Environmental Impact Assessment for the Proposed Temo Coal Rail Loop, Road Diversion and Pipeline Project, near Lephalale, Limpopo Province

Surface Water Assessment

Project Number:

NAM5335

Prepared for:

Namane Resources

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This document has been prepared by Digby Wells Environmental.

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Name	Responsibility	Signature	Date
Tshepiso Ratlagane	Report Compiler		February 2019
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EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) was appointed by Temo Coal (Pty) Ltd (Temo Coal) to undertake a surface water impact assessment study for the proposed development of a Rail loop, Road and Pipeline in Lephalale, Limpopo. Temo Coal proposes to divert the road D175 around the mining area. The proposed road diversion will branch off the existing route at the western mine boundary (west of the mine office area) and will be diverted just inside the eastern farm boundary of the Farm Draai Om 244 LQ. The total length of the road diversion is 3.36 km. The proposed rail loop will allow coal to be transported to Richards Bay Coal Terminal (RBCT) and the water pipeline will follow the existing road reserve crossing through quaternary catchments A42H and A42J to Temo Coal Mine located in A41E.

Baseline Hydrology

Lephalale experiences hot summers and mild winters. The month of November recorded the highest maximum temperature of 36°C while the lowest maximum temperature of 24°C was recorded during the month of July. The quaternary catchment A41E has an area of 816 km^2 with mean annual precipitation (MAP) of 440.07 and Mean Annual Runoff (MAR) of 121mm. The A42J has an area of 1027 km^2 with runoff of 1254mm whilst catchment A42H has an area of 1057 Km^2 with MAR of 145mm. As classified in WR2012 manual, the A41E, A42 J and A42H quaternary catchments fall within 1D evaporation zone, in which the monthly evaporation data has been estimated. The average annual potential evaporation for the 3-quaternary catchments is 1949 mm, thereby rendering the area as a semi-arid environment

Land and Water Uses

The A41E catchment is largely undeveloped with limited water resources and limited water uses. The main land use in this catchment is agricultural use involving livestock and game ranching, while a small section of the area is being used for mining purposes. The catchments A42J and A42H are surrounded by residential and industrial areas. The identified uses of water within the catchments include 87% agricultural activities while 13% collectively constitutes industrial, mining, power generation and domestic uses.

Surface Water Impact Assessment

The following impacts were identified for the construction, operational and decommissioning phases involving the rail loop, water pipeline and a diversion of a road. The interactive activities which bring about the identified impacts are also described:

Construction Phase

Impact 1: Siltation of surface water resources leading to deteriorated water quality

Interactions bringing about the impact:

- Exposure of soils due to clearance of vegetation and excavations during road diversion, pipeline installation and rail loop construction.

Impact 2: Alteration of channel geometry and occurrence of stream-bank erosion at pipeline river crossing

Interactions bringing about the impact:

- Excavation to install an underground water pipeline across a stream.

Impact 3: Contamination of water quality through oil spills, fuels and other hydrocarbons.

Interactions bringing about the impact:

- Storage and handling of hydrocarbon materials such as oils, fuels and grease.

Operational Phase

Impact 1: Contamination of surface water through spillage of hydrocarbons such as fuels and oils

Interactions bringing about the impact:

- Chemical spillages arising from moving vehicles and machinery during operation and maintenance of the rail loop, road and pipeline infrastructure.

Decommissioning Phase

Impact 1: Sedimentation and siltation of watercourses leading to deteriorated water quality.

Interactions bringing about the impact:

- Soil disturbance due to demolition and removal of pipeline, rail loop and road infrastructure.

Impact 2: Surface water contamination due to hydrocarbon waste spillages

Interactions bringing about the impact:

- Spillages of hydrocarbons (oils, fuels and grease) by vehicles and machinery used during demolition and transportation of material from decommissioned infrastructure.

Impact 3: Improvement of surface water drainage and streamflow regimes close to pre-development conditions

Interactions bringing about the impact:

- Rehabilitation, profiling and re-vegetation of the sites from where infrastructure has been removed.

