabilitation measures as outlined in the RAM and Section 9 of the Consolidated Aquatic Biodiversity Assessment Report will be adhered to. Should there be any changes to the project layout, a revised RAM will need to be undertaken.

Based on the findings of the analysis, it is recommended that Option 1 is utilised as this will create a larger area of hydrological zonations across the watercourse. Based on the wetland assimilation assessment, the maximum discharge should not exceed 2 Ml/day.

Based on the results obtained during this study and presented herein, it is the specialist's substantiated opinion that the proposed development continues, provided that all mitigation and rehabilitation measures proposed in the Consolidated Aquatic Biodiversity Assessment Report and the site-specific WUL be strictly implemented and subsequently monitored. This conclusion is subject to the condition that, all design measures recommended within Sub-Section 10.4, as well as all mitigation and rehabilitation measures presented within Section 9 of the Consolidated Aquatic Biodiversity Assessment Report are strictly implemented and subsequently monitored:

6-14.4 Summary of Findings and Recommendations of the Hydropedological Impact Assessment

The proposed discharge points associated with the South Deep JV: South Deep Gold Mine mining and processing activities have already been constructed but is not yet being used. This entire area has already been severely impacted upon by industrial activities, infrastructure and agricultural activities. The mining operation and processing activities occurs predominantly on deep recharge soils and soil/ bedrock interflow soils, which either flows vertically into the groundwater regime or on the soil/ bedrock interface to the downstream watercourses.

Eight (8) hillslopes were identified that form part of seven (7) sub-catchments over the study area. The impact from the proposed discharge will be very low as the water will be pumped directly into the watercourses and not onto the land where it may affect hydropedological flow paths and flow drivers.

With regards to the discharge points, it is recommended that discharge point one (1) be used as the infrastructure is already in place (in the form of aboveground pipes), the impact on hydropedological flow

paths/drivers is negligible due to the water being directly discharged into the Leeuspruit and the presence of clayey soils that prevent unnecessary infiltration back into the soils. It is important that the mitigation measures are implemented to prevent surface flow from being intercepted and diverted away from the wetlands.

Based on the findings of the assessment, the specialist believes that the proposed development poses a low risk to the hydrogeological environment, and with the implementation of the specified mitigation measures, impacts can be mitigated. This is due to the mining and processing operation existing for many years and resulting in a new “baseline” environment, and the fact that discharge water will enter watercourses directly and not higher on the hillslopes, where it may affect hydrogeological processes. The approval of the activity should be considered to enable South Deep JV: South Deep Gold Mine to continue with its mining and processing operations.

6-15 ASSESSMENT OF LEVEL OF INFORMATION AND CONFIDENCE OF INFORMATION

The information is considered to be at a high level of confidence. It must however be noted that the specialist studies pertinent to this IWWMP have incorporated assumptions and limitations as follows:

6-15.1 Groundwater Assessment and Numerical Model Update for the existing and newly drilled scavenger boreholes at South Deep and the Doornpoort TSF

The following assumptions and limitations were made:

- Simplifying assumptions regarding the direction of flow in aquifers and aquitards are often made to reduce the complexity for the purposes of mathematical analysis of the flow problem (both for steady state and unsteady state systems). One of these is that the flow in the aquifer is strictly horizontal, and that flow in aquitards is vertical. These assumptions are based on the observation that horizontal head gradients in aquifers are usually much greater than vertical gradients, and that the flow through aquitards tends to be along the shortest possible flow path.
- Model predictions are uncertain because models are built on information constraints and because the capacity to capture real-world complexity in a model is limited. In many cases results from models are presented in a way that suggests there is one right answer provided by the model, such as the presentation of a single set of head contours or hydrographs for a particular prediction. However, it is more useful (and correct) to show that all model predictions contain uncertainty and that, given the available data, there is a distribution or range of plausible outputs that should be considered for each model prediction.

6-15.2 Flood Hydrological Assessment and Conceptual Stormwater Management Plan

The following assumptions and limitations were made:

- Accuracy of terrain datasets – the 0.2m DTM and 2m DTM are assumed accurate despite errors likely being present (more so in the 2m DTM). The flood model accuracy cannot improve on the accuracy of the parent data.
- Terrain representation - The terrain can only be expected to represent the terrain at the time of data capture. Changes in terrain, including changes in the morphology of any flow paths or river channel morphology can alter the results of this assessment.
- Equivalence in recurrence interval – the design rainfall event applied to the flood model is assumed to result in the equivalent design flood event (i.e. the 1:100 RI storm produces the 1:100 RI flood and the 1:50 RI storm produces the 1:50 RI flood).
- PCSWMM parameterisation – Design hydrographs estimated using PCSWMM are accurate, given the potential for deviations in their estimation to significantly influence resulting flooding.

- Land-cover – the land-cover per the 2022 DFFE and aerial imagery is assumed to apply to the AHR and the site (i.e. the site has been evaluated in its 2022 condition). Changes in the land-cover will alter the flood model results.
- Potential error in the parameterisation of the model – this included the soils and land-cover classification used which may not accurately represent the AHR and the site. Infiltration losses are significant to this study. These losses have only been considered using a generalised approach to infiltration and are not based on measured data.
- Catchment delineation – a primary catchment (AHR) has been used for hydrological modelling. This catchment has been defined using the geoprocessing of the available terrain data. This geoprocessing is based upon an 8-point pour model with the lowest neighbouring cell assumed to receive all the flow from the cell upstream of it. As such, there is no consideration of the flow rate and the potential for an upstream cell to feed into more than one downstream cell. This has potential implications for the final primary catchment extent.
- Rainfall depth – DRESSA rainfall depths are assumed accurate, with normal DRESSA values applied to this study. DRESSA also includes upper values representative of upper confidence limits.
- Climate change – climate change was not considered in this study. A risk analysis using the expected life of a structure or process will indicate the relevance of considering climate change (i.e. as the expected life increases the influence of climate change increases). Climate change is expected to exacerbate any flooding due to a likely increase in rainfall intensities.
- Mesh detail – the model utilised a 10m mesh size and a refinement region with a 5m mesh size over the 0.2m DTM. While one of HEC-RAS's major strengths is the use of a subgrid, the obstructing or routing influence of linear features that are smaller than the mesh resolution will not be well defined.
- Breaklines – to compensate for mesh detail, linear features (and ridges in particular) were digitised as breaklines and then applied to the model mesh. The application of these breaklines is assumed correct/sufficient.
- Roughness values – the selected Manning's 'n' values were representative of the areas they covered, including being representative regardless of the depth of flooding.
- Model calibration – no calibration of the model was undertaken as there is no suitable observed data for calibration purposes.
- Software Performance - the software and methods utilised are assumed accurate with regard to their utilisation of input data and the processes they simulate.

6-15.3 Consolidated Aquatic Biodiversity Assessment

The following assumptions and limitations were made:

- A transitional gradient occurs within wetlands from the saturated permanent zone to dry terrestrial areas. This gradient makes it difficult to determine the exact boundary of wetland features and some differences in opinion on wetland boundaries may therefore occur. The delineation as presented in this report is, however considered to be a best estimate of the outer boundary of the temporary zone as determined by a wetland specialist with extensive experience in the wetland delineation techniques advocated by the DWS.
- The field survey relevant to this study was a once-off assessment that was conducted in July 2024 and therefore does not cover seasonal variations in freshwater habitat characteristics. Ecosystems vary both temporally and spatially.
- Once-off assessments such as this may potentially miss certain ecological information, specifically trends and floral species that do not flower within the field survey season.
- Wetland boundaries are essentially based on Geographic Positioning System (GPS) coordinate waypoints taken on-site of soil sampling points and of important morphological features. The variations experienced in GPS precision will ultimately affect the accuracy of the GPS waypoints and consequently will affect the accuracy of the recorded freshwater resource boundaries. All sampling waypoints were recorded using a Garmin Montana 650 GPS (estimated accuracy rating of 3-5 metres) and captured, analysed and geo-processed utilising a GIS (i.e. QGIS and ArcGIS).

- The assessment of impacts and recommendation of mitigation measures was informed by the site-specific ecological issues identified during the field survey and was based on the assessor's working knowledge and experience with similar projects.
- Evaluation of the significance of impacts with mitigation took into account mitigation measures provided in this report and standard mitigation measures included in the project-specific WUL.
- This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and the author reserves the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

6-15.4 Hydropedological Impact Assessment

The following assumptions and limitations were made:

- Sampling, by definition, means that not all areas are assessed, and therefore some aspects of soil and hydropedological characteristics may have been overlooked in this assessment. However, it is the opinion of the specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the EAP and the regulating authorities to make an informed decision regarding the proposed development.
- The SWAT+ model mainly models surface processes and does not entail processes relating to ground water recharge. Impacts on groundwater need to be considered on the broader landscape and drainage regime.
- The main limitation of the model is the spatial representation of the Hydrological Response Units (HRUs) within each sub-catchment (watershed). This approach ignores flow and pollutants routing between the HRUs. However, the results presented as landscape units (LSUs) are considered sufficient to guide the decision-making process.
- Modelled weather data (obtained from online sources) in the absence of measured weather data is not 100% accurate especially with respect to precipitation data thus inaccuracies can be expected.
- The effects of climate change dynamics were not considered as part this assessment; however, it is acknowledged that this might exacerbate the anticipated impacts associated with a reduction in water inputs and the resultant hydrological function of the remaining wetlands beyond the extent of the proposed development.
- Per requirements for hydropedology studies published by the DWS and the WRC (Van Tol, et al. 2023), this "Level 3" study (field investigation, conceptualisation of hillslopes impact discussion and quantification) was undertaken as the proposed development triggers the conditions given in this report.
- As water will be discharged directly into either a stream or onto the soil close to the stream, modelling did not include the increase of water volume on flow drivers/ paths. This is because water will not be allowed to enter the soil and affect flow drivers/ paths. Mitigation measures were provided, as well as a preferred discharge location.

SECTION 7: WATER AND WASTE MANAGEMENT

The following section describes water and waste aspects related to the proposed WUL and its addendum amendments, and consolidation project during construction/ rehabilitation, as well as the related operational and decommissioning processes.

7-1 WATER AND WASTE MANAGEMENT PHILOSOPHY

The general principle of water management is the recognition that water is a scarce resource. This in turn leads to the other principles, such as water use minimisation (water conservation) or reuse of water and pollution prevention or the limitation of pollution of water.

Water that exceeds the quality, as set by the DWS, shall not be released from site, with the exception of emergency conditions, but it must be reused, thus reducing the quantity of intake of clean water. South Deep JV: South Deep Gold Mine will endeavour to:

- Continually seek ways to improve its performance in terms of consumption, and water related impacts;
- Reduce consumption of clean water;
- Implement pollution prevention at source;
- Maximise, recycling and reuse of dirty storm water and process water;
- Implement process water treatment to facilitate reuse; and
- Collect, contain dirty storm water and process water on site for preferential use as process water.