Recommendations

Construction Phase

Clearing of vegetation and excavations should be confined within the project footprint, such as the pipeline river crossing and the route for the road diversion. If possible, construction activities must be prioritized during the dry months of the year (May-October) to limit mobilization of sediments or hazardous substances during site clearance. It is also recommended to re-vegetate the backfilled and reshaped underground pipeline route after installation to minimise erosion and sedimentation of nearby watercourses. All fuel storage areas should be appropriately bunded and spill kits should be in place, and construction workers trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills. Ablutions facility for construction workers and general waste bins should be provided. An accredited contractor should be appointed to properly dispose of the waste. An appointed Environmental Control Officer (ECO) must always be available to ensure implementation of the recommended mitigation/management measures during construction

Operational Phase

Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath. Surface water quality monitoring should continue to enable detection of the water quality impacts and therefore ensure that necessary mitigation measures are immediately implemented.

Decommissioning Phase

Use of accredited contractors for removal of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages. In the event of any accidental spillages, quick clean-ups should be conducted before contaminants spread to the surrounding natural environment.

It is vital to ensure the surface profiles of affected sites are rehabilitated to promote free surface runoff drainage to avoid ponding of water within the rehabilitated area. Rehabilitated sites should be re-vegetated to reduce erosion and subsequent sedimentation and siltation of nearby watercourses.

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1 Introduction

Temo Coal Mining (Pty) Ltd (hereinafter Temo Coal), proposes to construct ancillary infrastructure associated with their approved coal mining operation, the Temo Coal Mine ("Temo Mine"), near Lephalale in the Limpopo Province ("the Project"). The proposed ancillary infrastructure includes a road diversion, rail loop and water pipeline.

Digby Wells Environmental (Digby Wells) was commissioned by Temo Coal to perform a fauna and flora field survey to compile a report for the inclusion in an Environmental Impact Assessment (EIA) for Environmental Authorisation for Listed Activities as detailed in the EIA Regulations, under the National Environmental Management Act No. 7 of 1998 (NEMA).

1.1 Project Background

Temo currently has an approved mining right (MR) which was authorised by the Department of Mineral Resources on 27 September 2013 (Reference Number: LP 30/5/1/2/2/199 MR). That Project was also authorised in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations thereunder, dated 18 June 2010 (which have since been repealed). The Environmental Authorisation was granted by the Limpopo Department of Economic Development, Environment and Tourism (LEDET) on 13 July 2015 (Reference Number: 12/1/9/2-W55).

Temo Mine is located approximately 60km from Lephalale in the Limpopo Province. This project considers applying for Environmental Authorisation, in terms of NEMA, and a Water Use Licence (WUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) to construct a rail loop, road diversion and pipeline.

The farm portions on which the Temo Mine is situated comprise Verloren Valey 246 LQ, Duikerpan 249 LQ, Japie 714 LQ, Hans 713 LQ and Kleinberg 252 LQ. Temo proposes to mine coal using open pit methods and the open pit will be situated entirely within the Farm Verloren Valey 246 LQ.

In reference to this assessment, Temo proposes to divert the dirt road (D175) around the approved mining right area for mining to continue, to construct a rail loop for transportation of coal and construct a water pipeline to service the Temo mine. The regional and local setting of the project area is shown in Figure 1-1 and Figure 1-2 respectively.

1.2 Diversion of Road D175

Temo proposes to divert the road D175 around the mining area. The existing road runs from north-south from the farm Swelpan 245 LQ heading northwards to the farm Draai Om 244 LQ; continuing north into the mining area on the farm Verloren Valey 246 LQ. The proposed diversion will diverge from the existing route at the western mine boundary (west of the mine office area) and will be diverted just inside the eastern farm boundary of the Farm Draai Om 244 LQ. Where the southern boundary of the farm Nazarov 685 LQ meets the eastern boundary of Farm Draai Om 244 LQ, the diversion will head in a north-easterly direction and re-join the existing D175 alignment at the western boundary of Farm Dalyshope 323 LQ. The total length of the road diversion is 3.36 km

1.3 Proposed Rail Loop

Temo proposed a rail loop to allow for the transportation of coal to Richards Bay Coal Terminal (RBCT). The rail loop will include a loading loop which is within the Mining Right boundary at the Temo Mine. The total extent of the rail loop is 22.25 km in length. The loop itself will be on the Farm Duikerpan 249 LQ, and the railway line will then run to the west of the loop along the southern boundary of the mine, within the Farm Verloren Valey 246 LQ towards the D175 road

1.4 Proposed Pipeline

The water pipeline will follow the existing road reserve crossing along catchment A42H, A42J from the source to the mine based at A41E. The proposed project infrastructure is shown in Figure 1-3 below.