The hierarchical management approach comprises the implementation of best practice measures to minimise water consumption and reduce impacts on water resources, by:

- Implementing measures to ensure compliance with relevant water and waste legislation and with other standards to which the organisation subscribes;
- Proactively identifying and implement actions that are required to achieve the water and waste related objectives;
- Implement these actions in an open and transparent manner;
- Implement on-going water and waste related monitoring to support legal compliance;
- Continually seeking ways to improve the performance of water and waste management systems, process and objectives; and
- Encourage open and transparent communication with regulatory authorities and other I&APs within the context of the NWRS and Local CMS.

7-2 STRATEGIES

7-2.1 Surface Water

The strategies for water management are to minimise impacts on the surface water resources within the mine area as follows:

- Ensure that Stormwater management is undertaken in such a manner as to minimise the mine's impacts on the surrounding water environment;
- Maximise the reuse, reclamation and conservation of water;
- Minimise or even eliminate, discharge of contaminated water;
- Manage domestic wastewater in such a manner as to minimise the risks of contamination of the surrounding environment;
- Implement management measures to minimise the mine's impacts on and risks to the groundwater, particularly regarding groundwater contamination from the onsite stockpiles and long- term management thereof;

- Continue to develop and refine the water balance using the latest available water monitoring data to inform the decisions to be taken in becoming water secure;
- Undertake surface rehabilitation in such a manner as to reduce the mine's effect on the receiving water environment, most notably stormwater runoff; and
- Develop a long-term water management strategy during the operational phase to ensure the long-term sustainability of future land use(s) and water management during the post-closure phase.

7-2.2 Groundwater

The strategies for water management are to minimise impacts on groundwater resource:

- Identify and map seepages underground;
- Assess all known or identified potential source areas and determine whether everything practicable is done to contain all sources – wet and dry – of groundwater pollution;
- Continue to monitor groundwater levels;
- Use numerical model as a management tool for future scenarios including the following:
 - Potential mine closure scenarios; and
 - Potential sources of contamination.
- Assess the water balance process to ensure that recycling and reuse is maximised while clean water abstraction from boreholes is minimised; and
- Avoid any form of polluted discharge as far as practicable.

7-2.3 Waste

According to NEMWA, waste should be separated at its source and contained in appropriately labelled containers specifying the type of waste and its specific handling requirements. General waste will be collected in waste skips and should be removed by an appointed contractor and disposed of at an authorised local municipal waste site.

Hazardous waste, such as hydrocarbons and hydrocarbon contaminated material, should be stored in separate bins/drums or waste skips in bunded areas and will be removed and disposed of by reputable contractors. Where possible, the recycling of glass, paper, cans, oil and scrap waste will be implemented through collaboration with recycling companies.

The mine's waste management is undertaken according to the following strategy:

- Minimise the generation of waste as far as practicable;
- Separate waste at source;
- Recycle and reuse waste as far as practicable; and
- Dispose of waste to licensed offsite facilities only as a last resort.

The provision of adequate and appropriate equipment such as labelled waste containers; designated waste collection points; dedicated waste separation area; disposal of materials at appropriately licensed waste disposal facilities; and appointment of suitably qualified waste management and transport contractors effectively minimises the impacts of the mine on the receiving environment due to the generation of waste.

South Deep JV: South Deep Gold Mine will implement these strategies to avoid and/or reduce the impact on water resources.

7-2.4 Rehabilitation

The principles outlined in the BPG5: Water Management Aspects for Mine Closure that are appropriate and could be used to formulate the rehabilitation strategy for South Deep JV: South Deep Gold Mine are:

- Concurrent rehabilitation must be undertaken in a manner that supports the final closure landform to ensure that rehabilitation does not need to be redone at a later stage;
- Management measures at closure should primarily be of a passive nature with minimal long-term maintenance and operating costs;
- The final landform must be sustainable, free draining, must minimise erosion and avoid ponding; and
- Land use plan which is directly interlinked with water management issues insofar as water is required to support the intended land use and the land use itself may have an impact on the water resource.

South Deep JV: South Deep Gold Mine should update the Rehabilitation, Decommissioning and Mine Closure Plan in accordance with national legislation. This plan should be included in the annual IWWMP update reports to be developed during operation.

7-3 PERFORMANCE OBJECTIVES/GOALS

The following objectives and strategies will be followed in order to achieve the Safety, Health and Environmental (SHE) and Community Policy:

- Compliance:
 - Identify all applicable legislation and other applicable requirements to the identified environmental aspects and ensure that the operations remain in compliance with such legislation and requirements.
- Pollution Prevention:
 - Identify the impacts that all operations, processes and products have on the environment and will ensure that pollution on the environment is prevented or minimised.
- Improvement:
 - Set objectives and targets to improve environmental performance and the Environmental Management System (EMS) and continually strive to find even better sustainable solutions to problems.
- Competence:
 - Ensure that all people who perform work for or on behalf of South Deep JV: South Deep Gold Mine are competent and understand the impact of their activities on the environment, and their role in the prevention of pollution and the maintenance of the EMS.
- Communication:
 - Actively communicate this policy to persons working for and on behalf of South Deep JV: South Deep Gold Mine to ensure that they understand the content intent and will make it available to the public.
- Review:
 - Review the continued sustainability and adequacy of this policy at least annually to ensure it remains valid at all times.

7-4 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

The IWWMP must clearly demonstrate that it has incorporated all of the above objectives/principles or, alternatively, must clearly motivate why any of the above principles are not relevant. Water resources can be protected in the following ways by applying water conservation, pollution prevention and minimisation of impacts principles:

- Reduction in the level of contamination of water through implementation of pollution prevention strategies thereby increasing the economic reuse of the water without treatment; and
- Minimisation of impacts through capture, containment, reuse and reclamation of contaminated water, thereby preventing discharges/releases.

South Deep JV: South Deep Gold Mine has a SHE Policy in place, authorised by the organisation's top management that clearly states overall health, safety and environmental strategies and a commitment to managing all environmental issues. The policy includes a commitment to continually improve and prevent pollution. Furthermore, through this policy, South Deep JV: South Deep Gold Mine is committed to complying with current applicable legislation and with all other requirements which the organisation subscribes to. The

Policy is a document that is implemented and maintained, communicated to all employees, available to interested parties, and reviewed periodically to ensure that it remains relevant and appropriate to the mine.

Furthermore, the IWWMP Action Plan (Table 79) identifies measures to achieve water and waste related objectives.

7-5 OPTION ANALYSIS AND MOTIVATION FOR THE IMPLEMENTATION OF PREFERRED OPTIONS

Two (2) discharge points have been considered for discharge of treated water from the RO Plants i.e. Option 1 and Option 2. Option 1 is the preferred alternative (refer to Figure 29). There is also an existing discharge point associated with the Doornpoort TSF (refer to Figure 29), and no water is being discharged.

It is recommended that Option 1 is utilised as this will create a larger area of hydrological zonations across the watercourse. Based on the wetland assimilation assessment, the maximum discharge should not exceed 2 ML/day.

7-5.1 Proposed Discharge Point 1 (Option 1) – Preferred Option

Proposed discharge point (Option 1) - preferred option is located at approximate geographic coordinates 26°24'35.73"S; 27°41'22.36"E. Table 75 presents the findings that were observed at proposed discharge point (Option 1) - preferred option.

Table 75: Observations and photographic references at Discharge Point (Option 1) - preferred option

Photographic Reference	Observations
	Observations: The general area lacked hydrophytic vegetation and was heavily overgrazed. The vegetation comprised mainly of grasses with a few shrubs and no reeds.
	Observations: Dilapidated boundary walls were observed through the watercourse. These will have to be removed.

	Observations: • A historical road was present across the watercourse. This provides an opportunity for water to be discharged and spread across the watercourse. • This point is also located near to head of the watercourse which will provide a variety of hydrological zonation.
	Observations: • The geomorphology of the watercourse was highly disturbed and will need to be rehabilitated as part of the proposed discharge activity.

7-5.2 Proposed Discharge Point (Option 2)

The proposed discharge point is located at approximate geographic coordinates 26°25'18.87"S; 27°40'51.06"E and below the RWD and between an artificial watercourse and UVB wetland. Table 76 presents the key observations made during the infield investigation of discharge point (Option 2).

Table 76: Observations and photographic references at Discharge Point (Option 2)

Photographic Reference	Observations
	Observations: • A large two (2) box culvert was observed downstream and is associated with one of the main roads. During discharge events, this may result in back flooding and sedimentation of the watercourse particularly because the culvert is confined in extent. • During the infield assessment, majority of the hydrophytic vegetation had been burnt which provided minimal velocity dissipation thereby promoting the potential for erosion to occur. • No erosion protection or flow dissipators were observed at the inlets or outlets of the culverts.

**Observations:**

- A large earthen berm and pipeline are present at the proposed discharge point (Option 2). Should a discharge point be established here, the discharge pipeline will either need to be established underneath or above the existing pipeline. The earthen berm may also need to be modified to allow for the spread of water. Again, the earthen berm lacked vegetation cover, which could increase the potential for erosion.

7-5.3 Doornpoort Discharge Point

The Doornpoort discharge point is an existing discharge point which was originally preferred for discharge of treated water from the RO Plant which was planned to be constructed south of the Doornpoort RWD, which has since been disregarded, as the RO Plant will no longer be constructed at the Doornpoort RWD area. Instead, waste water from the Doornpoort RWD is being transported to the existing RO Plants 1 and 2, at South Shaft. The planned RO Plant 3 will also be treated water from all RWDs at the mine.

It located at approximate geographic coordinates 26°28'8.17"S; 27°38'14.79"E. During the infield investigation, existing discharge infrastructure was present in the form of a four (4) culvert outlet and an approximately 8 to 10 m wide by 50 m long vegetated apron/channel. No water was being discharged at the time of the infield assessment.

Table 77 presents the key observations made during the infield investigation of the Doornpoort discharge point.