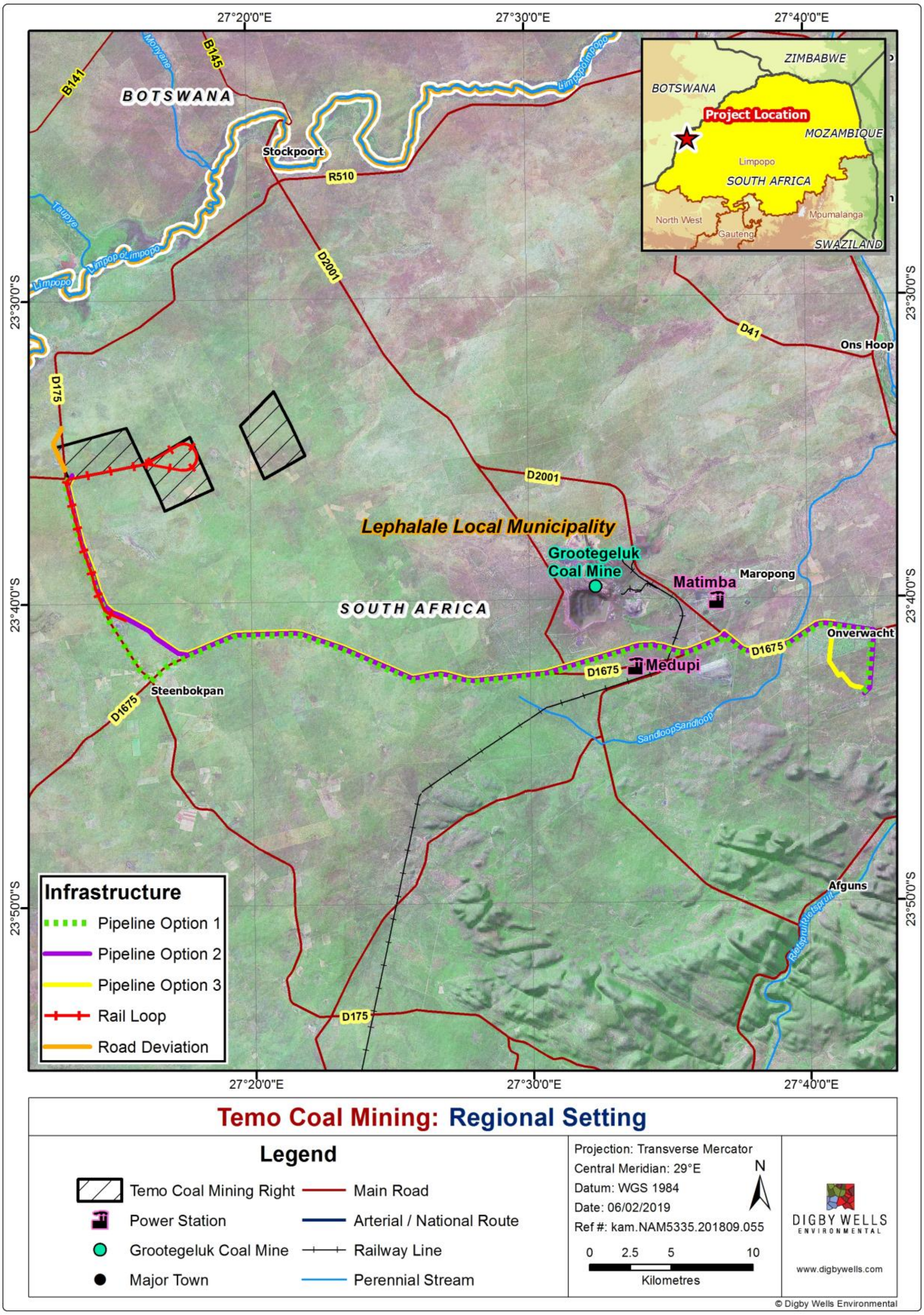

Figure 1-1: Regional Setting

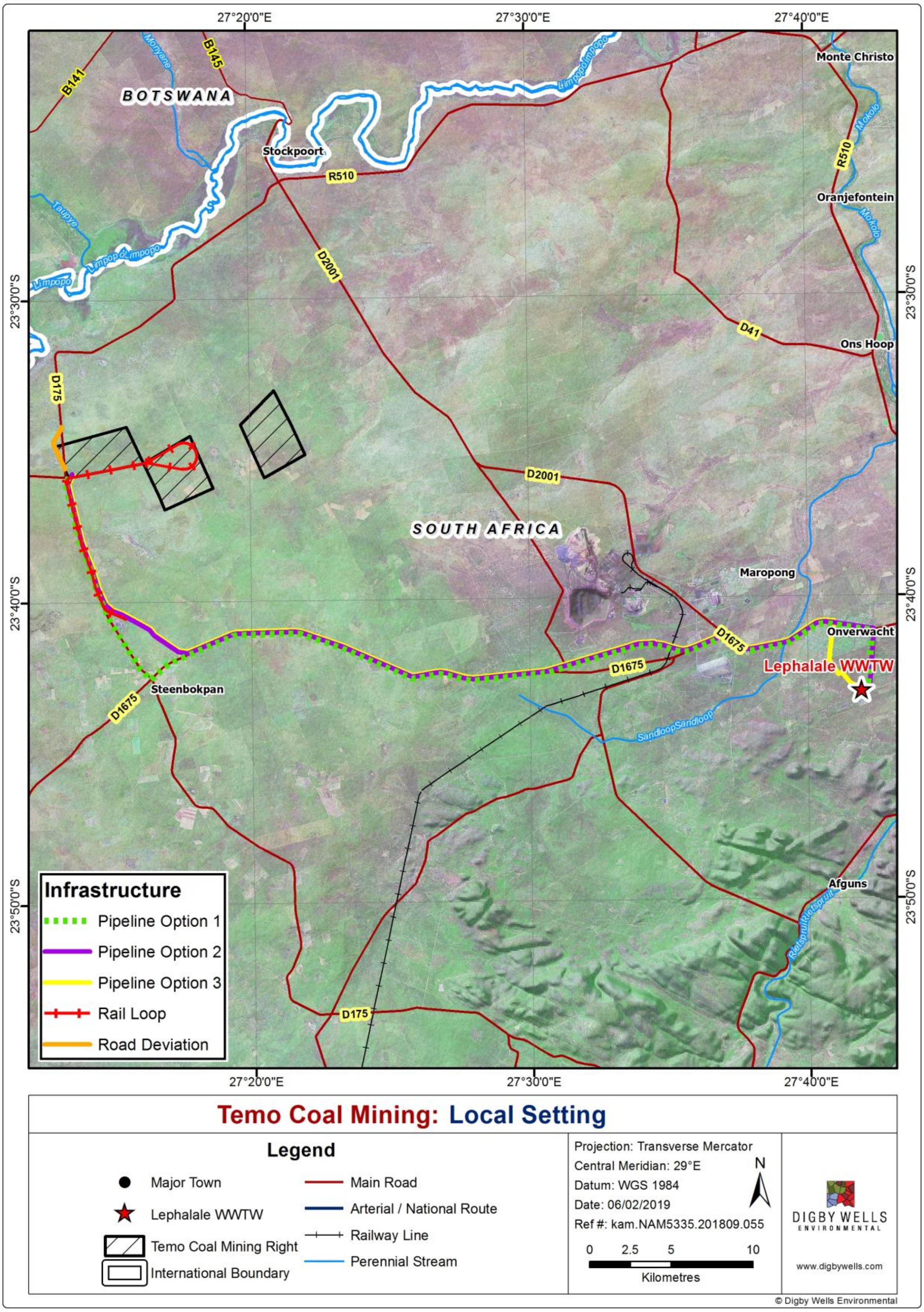

Figure 1-2: Local Setting

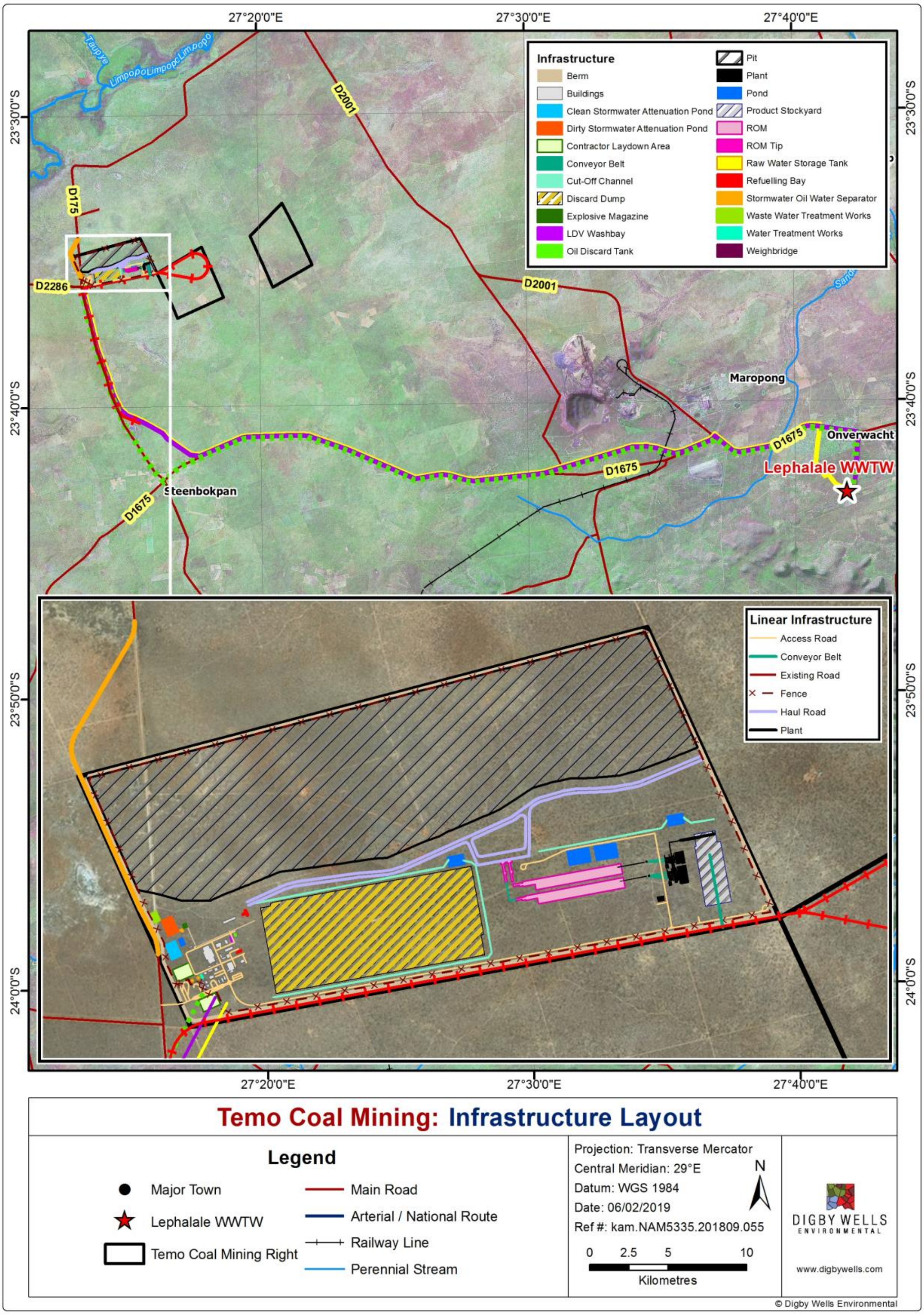

Figure 1-3: Infrastructure Layout

2 Details of the Specialist

Responsibility	**Report Writer**
Full Name of Specialist	Tshepiso Ratlagane
Highest Qualification	BSc (Hons) Environmental and Water Sciences
Responsibility	**Review and Technical Input**
Full Name of Specialist	Daniel Fundisi
Highest Qualification	MSc Hydrology
Years of experience in specialist field	8
Registration(s):	Pr.Sci.Nat. (SACNASP); Reg. Number: 400034/17
Responsibility	**Technical Review**
Full Name of Specialist	Mashudu Rafundisani
Highest Qualification	BSc (Hons) Environmental Management and Hydrology
Years of experience in specialist field	7
Responsibility	**Final Review**
Full Name of Specialist	Andre van Coller
Highest Qualification	MSc Geohydrology
Years of experience in specialist field	10

2.1 Declaration of Specialist

I, Daniel Fundisi, as the appointed specialist, hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent, other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Signature of the specialist

Daniel Fundisi (Pr.Sci.Nat)

Full Name and Surname of the specialist

Digby Wells Environmental

Name of company

February 2019

Date

3 Terms of Reference

3.1 Aims and Objectives

The aims and objectives of this surface water study are:

- To identify and characterise all surface water features (rivers/streams, pans and dams) within and near the project site; and
- To identify the potential surface water impacts (quality and quantity) that may result from the proposed project activities based on the established baseline conditions.
- To develop mitigation measures for implementation to prevent and/or reduce the identified potential surface water impacts.

4 Methodology

4.1 Desktop Assessment

The desktop assessment involved the characterisation of the catchment drained by the Mokolo River and its tributaries. Hydrometeorological parameters were evaluated from data obtained from the database of the Water Resources study of 2012 (WRC, 2015) to determine the Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and Mean Annual Runoff (MAR) for quaternary catchments A41E, A42J and A42H where the Temo Coal Mine, rail and road infrastructure are located. The Google Earth Pro satellite imagery and the South African Atlas for Climatology and Agrohydrology (Schulze, 2008) were used to characterise the general land cover for the area.

4.2 Impact Assessment

Surface water impacts were assessed based on their magnitude and the receiving environment's sensitivity, culminating in impact significance which identifies the most important impacts that require management.

Based on international guidelines and South African legislation, the following criteria were taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/ negative);
- Duration (short/medium/long-term, permanent(irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

The significance rating process followed the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts.

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 4-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the proposed mitigation measures. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 4-1 which is extracted from Table 4-2. The description of the significance ratings is discussed in Table 4-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 4-1: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	**Positive impacts**			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and / or social order.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and / or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and / or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
4	On-going serious natural and / or social issues. Significant changes to structures / items of natural or social significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.
3	On-going natural and / or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and / or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 4-2: Probability/Consequence Matrix

Probability	Significance																																					
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Consequence																																					

Table 4-3: Significance Rating Description[1]

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

5 Assumptions and Limitations

The following assumptions and limitations are applicable to this surface water assessment:

- The surface water assessment was undertaken on a desktop level and no field work was undertaken;
- No water quality data was available for the non-perennial stream that the pipeline crosses; hence water quality assessment was excluded as part of the study.

6 Baseline Surface Water Environment

This section provides the hydrological baseline description of the project area and surrounds. This includes descriptions of catchment characteristics, water management areas (WMA), rivers and drainage lines, climate (rainfall, evaporation and temperature), and topography of the area.

6.1 Hydrometeorology

South Africa is divided into nine Water Management Areas (WMA) as part of the Revised National Water Resource Strategy (NWRS) (DWS, 2012), and are managed by the Department of Water and Sanitation or in the case where Catchment Management Agencies (CMAs) are established. Each of the WMAs is made up of quaternary catchments which relate to the drainage regions of South Africa, ranging from A to X (excluding O). These drainage regions are subdivided into four known divisions based on size. For example, the letter A represents the primary drainage catchment; A2 for example will represent the secondary catchment; A21 represents the tertiary catchment and A21D would represent the quaternary catchment which is the lowest subdivision in the Water Resources of South Africa, 2012 manual. Each of the quaternary catchments has associated hydrological parameters.

The proposed Project area is located within the Limpopo Water Management Area (WMA 01), in the A4 secondary catchment, within the A41E, A42J and A42H quaternary catchments. However, most of the proposed activities are situated within quaternary catchment A41E.

The proposed Project is approximately 10 km from the Limpopo River which is the only perennial river associated with this catchment. The project area has gentle slopes of less than 1° in a north-westerly direction towards the Limpopo River. (Digby Wells, 2016). Several pans are found within the quaternary catchments with few drainages existing along the Limpopo River. A small pan was identified on the southern boundary of the Temo Coal project area.

6.1.1 Rainfall and Runoff

Generally the 3 quaternary catchments receive moderate to low rainfall. The wet season ranges from October to April, while the period from September to May represent the dry season. The MAP for A41E, A42J and A42H quaternary catchments, are 440.07 mm, 427.75 mm and 517.69 mm respectively (Table 6-1). Corresponding MAR for the aforementioned quaternaries are 121 mm, 1254 mm and 145 mm, respectively. The rainfall and runoff averages are based on rainfall data for the period from 1920 to 2009 (WRC, 2015).