Table 77: Observations and photographic references at Doornpoort discharge point

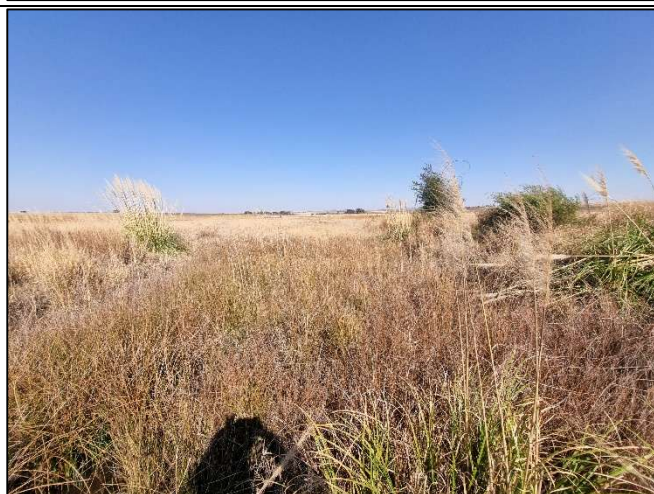
Photographic Reference	Observations
	Observations: • The outlets of the culverts are slightly above the base level of the channel. If water were to be discharged in large volumes in its current state, undercutting and bed scour may result if the culverts are above the base level of the beds. • No erosion protection or flow dissipators were observed at the outlets of the culverts.

**Observations:**

- The culverts have not been keyed into the side walls of the embankments which presents the risk of erosion around the side of the culverts.
- The culverts were not concreted into place.
- Undercutting was observed beneath the concrete fence within the Doornpoort TSF boundary (see red box in the image).

**Observations:**

- A robust vegetation cover was present throughout the discharge outlet channel with minimal erosional features present. This promoted a largely diffuse and laminar flow further downstream into the receiving watercourse. A variety of hygrophilous grasses and sedges were observed. Further downstream of the channel outlet, increased soil wetness was evident with dense hydrophytic vegetation.

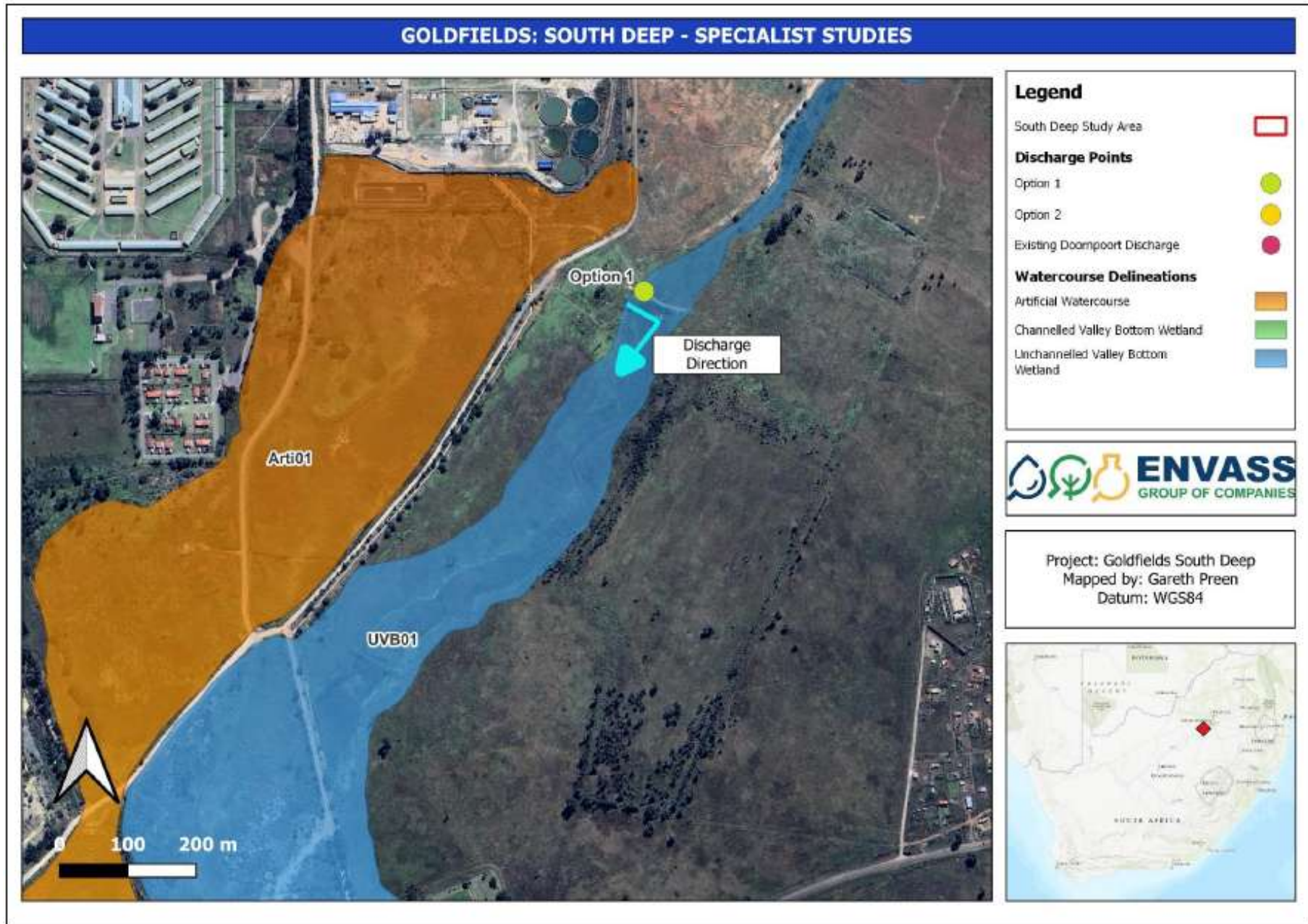


7-5.4 Proposed Discharge Design Measures

Based on the findings presented in Table 75 to Table 77, the following should be considered by the site engineer in the design of the discharge points:

- It is recommended that discharge point (Option 1) - preferred option be utilised as this will create a larger area of hydrological zonations across the watercourse (Figure 57). This discharge point is also located closer to the head of the wetland, which means that a greater area will be positively impacted.
- Certain rehabilitation measures, informed by a rehabilitation plan, may need to be implemented prior to the discharge point being implemented such as the following:
 - The residue stockpiles of soil will need to be removed.
 - The dilapidated fence will either need to be removed or repaired.

- The feasibility of a grass-lined chute should be investigated as opposed to culvert outlets. If appropriately designed and constructed, a chute will reduce the potential for the development of preferential paths and dissipate flow. In contrast, culverts have a tendency to promote concentrated flow paths due to the confined surface area and generally result in erosion downstream if suitable control measures are not implemented. It would also be recommended that an energy dissipator be incorporated near the toe of the chute to further reduce erosion potential. Figure 58 provides an illustration of a typical chute design.
- If culvert outlets are the preferred option, it is essential that the existing culverts be upgraded and repositioned at the base level of the outlet channel. In addition, erosion control and flow dissipators must be established at the culvert outlets either in the form of vegetated gabion mattresses or rock packing. It is essential that the culverts be keyed into the side wall and bed using an appropriate medium (concrete). This will improve the structural integrity and reduce the potential for any undercutting beneath and scouring around the culverts.
- The current vegetation cover must be maintained and a wider spread of water discharge across the wetland must be promoted to enhance soil wetness and promote increased hydrophytic biodiversity.



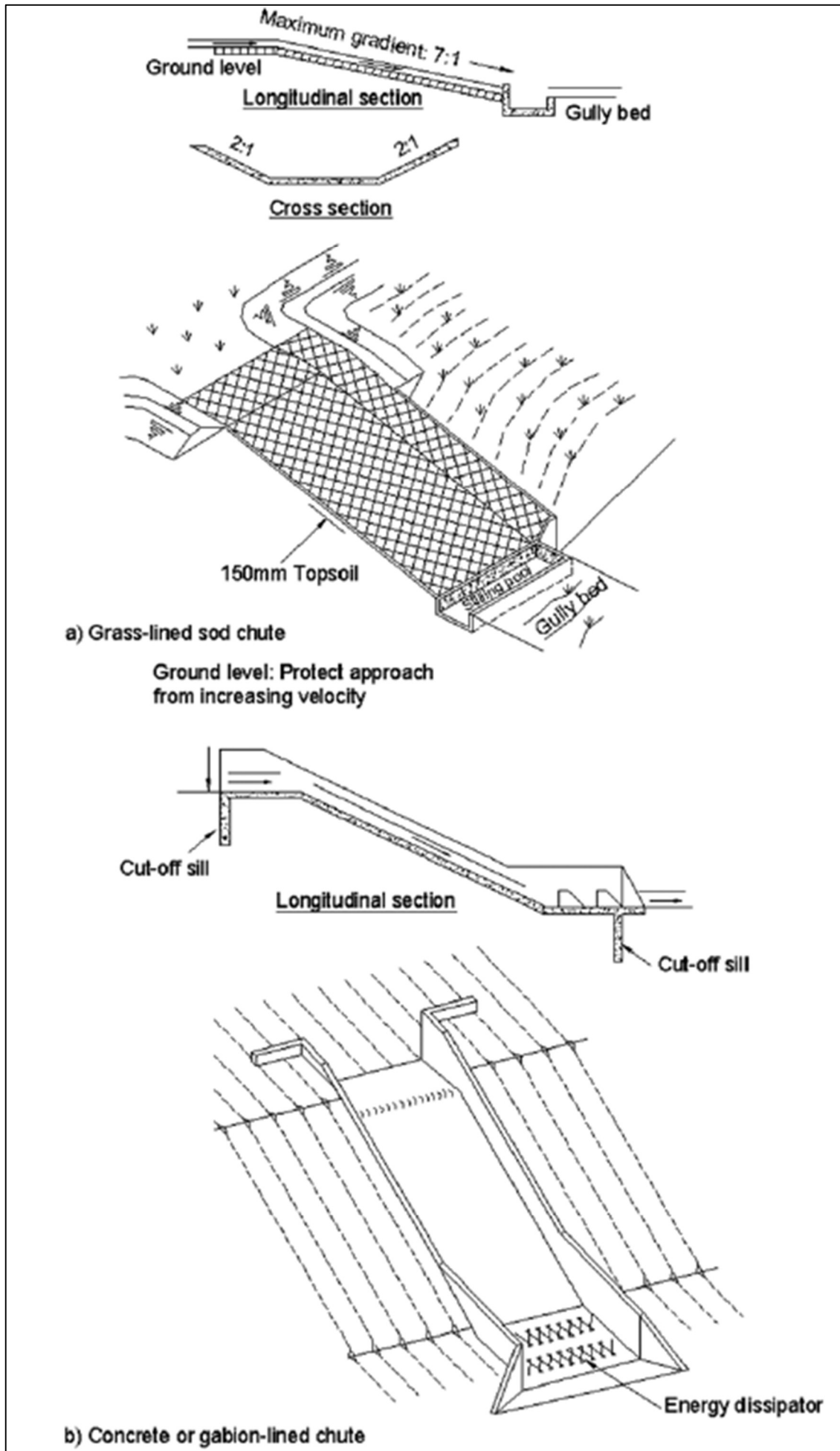


Figure 58: Typical chute design (Russel, 2009).

7-5.5 Leeuspruit Wetland Proposed Rehabilitation

The Leeuspruit Wetland Area, as shown in Figure 59, is an integral part of the South Deep Gold Mine. The wetland to be rehabilitated starts east of South Deep Gold Mine's operations near the ridge system and stretches south of the South Shaft Complex, just beyond the TSF complex. This region plays a pivotal role in stormwater management, capturing runoff from the surrounding ridge system and adjacent infrastructures and directing it towards the Leeuspruit and its contributing streams.



Figure 59: Leeuspruit Wetland Area to be rehabilitated with the TSF complex circled in red

A pre-feasibility study [University of Free State (UFS), 2024] was undertaken which focused on challenges that have arisen concerning the wetland's functionality, potentially affecting its ability to effectively fulfill and enhance its ecological functions. Recognising the necessity to preserve and rehabilitate this vital natural asset, South Deep JV: South Deep Gold Mine initiated the study to thoroughly understand the wetland's current condition and devise suitable strategies for its optimisation.

The study primarily investigated the use of passive ecological engineering optimisation methods to reinstate and enhance the ecological integrity of the Leeuspruit wetland. It aimed to address water quality improvement and explore water treatment solutions for operational reuse, ensuring alignment with sustainable practices and meeting both the ecological needs of the surrounding area and the operational requirements of the South Deep Gold Mine.

The primary purpose of the pre-feasibility study was to propose various options for regenerating the wetland system based on the assessment of the ecohydrological health and functionality of the Leeuspruit wetland system. By identifying the factors that limit its functionality and those contributing to its success or degradation, the study sought to lay the groundwork for proposing ecological engineering solutions that enhance ecological sustainability and support operational reuse. The ultimate goal was to determine the feasibility of these options and provide a comprehensive understanding of their potential benefits, limitations, and associated costs.

The objectives for the pre-feasibility study include:

- Assessing the state of the Leeuspruit wetland system.
- Evaluating the health and functionality of the wetland.
- Identifying factors that impact the wetland's functionality and water quality.
- Proposing options for the passive optimisation of the wetland.
- Investigating water quality improvement measures within the wetland system.

- Exploring water treatment options for operational reuse.
- Determining the feasibility and effectiveness of the proposed ecological engineering options.
- Considering the environmental, social, and economic implications of the proposed strategies.
- Providing conceptual designs and layouts for the optimised Leeuspruit wetland system.
- Recommending the best course of action based on the study's findings.

These objectives are designed to address specific concerns related to the Leeuspruit wetland, developing a comprehensive understanding of potential optimisation options and their impact on water quality and operational reuse at the South Deep Gold Mine.

7-5.5.1 Optimisation options for the Leeuspruit wetland area

(a) Proposed Ecological Engineering Strategies

The proposed ecological engineering strategies for optimising the Leeuspruit wetland area are presented in Table 78.

Table 78: Proposed ecological engineering strategies for optimising the Leeuspruit wetland area at SDGM

Ecological Engineering Principle	Principle Solutions	Pre-feasibility Considerations	Nature-Based Solutions for Water Quality and Biodiversity
1. Forcing Functions and Ecosystem Adaptation	1. Monitoring and Adaptive Management. 2. Climate Resilience Planning. 3. Community Involvement. 4. Managed Retreat. 5. Ecosystem Flexibility Enhancement. 6. Long-term Monitoring Programs.	- Assess mining impact and contribution as part of a dedicated wetland water balance. - Understand ecosystem adaptability. - Engage communities. - Evaluate infrastructure relocation. - Determine funding for monitoring.	- Constructed wetlands for filtration. - Riparian buffers for habitat and water quality. - Adaptive vegetation management. - Dedicated phyto, phyco, myco and/or bioremediation cells strategically located.
2. Energy Limitations and Sustainable Solutions	1. Renewable Energy Integration. 2. Low-energy Water Treatment. 3. Energy-Efficient Infrastructure. 4. Renewable Energy Integration (for mining). 5. Energy Conservation Measures. 6. Green Technology Adoption.	- Feasibility study for renewable energy. - Evaluate natural water treatment methods. - Cost-benefit analysis of energy-efficient infrastructure. - Explore green technology partnerships.	- Solar-powered/alternative low energy water treatment systems. - Low-energy biofiltration systems. - Energy-efficient habitat restoration techniques.
3. Ecosystem Connectivity and Buffer Zones	1. Corridor Creation. 2. Buffer Zone Enhancement. 3. Hydrological Connectivity. 4. Corridor Development. 5. Buffer Zone Enhancement (expansion). 6. Habitat Linkages.	- Map ecosystem connectivity. - Assess hydrological impact of mining as part of a dedicated wetland water balance. - Consider legal implications for corridor development.	- Corridors and buffer zones with indigenous vegetation integrated into the greater landscape. - Wetland restoration for hydrological connectivity. - Biodiversity corridors linking habitats. - Compact hybrid constructed wetland.
4. Limiting Factors and Strategic Regeneration vs. Restoration	1. Pollution Reduction Strategies. 2. Habitat Enrichment. 3. Water Regulation. 4. Pollution Control Mechanisms. 5. Regeneration Projects. 6. Restoration Practices.	- Identify pollutants and seepage/recharge areas from mining. - Evaluate habitat enrichment and water regulation. - Balance between regeneration and restoration.	- Bioremediation using indigenous plants. - Habitat creation for species diversity. - Regenerative water management practices.
5. Homeostasis and Stability Enhancement	1. Controlled Flooding. 2. Invasive Species Management. 3. Vegetative Buffers. 4. Stabilization Techniques. 5. Adaptive Management Strategies. 6. Resilience Building Initiatives.	- Analyse ecological balance and invasive species. - Feasibility of controlled flooding. - Assess vegetative buffers against mining impacts.	- Controlled wetland flooding for habitat diversity. - Invasive species control using indigenous predators. - Vegetative buffers for erosion control.

Ecological Engineering Principle	Principle Solutions	Pre-feasibility Considerations	Nature-Based Solutions for Water Quality and Biodiversity
6. Nutrient Cycling and Effective Recirculation	1. Constructed Wetlands for Nutrient Removal. 2. Composting of Wetland Biomass. 3. Phyto, phyco, myco and/or bioremediation. 4. Nutrient Management Plans. 5. Composting and Organic Waste Use. 6. Integrated Pest and Nutrient Management.	- Study nutrient cycling process. - Evaluate constructed wetlands and composting. - Balance nutrients and phytoremediation.	- Phytoremediation wetlands for nutrient uptake. - Composting wetland biomass for soil enrichment. - Integrated wetland-agriculture systems.
7. Pulsing Systems and Timing Efficiency	1. Seasonal Water Management. 2. Pulsed Flow Restoration. 3. Adaptive Planting Schedules. 4. Flood Pulse Optimization. 5. Seasonal Adjustments in Management. 6. Temporal Habitat Variability.	- Analyse water management data and understand the overall wetland water balance. - Implement pulsed flows and planting schedules. - Temporal habitat variability management.	- Timed water releases for wetland health. - Seasonal planting for habitat diversity. - Dynamic water level management for biodiversity.
8. Self-Designing Systems and Low-Maintenance Solutions	1. Indigenous Species Reintroduction. 2. Natural Contour Restoration. 3. Bioengineering Techniques. 4. Autonomous Monitoring Systems. 5. Low-impact Development Practices. 6. Self-sustaining Habitat Designs.	- Evaluate the resilience of indigenous species. - Study land contours for water flow. - Bioengineering feasibility.	- Use of indigenous species for self-sustaining habitats. - Natural landform restoration for water management. - Bioengineering with natural materials.
9. Effective Use of Landscape Patterns	1. Landscape Scale Planning. 2. Contaminant Filtration Zones. 3. Landform Replication. 4. Landscape Connectivity Planning. 5. Pollutant Filtration Landscapes. 6. Ecological Landscape Architecture.	- Landscape-scale planning alignment. - Identify contaminant filtration areas. - Replicate natural landforms.	- Landscape design for natural water filtration. - Landform replication for habitat diversity. - Large-scale ecological network planning.
10. Diversity for Resilience	1. Diverse Planting Strategy. 2. Habitat Diversification. 3. Genetic Diversity Focus. 4. Biodiversity Enhancement Programs. 5. Genetic Diversity Initiatives. 6. Habitat Diversity Enhancement.	- Assess current biodiversity. - Genetic diversity potential. - Impact of indigenous species introduction.	- Diverse plantings for habitat enhancement. - Genetic diversity in reforestation. - Creation of microhabitats for species that can biostimulate the ecosystem.
11. Smooth Transitions and Ecotones	1. Ecotone Restoration. 2. Mixed Habitat Creation. 3. Gradual Sloping. 4. Ecotone Restoration Projects. 5. Edge Effect Management. 6. Gradual Transition Zones.	- Map ecotones. - Mixed-use habitats feasibility. - Gradual sloping impact.	- Ecotone restoration for species migration. - Mixed habitat zones for edge species. - Sloped wetland margins for diverse habitats.