The monthly distribution of rainfall and runoff, on average, are also indicated in Table 6-1.

Table 6-1: Monthly rainfall-runoff for A41E, A42J and A42H quaternary catchments

Month	**Quaternary Catchment**					
	A41 E		**A42J**		**A42H**	
	Rainfall	**Runoff**	**Rainfall**	**Runoff**	**Rainfall**	**Runoff**
	(mm)					
January	80.36	2.10	84.77	5.64	102.59	3.85
February	76.38	2.70	69.35	7.26	83.94	4.95
March	57.13	2.26	54.04	6.09	65.40	4.15
April	30.85	1.03	28.38	2.76	34.35	1.88
May	10.11	0.29	9.54	0.77	11.54	0.52
June	3.78	0.13	3.91	0.34	4.73	0.23
July	1.97	0.10	2.09	0.27	2.53	0.19
August	2.38	0.08	2.11	0.23	2.55	0.15
September	8.07	0.07	8.20	0.18	9.92	0.12
October	31.41	0.14	30.58	0.37	37.01	0.25
November	61.86	0.48	59.35	1.30	71.83	0.89
December	75.76	1.24	75.43	3.33	91.29	2.27
Totals	**440.07**	**10.61**	**427.75**	**11.36**	**517.69**	**19.47**

6.1.2 Temperature

Lephalale experiences hot summers and mild winters. During the winter, temperature can drop to 3.7°C on average in July.

The monthly maximum and average temperatures for Lephalale are depicted in Figure 6-1. The month of November recorded the highest maximum temperature of 36°C while the lowest maximum temperature of 24°C was recorded during the month of July.

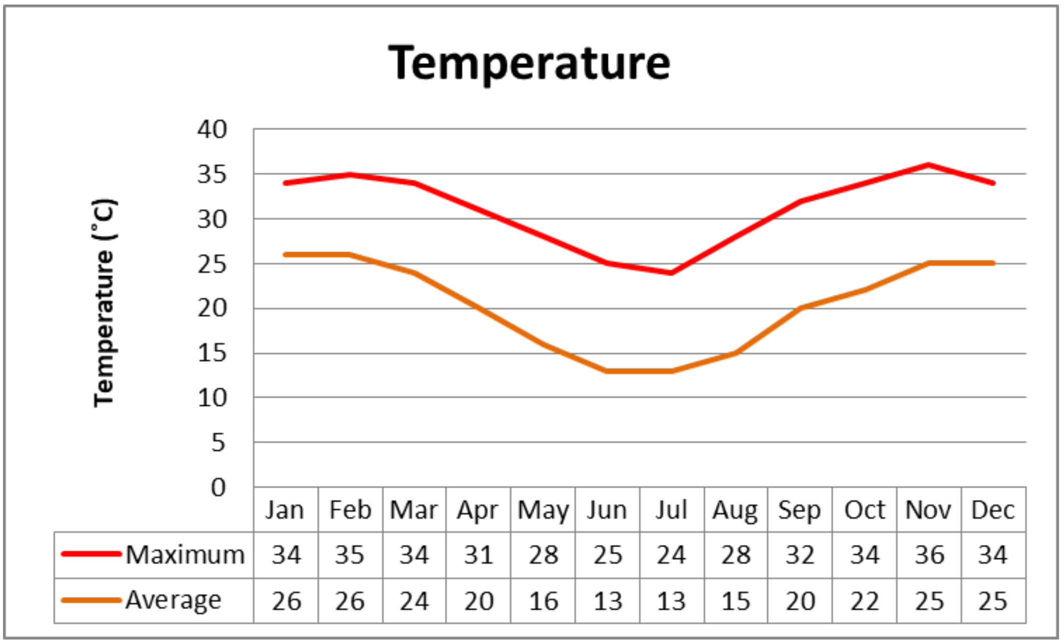

Figure 6-1: Average Monthly Temperature (2012-2014)

6.1.3 Evaporation

Quaternaries A41E, A42 J and A42H are under 1D evaporation zone. The higher evaporation rates are expected to be during the month of January whilst the lower evaporation rates are expected to be around September.

The average annual potential evaporation for the 3-quaternary catchments is 1949 mm, thereby rendering the area as a semi-arid environment (Table 6-2). The evaporation rates are higher than the average annual rainfall.