Ecological Engineering Principle	Principle Solutions	Pre-feasibility Considerations	Nature-Based Solutions for Water Quality and Biodiversity
12. Synergistic Networks as Ecosystem Components for Effective Solutions	1. Species Interaction Studies. 2. Habitat Linkage. 3. Ecosystem Service Enhancement. 4. Integrated Ecosystem Management. 5. Collaborative Conservation Efforts. 6. Habitat Interconnectivity Projects.	- Identify species interactions. - Enhance ecosystem services. - Collaborative ecosystem management.	- Habitat network creation for species interaction. - Ecosystem service mapping and enhancement. - Integrated habitat management plans.
13. Regional and Global Considerations	1. Collaborative Management Plans. 2. Cross-Boundary Conservation Initiatives. 3. Global Best Practices Implementation. 4. Regional Collaboration Initiatives. 5. Global Environmental Standards. 6. Cross-border Ecosystem Management.	- Regional and global partnership exploration, primarily carbon and biodiversity trading and financial incentives. - Global best practices feasibility. - Legal and political cross-boundary issues.	- Cross-border wetland conservation projects. - Global knowledge exchange for wetland management. - Regional biodiversity conservation initiatives.
14. Historical Context in Management	1. Historical Data Analysis. 2. Cultural Heritage Integration. 3. Legacy Pollutant Management. 4. Cultural Heritage Preservation. 5. Historical Ecosystem Analysis. 6. Legacy Effects Mitigation.	- Historical data analysis. - Cultural heritage integration. - Legacy pollutant management.	- Restoration based on historical ecosystem states. - Cultural landscapes for biodiversity. - Bioremediation of historical pollution sites.
15. Species Geography and Vulnerability	1. Vulnerable Species Protection Plans. 2. Habitat Suitability Analysis. 3. Climate Change Impact Assessments. 4. Species Relocation Programs. 5. Habitat Suitability Assessments. 6. Conservation Genetics.	- Identify affected species. - Habitat suitability studies. - Climate change impact assessments.	- Targeted habitat creation for vulnerable species. - Climate-resilient habitat design. - Geographic mapping for species conservation.
16. Holistic Approaches and Hierarchical Organization	1. Integrated Management Systems. 2. Stakeholder Engagement Programs. 3. Multi-tiered Habitat Design. 4. Integrated Wetland Management. 5. Multiscale Ecosystem Planning. 6. Holistic Biodiversity Surveys.	- Integrated management system development. - Stakeholder engagement. - Multi-tiered habitat design.	- Whole-systems approach to wetland restoration. - Community-led habitat conservation projects. - Layered habitat structures for diverse species.
17. Interactive Processes for Desired Outcomes	1. Ecological Process Mapping. 2. Dynamic Management Approaches. 3. Process-Based Restoration Techniques. 4. Ecosystem Process Modelling. 5. Interactive Educational Programs. 6. Collaborative Decision-Making Platforms.	- Ecological process mapping. - Dynamic management adaptation. - Process-based restoration techniques.	- Ecological modelling for process understanding. - Adaptive management for changing conditions. - Restoration aligning with ecological processes.
18. Emergent Properties from Interactions	1. Ecosystem Functionality Studies. 2. Novel Ecosystems Creation.	- Ecosystem functionality studies. - Novel ecosystems encouragement.	- Designing for emergent ecological functions. - Creation of new habitat types.

Ecological Engineering Principle	Principle Solutions	Pre-feasibility Considerations	Nature-Based Solutions for Water Quality and Biodiversity
	3. Feedback Loop Integration. 4. Complex Systems Analysis. 5. Adaptive Ecosystem Management. 6. Resilience Assessment Tools.	- Feedback loop integration.	- Management systems responsive to ecological feedback.
19. Information Storage in Systems	1. Long-term Monitoring Programs. 2. Data Sharing Platforms. 3. Historical Trend Analysis. 4. Ecosystem Data Repositories. 5. Long-term Monitoring and Research. 6. Knowledge Sharing Platforms.	- Long-term monitoring establishment. - Data sharing platforms. - Historical trend analysis.	- Data-driven wetland management. - Community science projects for biodiversity. - Trend analysis for habitat changes.
20. Regenerative Design and Open Systems	1. Adaptive Design Strategies. 2. Open System Water Management. 3. Resilience Building Measures. 4. Regenerative Landscaping Techniques. 5. Open System Resource Flows. 6. Sustainable Resource Management.	- Adaptive design implementation. - Open system water management. - Resilience building measures.	- Regenerative landscaping for wetland health. - Natural water flow restoration. - Design for ecosystem resilience and regeneration.
22. Technological Synergy with Natural Systems	1. AI-Driven Monitoring System. 2. Remote Sensing for Habitat Analysis. 3. Technology for Water Quality Management. 4. Eco-Technology Integration. 5. Remote Sensing for Ecosystem Monitoring. 6. Bio-inspired Engineering Solutions.	- AI and remote sensing implementation. - Efficient water quality management technology. - Eco-technology integration.	- AI for wetland monitoring and management. - Remote sensing for water quality assessment. - Eco-friendly technology for habitat enhancement.
23. Anticipatory Design for Future Scenarios	1. Climate Change Adaptation Planning. 2. Future Scenario Modelling. 3. Flexible Infrastructure Development. 4. Scenario Planning. 5. Resilience Forecasting Models. 6. Adaptive Infrastructure Design.	- Future climate scenario planning. - Future scenario modelling. - Flexible infrastructure development.	- Climate-adaptive wetland design. - Modelling for future biodiversity scenarios. - Infrastructure resilient to environmental changes.

7-5.5.2 Water Quality Improvement Measures

The Leeuspruit wetland area requires comprehensive water quality improvement measures. These measures should focus on reducing contaminants, enhancing natural filtration processes, and restoring ecological balance. Key strategies include:

- **Phyto, Phyco, Myco and Microbial Bioremediation:** Utilising specific plant, fungi and bacteria species known for their ability to absorb and neutralise pollutants, particularly heavy metals and organic contaminants.
- **Hybrid Constructed Wetlands:** Creating engineered wetland areas as integrated buffer zones designed to regenerate, support and optimise natural filtration processes, effectively removing pollutants from water.
- **Buffer Zones:** Establishing vegetated buffer areas around the wetland to intercept and treat runoff before it enters the wetland system.
- **Sediment Control:** Implementing erosion control methods to reduce sedimentation and its associated pollutants in the wetland.
- **Monitoring and adaptive management** should be integral to these measures to ensure their effectiveness and sustainability.

7-5.6 Conceptual Design and Layouts

7-5.6.1 Proposed Designs for Optimising the Leeuspruit Wetland System

Apart from the phased wetland regeneration approach, a hybrid constructed wetland system is proposed for implementation on the eastern boundary of the Leeuspruit wetland system as aligned to the flow paths that will need to be confirmed as part of the water balance confirmation of the wetland area. The design configuration is proposed as follows:

- **Location and Size:**
 - Select a strategic section of the wetland that is most impacted by pollutants yet has sufficient space for constructing the hybrid system. The size would depend on the water treatment needs, available land, and desired ecological outcomes.
- **Surface Flow Constructed Wetland (SFCW):**
 - **Primary Treatment Zone:** The SFCW serves as the primary treatment area where water first enters. It is designed with shallow ponds or channels with slow-moving water and is densely planted with emergent macrophytes such as reeds (*Phragmites sp.*) and cattails (*Typha sp.*).
 - **Function:** This zone focuses on sedimentation and the removal of large particulates, as well as the initial breakdown of organic matter. The vegetation provides a habitat for wildlife and promotes biodiversity.
- **Subsurface Flow Constructed Wetland (SSFCW):**
 - **Secondary Treatment Zone:** Following the SFCW, water flows into the SSFCW, which is filled with a gravel or sand medium. Depending on space constraints and specific treatment goals, the system can be designed as either horizontal or vertical flow.
 - **Function:** The SSFCW targets the removal of finer particulates, nutrients (nitrogen and phosphorus), and further breakdown of organic pollutants. The subsurface flow minimizes mosquito breeding and provides a different habitat type within the wetland.
- **Floating Treatment Wetlands (FTWs) (where required):**
 - **Tertiary Treatment and Habitat Enhancement Zone:** FTWs are introduced within open water zones of the SFCW or as standalone units. These consist of floating mats that support emergent and submerged plants, with roots hanging in the water.
 - **Function:** FTWs enhance nutrient uptake, and provide additional surface area for microbial activity, further improving water quality. They also increase habitat complexity and biodiversity within the wetland.
 - FTWs are to be supported by microbial curtains.

This hybrid wetland design configuration optimises the existing natural wetland system by enhancing water quality treatment capabilities, increasing biodiversity, and providing educational and recreational opportunities for the community. It represents a holistic approach to wetland management, balancing ecological, social, and technical considerations.

7-5.6.2 Phycoremediation Integration

Phycoremediation utilises algae and cyanobacteria for the removal of pollutants, nutrient cycling, and oxygen production. It is particularly effective in treating waters with high nutrient loads and certain organic and inorganic pollutants.

- In SFCWs: Algal communities can be naturally supported on the water's surface and along the edges of shallow SFCW zones. Algae utilise nutrients (nitrogen and phosphorus) from the water, contributing to nutrient removal and water quality improvement.
- FTWs: Incorporate specific algae or cyanobacteria species into FTWs, either attached to the floating mats or coexisting with the root systems of the planted vegetation. This setup promotes the synergistic relationship between algae and higher plants, enhancing overall treatment efficiency.
- Algal Turf Scrubbers: Implement algal turf scrubbers (ATS) along the water flow paths within the wetland. ATS are engineered systems that cultivate dense algal mats on inclined surfaces, through which water is gently flowed. These systems are highly effective in nutrient uptake and can be periodically harvested to permanently remove the nutrients from the system.

7-5.6.3 Bioremediation Integration

Bioremediation leverages microorganisms to degrade, transform, or immobilise pollutants, including organic contaminants and heavy metals.

- In SSFCWs: The gravel or sand medium within SSFCWs provides a large surface area for microbial biofilms to thrive. Introducing or enhancing microbial communities that specialise in degrading specific pollutants can be done through bioaugmentation, ensuring these zones are optimised for bioremediation processes.
- Rhizosphere of Wetland Plants: The rhizosphere, the soil region adjacent to plant roots, is a hotbed for microbial activity. Selecting plants with beneficial root exudates that attract and sustain pollutant-degrading microorganisms can enhance the bioremediation capacity of both SFCWs and SSFCWs.
- Dedicated Bioremediation Zones: Establish specific areas within the wetland system where conditions are optimised for the growth and activity of pollutant-degrading microbes. These could be areas with controlled water flow and aeration, supplemented with microbial inoculants and, if necessary, specific substrates that enhance microbial degradation processes.

7-6 INTEGRATED WATER AND WASTE MANAGEMENT PLAN ACTION PLAN

This part of the IWWMP details the actions that will be taken to give effect to the water management strategy. The action plan focuses on the measures that should be implemented during the construction, operational and rehabilitation phases of the proposed WUL and its addendum amendments, and consolidation project.

The compilation of an IWWMP is a long-term commitment in terms of resources requirements including technical investigations that are conducted. These also require disbursing financial resources to implement management measures which can in most cases take months. This Action Plan should be reviewed and updated every year. It is the intention of the mine to have yearly interaction with DWS and update the Action Plan accordingly (refer to Table 79).

Table 79: IWWMP Action Plan

Activity	Aspects Affected	Mitigation Type	Monitoring frequency and tools	Performance Indicators	Responsible party for implementation and Monitoring Tool
STAFF AND MANAGEMENT AWARENESS					
Staff awareness programme and training	Risk mitigation	South Deep JV: South Deep Gold Mine must inform its employees of risk associated with their operations and make sure that all employees are trained prior to undertaking any activity associated with their operations. Ensure that the Contractor and key personnel are aware of the relevant provisions of the IWWMP, sensitive environmental features and agreements made with individual landowners and/or land users.	Permanent/ Continuous	Reduction in incidents and identified risks.	Management - IWWMP
Appoint Contractors Environmental Representative (CER)	Oversee and enforce IWWMP	South Deep JV: South Deep Gold Mine's management to assign a team that will monitor IWWMP implementation and compliance by the employees. Enforcement should be applied to those employees that are not complying.	Permanent/ Continuous	Management satisfied with CER performance based on IWWMP implementation.	Management- IWWMP, compliance checklists and audit reports
CONSTRUCTION/ REHABILITATION AND OPERATION					
Water for human consumption	- Soil and water pollution - Health	- Water for human consumption shall be available at the site offices and at other convenient locations on site. - All drinking water must be from a legal source and comply with recognised standards for potable use. - South Deep JV: South Deep Gold Mine shall comply with the provisions of the NWA and its Regulations pertaining to the abstraction of water from watercourses and the use thereof. - All effluent from the offices shall be collected and disposed of properly, (e.g. chemical toilets should be emptied). If this is not feasible (due to the construction/ rehabilitation duration or other difficulties), all effluent water from the camp sites shall be disposed of in a properly designed and constructed system, situated so as not to adversely affect water resources.	Weekly monitoring of waste and effluent removal/ disposal	- Adequate quantities of potable water - Proper effluent disposal	Compliance checklists
Waste Management	- Soil and water pollution - Waste disposal	- A refuse control system shall be established for the collection and removal of refuse. - Bins and containers must be available on-site for collection, separation, and storage of waste (such as wood, metals, general refuse etc.). - Solid waste shall be stored within a designated area that is covered, utilising plastic wheelie bins for collection and disposal. - Disposal of solid waste shall be at a licensed waste disposal facility. - No waste shall be burned or buried at or near the site offices, or anywhere else on the site.	Permanent/ Continuous	- No waste or litter accumulation on site - Proof of disposal certificates - No burning of waste	Management- IWWMP and compliance checklists
Sewage	- Soil and water pollution - Waste disposal	Ensure that the WWTW and the transfer station are optimally operational.	Weekly monitoring of sewage facilities, maintenance and disposal	Adequate and operational sewage treatment/disposal	Management- IWWMP and compliance checklists
Wastewater	Soil and water pollution	South Deep JV: South Deep Gold Mine shall comply with the provisions of the NWA and its Regulations pertaining to the storage and reuse of wastewater collected on site.	Monthly monitoring	No ground and water contamination	Management- IWWMP and compliance checklists
Litter	- Soil and water pollution - Waste disposal	- No littering by construction/ rehabilitation workers shall be allowed. - During the construction/ rehabilitation period, the facilities shall be maintained in a neat and tidy condition, and the site shall be kept free of litter. - Measures shall be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. - The contractor shall provide litter collection facilities for later safe disposal at approved sites.	Bi weekly monitoring	- No waste or litter accumulation on site - Proof of disposal certificates - Availability and maintenance of litter / refuse collection facilities - No burning of waste	Management- IWWMP and compliance checklists
Hazardous waste	- Soil and water pollution - Waste disposal	- Hazardous waste such as oils etc. shall be disposed of at an approved waste disposal facility. - Any spillage shall be attended to immediately and affected areas shall be promptly reinstated to the satisfaction of the engineer.	Weekly monitoring	- No spillages or direct disposal - No waste or litter accumulation on site - Proof of disposal certificates - Proof of reinstatement following any spillages - No burning of waste	Management- IWWMP and compliance checklists
Control at the workshops	- Soil and water pollution - Waste disposal	- Management and maintenance of plant and machinery will be strictly monitored, regardless of whether it is serviced on site (i.e. at the place of construction/ rehabilitation activity or at a formalised workshop). - All maintenance, including washing and refuelling of plant on site shall take place at designated locations at the workshop areas. All machinery servicing areas shall be bunded.	Monthly monitoring	Random visual inspection during site visits	Management- IWWMP and compliance checklists
Hazardous Material Storage	- Soil and water pollution - Waste disposal	- Petrochemicals, oils and identified hazardous substances shall only be stored under controlled conditions. - All hazardous materials shall be stored in a secured, appointed area that is fenced and has restricted entry. - South Deep JV: South Deep Gold Mine should ensure that they keep proof that relevant authorisation to store such substances has been obtained from the relevant authority. In addition, hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or containment structure. - Before containment or storage facilities can be erected, South Deep JV: South Deep Gold Mine should	Weekly monitoring	- No hazardous waste accumulation on site - Proof of disposal certificates - No burning of waste - Suitable and adequate hazardous substance storage areas - Proof of submission and	Management- IWWMP and compliance checklists

Activity	Aspects Affected	Mitigation Type	Monitoring frequency and tools	Performance Indicators	Responsible party for implementation and Monitoring Tool
		ensure that preventative measures are put in place to mitigate against pollution of the surrounding environment from leaks or spillage. The preferred method shall be a concrete floor that is bunded. Any deviation from the method will require proof from the relevant authority that the alternative method proposed is acceptable to that authority. The proposals shall also indicate the emergency procedures in the event of misuse or spillage that will negatively affect an individual or the environment.		approval from the Employers Environmental Manager/Environmental Officer (EO)	
Fuel and Gas Storage	- Soil and water pollution - Waste disposal	- Fuel shall be stored in a secure area in a steel tank supplied and maintained by the fuel suppliers. An adequate bund wall of at least 110% of the volume stored, shall be provided for fuel and diesel areas to accommodate any leakage spillage or overflow of these substances. - The area inside the bund wall shall be lined with an impervious lining to prevent infiltration of the fuel into the soil. Any leakage, spillage or overflow of fuel shall be attended to immediately. - Gas welding cylinders and Liquefied Petroleum Gas (LPG) cylinders shall be stored in a secure, well-ventilated area. Storage of hazardous substances must comply with the relevant regulations under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA).	Weekly monitoring	- Inspect bunded area for leaks / drainage - Proof of disposal certificates - No burning of waste	Management- IWWMP and compliance checklists
Oil and Lubricant Waste	- Soil and water pollution - Waste disposal	- Used oil, lubricants and cleaning materials from the maintenance of vehicles and machinery shall be collected in a holding tank and sent back to the supplier. - Oils collected in this manner, shall be retained in a safe holding tank and removed from site by a specialist oil recycling company for disposal at approved waste disposal sites. - Oil collected by a mobile servicing unit shall be stored in the service unit's sludge tank and discharged into the safe holding tank for collection by the specialist oil recycling company. - All used filter materials shall be stored in a secure bin for disposal off site. Any contaminated soil shall be removed and replaced. Soils contaminated by oils and lubricants shall be collected and disposed of at a facility designated by the local authority to accept contaminated materials.	Weekly monitoring	- Inspect bunded area for leaks / drainage - Proof of disposal certificates. - No burning of waste.	Management- IWWMP and compliance checklists
Soil and Stockpile Management	Soil erosion	- Topsoil shall be removed from all areas where physical disturbance of the surface will occur and shall be stored and adequately protected. South Deep JV: South Deep Gold Mine will provide for the stripping and stockpiling of topsoil from the site for later re-use. Topsoil is considered to be the natural soil covering, including all the vegetation and organic matter. Depth may vary at each site. - The areas to be cleared of topsoil shall include the storage areas. All topsoil stockpiles and windrows shall be maintained throughout the contract period in a weed-free condition. - Weeds appearing on the stockpiled or windrowed topsoil shall be removed by hand. - Soils contaminated by hazardous substances shall be disposed of at an approved waste disposal site. - The topsoil stockpiles shall be stored, shaped and sited in such a way that they do not interfere with the flow of water to cause damming or erosion, or itself be eroded by the action of water. - Stockpiles of topsoil shall not exceed a height of 2m, and if they are to be left for longer than 6 months, shall be analysed, and if necessary, fertility improved before replacement. - Stockpiles shall be protected against infestation by weeds. - South Deep JV: South Deep Gold Mine shall ensure that no topsoil is lost due to erosion – either by wind or water. - Areas to be top-soiled and grassed shall be done so systematically to allow for quick cover and reduction in the chance of heavy topsoil losses due to unusual weather patterns.	Monthly monitoring	Visual inspection of stockpiles	Management- IWWMP and compliance checklists
Abstraction of groundwater for the continuation of operations to ensure a safe mine working Environment Abstraction of water from scavenger boreholes for plume interception	Ground and Surface Water due to dewatering.	- Authorised abstraction volume of 3 686 544 m³/a be complied with to align with modelled containment requirements. - Maintain existing scavenger borehole network and pumping regime to ensure continued plume containment. - It is crucial to monitor the groundwater levels and volumes in response to abstraction. This is to ensure successful dewatering and collection of contact water moving through the subsurface. - A comprehensive quarterly analysis at an accredited laboratory for parameters pH, Electrical conductivity, total dissolved solids, major anions and cations (Ca, Mg, Na, NO₃, Cl, SO₄) and metals Al, Fe, and Mn. - The proposed abstraction boreholes must be pumped according to the recommended sustainable yield, and at the proposed pumping schedule of 24 hours of pumping per day. - Reassess abstraction rates periodically based on observed drawdown and recharge trends. - Update the model every second to evaluate dewatering impacts. - Treat waste water to potable standards for use on the mine and distribution to the Rand Water distribution system. Discharge to a water resource for the human and Ecological Reserve requirements. - Ensure that the volume of water abstracted from groundwater sources are monitored using flow meters and compliant with the licenced conditions.	- Physical monthly groundwater level measurements of abstraction boreholes - A comprehensive quarterly analysis	- Increased/ stable surface water volumes for other users - Improved ecological functionality - Increased groundwater yields for other users, especially farmers in the area - Decreased pollution plumes under the tailings facilities due to the drawing of contaminated groundwater	Environmental/ Operational Management - IWWMP and compliance checklists
Excessive flow due to discharges.	Surface and Ground Water Quality, Soil, Stormwater Management	Avoid discharges in excess of the flow required in the water resource (not more than 2ML/day) which may lead to erosion and sedimentation, and alteration of drainage patterns, especially at the discharge points.	Physical monthly groundwater level	Controlled and compliant discharges quantities	Environmental/ Operational Management - IWWMP and

Activity	Aspects Affected	Mitigation Type	Monitoring frequency and tools	Performance Indicators	Responsible party for implementation and Monitoring Tool
		- Reclaim water for re-use on the mine and treat water to acceptable standards for potable and process water on the mine and discharge to a water resource for the human and Ecological Reserve requirements. - Treat waste water to potable standards for use on the mine and distribution to the Rand Water distribution system. Discharge to a water resource for the human and Ecological Reserve requirements. - Conserve water. Water containing waste must be separated from clean water. Prevent cross-contamination. Follow good cleaning practices to conserve water and to avoid cross-contamination. - Prevent contamination of soil, surface and groundwater resources. - Equipment should be kept in working condition to promote water conservation. - Ensure sustainability.	- measurements of abstraction boreholes - A comprehensive quarterly analysis	- Treated waste water to potable standards for use on the mine. - Water conservation - No contamination of soil, surface and groundwater resources	compliance checklists
Drainage / Stormwater Management	Water Quality, Soil, Stormwater Management	- The quality, quantity and flow direction of any surface water runoff shall be established with the aid of a qualified engineer prior to disturbing any area for construction/ rehabilitation purposes. Cognisance shall be taken of these aspects and incorporated into the planning of all construction/ rehabilitation activities. - Before a site is developed or rehabilitation activities are commenced with, it shall be established how this development/ rehabilitation activities will affect the drainage pattern. - No water resource shall be polluted in any way due to the proposed activities. - No wastewater may run freely into any of the surrounding environment or neighbouring properties. The contractor shall implement the storm water design in accordance with the approved SWMP. - South Deep JV: South Deep Gold Mine and Contractor(s) shall ensure compliance with the requirements of the NWA and GN 704. Adequate storm water systems (in alignment with GN704) must be in place to collect contaminated storm water to prevent contaminated storm water entering the water resources. - All areas susceptible to erosion shall be protected by ensuring that there is no undue soil erosion resultant from construction/ rehabilitation and/or mining activities. - Berms shall be constructed where necessary to direct all runoff into the storm water system. - Care must be taken to avoid scouring and erosion and suitable measures should be placed in areas where runoff concentrates, in order to detain the sediment load and slow down the runoff. - All erosion damage shall be repaired as soon as possible as directed by the Environmental Representative. - Consideration shall be given to the placement of silt traps or barriers where the soils are of a dispersive nature or where toxic fluids are used in the construction/ rehabilitation process. - The silt traps must be large enough to contain runoff so that they function properly under heavy rain conditions. - Bunded areas in the chemical stores areas; and adequately designed return water dams/storm water containment dams must be maintained. - Implement storm water maintenance programme and maintain updated water balance. - Threshold levels of salts, metals and other potential contaminants should be maintained to avoid contamination of the water resources.	- Conduct daily inspections on stormwater infrastructure - Surface water monitoring at frequencies approved by the DWS	- Visual inspection, no excessive soil erosion or sedimentation. - No deteriorating water quality due to diffuse storm water runoff.	Environmental/ Operational Management - IWWMP and compliance checklists
Spillages	Soil and water pollution	- Watercourses shall be protected from direct or indirect spillage of pollutants such as refuse, garbage, cement, concrete, sewage, chemicals, fuels, oils, aggregate, wash water, and organic materials. - In the event of a spillage, South Deep JV: South Deep Gold Mine should arrange for professional service providers to clear the affected area. - All spills must be dealt with as per the Emergency Response Procedure. - Should water downstream of the spill be polluted, and fauna and flora show signs of deterioration or death, specialist hydrological or ecological advice will be sought for appropriate treatment and remedial procedures to be followed.	Weekly monitoring	Visual inspection	Management- IWWMP and compliance checklists
Areas of Specific Importance/ Sensitive Areas	- Loss of populations of threatened plant species - Loss of habitat of threatened animal species - Loss of indigenous natural vegetation - Erosion and siltation due to change in runoff and drainage patterns - Establishment and spread of declared weeds and alien invader plants - Noise impacts on local residents	- Any area, as determined and identified as sensitive or of special interest within the site (e.g. watercourses) shall be treated according to the express instructions contained in these specifications or the approved IWWMP. - The overriding principle is that such defined areas requiring protection shall not be changed. - No unnecessary vegetation clearing will be allowed in natural vegetation areas.	Weekly monitoring	No vegetation has been unnecessarily removed (photo graphic evidence)	Management- IWWMP and compliance checklists
Dust Control	Nuisance pollution	- Dust caused by strong winds, construction/ rehabilitation and operational activities shall be controlled by means of water spray vehicles. - Exposed soils and material stockpiles shall be protected against wind erosion.	Monthly monitoring	Routine observation, no complaints from residents	Management- IWWMP and compliance checklists

Activity	Aspects Affected	Mitigation Type	Monitoring frequency and tools	Performance Indicators	Responsible party for implementation and Monitoring Tool
		- The location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. - A dust monitoring system needs to be put in place to ensure that dust falls within the acceptable limits as per the ambient air quality standards.			
Alien Vegetation	Habitat destruction	- South Deep JV: South Deep Gold Mine shall establish an on-going monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per the NEMBA). - South Deep JV: South Deep Gold Mine shall be held responsible for the removal of alien vegetation within the boundary of the site disturbed during construction/ rehabilitation. This includes, for example, service roads, stockpile areas, and wherever material generated for or from construction/ rehabilitation has been stored temporarily.	Monthly monitoring	Visual inspection, vegetation removal record by contractor, no unnecessary vegetation clearing material generated for or from construction/ rehabilitation site has been stored temporarily.	Management- IWWMP and compliance checklists
Compliance	Fines	- Any additional licensing or permitting requirements must be identified prior to any construction/ rehabilitation activities commencement. - All waste which requires disposal must be disposed of at a suitably licenced facility. - An inventory of infrastructure and wastes together with the ultimate destination (e.g. recycler, waste disposal) should be kept for future records. - The sites must be rehabilitated to the pre-construction/ rehabilitation condition or alternatively to align with the surrounding land-uses at the time. - The rehabilitated site must be protected from future erosion. - The area where the site offices are placed will require rehabilitation at the end of the contract. - All construction/ rehabilitation material, including concrete slabs shall be removed from the site on completion of the contract, to South Deep JV: South Deep Gold Mines satisfaction. - Any disturbed areas should be rehabilitated with natural vegetation endemic to the area as soon as possible after decommissioning.	Weekly Monitoring.	Routine check for IWWMP availability and awareness.	Management- IWWMP and compliance checklists

In addition to the IWWMP Action Plan, the high-level mitigation measures for potential impacts identified for the proposed WUL and its addendum amendments, and consolidation project must be implemented. The potential impacts and mitigation measures that are expected from the proposed activities are presented in Table 74.

7-7 CONTROL AND MONITORING

Monitoring as described in Section 6-11 should be undertaken. Data from water quality- and biomonitoring should be assessed against the WUL compliance limits.

7-8 MONITORING PROGRAMME AND AUDIT PLAN

The impact management actions must be implemented throughout the life of the proposed WUL and its addendum amendments, and consolidation project, from planning to post closure phases. A monitoring programme and an audit plan (Table 80) must be implemented.

Table 80: Proposed Monitoring Programme and Audit Plan

Component/ Aspect	Monitoring Objective	Monitoring Requirements and Frequency/ duration	Reporting	Responsible Party	Performance / success criteria
WUL Audit Reports	To audit against the conditions of the issued IWUL.	- Monthly during construction/ rehabilitation, and annually during operation. - During decommissioning, the frequency will be as determined in the issued WUL.	WUL Audit Report.	External Independent EAP.	- Closure and Decommissioning Commitments on the issued proposed project WUL Conditions met. - Annual WUL audits.
Freshwater (Wetlands and Aquatic) Biomonitoring	- Monitoring of impacts on the extent of the functional area of the wetlands and riverine systems. - Define the PES, Ecological Importance and Sensitivity (EIS), and ecological service provision of the identified wetlands and riverine systems.	Bi-annual (twice a year), during construction/ rehabilitation, operation and decommissioning phases, and for at least 10 years post-closure (or until a closure certificate is issued).	The Aquatic Biomonitoring Report will be compiled to: - Comply with the monitoring measures - To characterise the biotic integrity of the aquatic resources at predetermined biomonitoring points. - To evaluate the extent of site-related effects using selected ecological indicators. - To assess spatial and temporal trends. - To identify any impacts to the aquatic resources which may have occurred since the previous biomonitoring event.	- The environmental officer who is professionally registered, South African Scoring System version 5 (SASS5) accredited and holds a relevant qualification in biological or water sciences. - Wetland Specialist.	- Free-draining landforms. - Re-instated pre-mining surface water flow patterns maximising the clean surface water runoff into natural drainage lines. - In situ water quality within ranges of in-county standards. - Free movement of wetland species, including migratory species. - Maintained levels of biodiversity.
Surface Water (water quality)	- Ensure that monitoring is implemented to cover all mining activity areas. - The monitoring should cover a minimum location as proposed in Table 62 and Figure 54. The details of locations, parameters and standards for comparison are presented in Table 63.	Monthly. Monitoring must continue after the project has ceased and the results reach a steady state to detect residual impacts.	Results and findings will be compiled into water quality monitoring report, with attached laboratory results.	Hydrologist.	- Water quality results within ranges of in-country water quality standards. - No evidence of significant erosion and water pooling on rehabilitated areas. - No possible surface contaminant sources remaining on the rehabilitated mine site that could compromise the planned land use and/ or pose health and safety threats.
Surface Water (flow volumes)	- Flow monitoring should be carried out in channels and pipelines, at abstraction and discharge facilities on site, and at any discharge points onto the nearby identified watercourses. Dewatering volumes should also be recorded. - Determine whether the rehabilitated mine site is free draining, and that unnecessary impoundment of surface water run-off is prevented. - Conduct a site inspection after the onset of the rainy period, after all closure related measures have been implemented;	- Monthly to update and calibrate the water balance for the mine, during operation. - Quarterly for 10 years after decommissioning or as deemed necessary.			
Groundwater quality	To monitor groundwater quality in both natural aquifers and mine workings, to track water quality changes (improvements) over time as a result of closure rehabilitation activities.	Quarterly during operation, and for at least 10 years post-closure (or until a closure certificate is issued).	- Results and findings will be compiled into a quarterly water quality monitoring report, with attached laboratory results. - An annual compliance report will be compiled and submitted to the authorities for evaluation and comment.	Geohydrologist for analysis by an accredited water laboratory.	- Acceptable threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the land use. - The applicable thresholds do not pose a threat to surrounding land uses or land users. - Water quality results within ranges of in-country water quality standards. - No evidence of dewatering and lowering of water tables within the vicinity of the mine.
Groundwater flows/ levels	To monitor the piezometric (water table) levels in all monitoring borehole openings to measure the rate of recharge to underground workings in closed mining areas				
Soils	- All areas disturbed by mining activities and land reinstated by rehabilitation activities. - The rehabilitated area must be assessed for compaction, fertility, and erosion and must meet the Chamber of Mines Guidelines.	- Undertake rehabilitation activities as per the approved rehabilitation plan for the site. - Sample rehabilitated soils annually for the first 3 years, and every 3 years thereafter until fertility targets are met or a closure certificate is issued. - The soils must be assessed yearly (during the dry season so that recommendations can be implemented before the start of the wet season) to correct any nutrient deficiencies. Apply amelioration measures where required as informed by sampling undertaken. - Where soil pollution has likely occurred, methodologies for bioremediating hydrocarbon contaminated soils on site for reuse in the rehabilitation process must be investigated. Then Collect soil samples from various locations and depths for laboratory analysis to determine contamination levels and to Identify specific contaminants present.	Sample rehabilitated soils annually for the first 3 years, and every 3 years thereafter until fertility targets are met or a closure certificate is issued.	Soil specialist.	- Soil analysis results comply with remediation targets at a 95-percentile level in line with best practice; and - Self-sustaining vegetation establishment.
Financial Provisions Update	To ensure that the mine is compliant with the financial provision Regulations of 2015, and that there is sufficient funding provided by the mine for closure and rehabilitation costs.	Annually during operation.	Financial Provision Update Report.	External Independent EAP.	Annual update.

7-9 MONITORING OF CHANGE IN BASELINE INFORMATION

Monitoring provides information pertaining to the changes in baseline conditions and the impacts of the mine on the environment and enables the effectiveness of the environmental management implemented on site to be measured both qualitatively and quantitatively.

For the proposed project, surface water monitoring, groundwater monitoring and biomonitoring will be conducted by suitably qualified persons, and interpretation of monitoring results will be done by appropriately qualified and experienced scientists. The appointed person will communicate, on a regular basis, with the local I&APs identified with regards to the project and will report on the progress made with regards to implementation of mitigation measures. Any complaint, with regards to the activities at South Deep JV: South Deep Gold Mine, will be reported to the appointed person and be recorded in the complaints register. Information from the assessment of the data and reporting will be used towards continual improvement at the mine and will inform the annual updates of the IWWMP. Reports will be submitted on an annual basis to various government departments and formal institutions as requested by management objectives, conformance targets and applicable legislation and other legal requirements. All results will be electronically available to DWS.

7-10 AUDIT REPORT ON PERFORMANCE MEASURES

South Deep JV: South Deep Gold Mine was originally granted a WUL in terms of Chapter 4 of the NWA on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369). From 2016 to 2017, South Deep JV: South Deep Gold Mine identified some errors on the issued WUL i.e. the amendments to quantities which were contrary to what was applied for. Other amendments included the addition of scavenger boreholes mainly established to control the pollution plume around the TSFs and RWDs, for the removal and containment of contamination from the TSFs by abstracting contaminated water from the aquifers. The WUL was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705). The WUL also had errors. An addendum to the issued WUL was issued on 29 July 2021 (Refer to Appendix B for WULs and Addendum).

Since the issuance of the original WUL, internal and external WUL audits are conducted annually. An annual water quality and quantity (surface and groundwater) report will be compiled and submitted to the Regional Director: DWS: Gauteng in accordance with the requirements of the WUL. The contents of the report will include:

- Water quality results of monthly water quality sampling at surface points and quarterly results at groundwater monitoring positions; and Water levels of identified boreholes.

A register of environmental monitoring and auditing results will be available for inspection. This will also include compliance with environmental legislation, such as the NEMWA, NEMA, NWA and the mines ISO 14000 implementation. For the proposed WUL and its addendum amendments, and consolidation project, monitoring and auditing will be conducted as indicated in Table 80. Concerns and non-compliances that will be identified during the audits will be included in the action plan (Table 79) for implementation and tracking progress, annually when the IWWMP is updated.

7-11 AUDIT AND REPORT ON RELEVANCE OF IWWMP ACTION PLAN

The IWWMP action plan will be reviewed as required in terms of the IWUL or any review and amendment thereof. South Deep JV: South Deep Gold Mine should conduct audits as follows:

- ISO 14001 audits will be conducted annually;
- Internal and external audits against the WUL will be conducted annually for submission to DWS. Actions identified to rectify non-compliances will be incorporated into the action plans of the IWWMP updates; and
- DWS will conduct scheduled site visits and compliance audits to assess compliance to the NWA and

WUL.

SECTION 8: CONCLUSION

South Deep JV: South Deep Gold Mine was originally granted a WUL in terms of Chapter 4 of the NWA on 21 November 2011 (License number: 03/C22J/ACFGIJ/1369). From 2016 to 2017, South Deep JV: South Deep Gold Mine identified some errors on the issued WUL i.e. the amendments to quantities which were contrary to what was applied for. Other amendments included the addition of scavenger boreholes mainly established to control the pollution plume around the TSFs and RWDs, for the removal and containment of contamination from the TSFs by abstracting contaminated water from the aquifers. The WUL was issued on 19 November 2018 (which supersedes the 2011 WUL) (License number: 08/C22J/GCEFIJA/8705). The 2018 WUL also had errors. An addendum to the issued WUL was issued on 29 July 2021 (Refer to Appendix B for WULs and Addendum).

As detailed in Section 3-4, South Deep JV: South Deep Gold Mine is required to compile and submit for approval, an IWULA for the following NWA Section 21 water uses: Section 21 (a), (b), (c), (e), (f), (g), (i), (j).

A pre- application enquiry was submitted on 17 July 2023. A request for a pre-application meeting was received on 11 August 2023. A site visit/ meeting with the DWS officials was convened on 31 August 2023. From the site visit/ meeting, MC was requested by the DWS to submit on behalf of South Deep JV: South Deep Gold Mine, a IWULA for the consolidation and amendment of the WULs granted to South Deep JV: South Deep Gold Mine as well as incorporating new activities proposed to be conducted for future proofing the mining operation. DWS also advised that South Deep JV: South Deep Gold Mine also considers investigating water uses within the entire mine, so that a consolidated application is submitted for the issuance of an amended WUL, which would cover all water uses which might not have been authorised.

MC conducted five (5) days of site visits in the presence of the South Deep JV: South Deep Gold Mine team. The site visits were undertaken to understand the receiving environment and the current activities. A screening exercise has been undertaken to determine the applicable activities and the relevant legislation and necessity for application to be lodged with the DWS.

An authority's meeting was convened with the DWS on 09 May 2025 to present the findings of the investigation/ assessment of the water uses within the entire mine. MC was advised to submit the Phase 1 documentation, outlining all the water uses identified (authorised and to be authorised). Phase 1 Application: Application details based on the outcome of the pre-application meeting were uploaded. The documentation was submitted on 06 November 2025.

Another site visit was conducted on 10 February 2026, in the presence of the DWS representatives and South Deep: South Deep Gold Mine representatives. DWS are yet to reopen Phase 1 for submission of additional information; and correction of the water uses being applied for.

The IWWMP is a living document that will be revised and updated throughout the life of the operations of the proposed WUL and its addendum amendments, and consolidation project and its associated infrastructure, to accommodate additional information and improved technologies. This will ensure that water and waste management is continually optimised and adapted to the changing needs of the proposed project at West Mine and the WMA.

SECTION 9: REFERENCES

- Department of Water and Sanitation (2011). Licence No: 03/C22J/ACFGIJ/1369.
- Department of Water and Sanitation (2018). Licence No:08/C22J/GCEFIJA/8705.
- Department of Water and Sanitation (2021). Licence No:08/C22J/GCEFIJA/8705. Addendum.
- DWAF (1996) South African Water Quality Guidelines, Volumes, 1, 4 and 6. First Edition
- Envass (2026). Aquatic Biodiversity Assessment for the South Deep Gold Mine.
- Envass (2026). Biannual Aquatic Biomonitoring Assessment for the Goldfields South Deep Gold Mine: 2025 Wet Season.
- Envass (2026). Hydropedological Impact Assessment for the South Deep Gold Mine.
- Envass (2026). Watercourse Rehabilitation and Plant Species Plan for the South Deep Gold Mine.
- Golder Associates (2016). Integrated Water and Waste Management Plan for South Deep Gold Mine.
- Gold Fields South Deep Gold Mine, 2024. Social and Labour Plan 2022-2024.
- Highlands Hydrology (Pty) Ltd (2026). Flood Hydrological Assessment and Conceptual Storm Water Management Plan for the existing Goldfields South Deep Mining Operation.
- Rayten Engineering and Environmental Consultants (2026): Dustfall Monitoring Report (02 April – 30 April 2026)
- Rison Groundwater Consulting (2026). South Deep Gold Mine: January 2026 (Fourth Quarter of 2025) Licenced Monitoring Boreholes. Groundwater Quality Monitoring Report.
- SLR (2025). Doornpoort TSF Geochemistry & Hydrogeology Study.
- Water Hunters CC (2025). Groundwater assessment and numerical groundwater flow model for the South Deep Gold Mine Water Use License (WUL).
- West Rand District Municipality, 2022. Integrated Development Plan (IDP) 2022/23 to 20226/27 as revised in 2022/23.
- SANS 241-1 (2011) South African National Standard: Drinking Water, ISBN 978-0-626-26115-3

APPENDIX A:
EAP'S DETAILS

APPENDIX B:

**WUL GRANTED ON 21 NOVEMBER 2011 (LICENSE NUMBER:
03/C22J/ACFGIJ/1369); AMENDED WUL ISSUED ON 19 NOVEMBER 2018 (WHICH
SUPERSEDES THE 2011 WUL) (LICENSE NUMBER: 08/C22J/GCEFIJA/8705); AND
AN ADDENDUM TO THE ISSUED WUL WHICH WAS ISSUED ON 29 JULY 2021**

APPENDIX C:
INFRASTRUCTURE LAYOUT PLAN

APPENDIX D:
ENGINEERING DESIGN REPORTS

APPENDIX E:
FLOOD HYDROLOGICAL ASSESSMENT AND CONCEPTUAL STORMWATER
MANAGEMENT PLAN

APPENDIX F:
HYDROPEDOLOGICAL ASSESSMENT REPORT

APPENDIX G:
GROUNDWATER ASSESSMENT AND NUMERICAL GROUNDWATER FLOW
MODEL REPORT

APPENDIX H:
AQUATIC BIODIVERSITY ASSESSMENT REPORT

APPENDIX I:
REHABILITATION AND PLANT SPECIES PLAN

APPENDIX J:
DWS CORRESPONDENCE

APPENDIX K:

SOUTH DEEP JV: SOUTH DEEP GOLD MINE GN 704 EXEMPTIONS

APPENDIX L:

**SOUTH DEEP JV: SOUTH DEEP GOLD MINE CERTIFICATE OF REGISTRATION
(COR-18) ISSUED BY THE NNR FOR THEIR SOUTH DEEP GOLD MINE
OPERATIONS**

APPENDIX M:
CONTINUOUS TRANSPORT PERMIT NO. CPT 204313, ISSUED BY SOUTH
AFRICAN POLICE SERVICES (SAPS)

APPENDIX N:
DETAILED SURFACE WATER QUALITY RESULTS

APPENDIX O:
PUBLIC PARTICIPATION PROCESS INFORMATION

APPENDIX P:
MOTIVATION IN TERMS OF SECTION 27(1) OF THE NWA