Table 6-2: Summary of Evaporation Data

Months	Symons Pan Evaporation	Lake Evaporation
	(mm)	
January	226	190
February	210	185
March	210	185
April	209	184
May	174	152
June	165	140
July	129	107
August	110	89
September	91	73

Months	Symons Pan Evaporation	Lake Evaporation
October	102	83
November	137	112
December	186	155
Totals	**226**	**190**

7 Land and Water Uses

The A41E catchment is a largely undeveloped catchment with limited water resources and limited water uses. It is characterised as a rural catchment with a smaller settlement which includes Steenbokpan and Sandbult communities. Lephalale is the nearest developed town on the neighbouring quaternary catchment.

There are no significant dams in this catchment. A significant portion of the water used in the area is sourced from underground aquifers due to the low assurance of the run-of-river yields. The main land use in the A41E catchment is agricultural involving livestock and game ranching with one section of the area being occupied by an existing mine.

The catchments A42J and A42H are surrounded by residential and industrial areas. The catchment A42H consists of small tributaries that join the main Mokolo River up its confluence with the Limpopo River. The identified uses of water within the catchments include 87% agricultural activities and 13% collectively constituting industrial, mining, power generation and domestic uses.

8 Impact Assessment

The surface water impact assessment was conducted for 3 phases which include the construction, operation and decommissioning phases.

8.1 Identified Potential Surface Water Impacts and Mitigations

The assessed activities under construction phase include site clearance or removing vegetation prior to installation of proposed pipeline and construction of road diversion. The proposed pipeline crosses one non-perennial stream within the A42J quaternary catchment, whilst the proposed road diversion is will be located approximately 5km away from the Limpopo River. While it is unlikely for surface water impacts to occur due to the proposed road diversion, installation of the pipeline over the non-perennial stream has the potential to impact on the surface water resources as discussed in the sections below.

8.1.1 Construction Phase

Table 8-1: Interactions and Impacts of Activity

Interaction	Impact
Exposure of soils due to clearance of vegetation and excavations during road diversion, pipeline installation and rail loop construction	Siltation of surface water resources leading to deteriorated water quality.
Excavation to install an underground water pipeline across a stream	Alteration of channel geometry and occurrence of streambank erosion at pipeline river crossing
Storage and handling of hydrocarbon materials such as oils, fuels and grease.	Contamination of water quality through oil spills, fuels and other hydrocarbons.

8.1.1.1 *Impact Description: Siltation of surface water resources leading to deteriorated water quality*

Clearing of vegetation and excavation on the project site, during the diversion of road, rail loop and installation of pipeline, leave the soils prone to erosion during rainfall events. Runoff from these areas, high in suspended solids, will cause an increase in turbidity in nearby natural water resources. This could also result from the stockpiled topsoil if not vegetated or well compacted.

Dust generated during the construction activities and increased vehicular movements can also be deposited into the pans and the Mokolo River thereby contributing to the accumulation of suspended solids and siltation of the water resources.

8.1.1.2 *Impact Description: Alteration of channel geometry and occurrence of streambank erosion at pipeline river crossing*

Excavation activities on the streambed and banks leads to alteration of channel geometry and the occurrence of streambank erosion, this will change streamflow regime and may impact on the surrounding riparian ecosystems.

8.1.1.3 *Impact Description: Surface Water contamination through oil spills, fuels and other hydrocarbons*

Dirty or contaminated runoff emanating from cement washing operations, fuel and oil storage areas, oil spills, spillages of other liquid waste and general waste have the potential to contaminate the watercourses.

Human activity will generate waste which includes general wastes (paper, glass, plastic and cans), biological sewage waste and other hazardous waste that may be exposed during construction. The handling and disposal of these wastes may have an impact on the surrounding streams if not managed appropriately.

These impacts will lead to the deterioration of water quality, thereby impacting aquatic life and downstream water users.

8.1.1.4 *Management/Mitigation Measures*

- Clearing of vegetation and excavations should be confined within the project footprint, such as the pipeline river crossing and the route for the road diversion.
- If possible, construction activities must be prioritized during the dry months of the year (May-October) to limit mobilization of sediments or hazardous substances during site clearance;
- Re-vegetate the backfilled and reshaped underground pipeline route after installation to minimise erosion and sedimentation of nearby watercourses.
- An appointed Environmental Control Officer (ECO) must always be available to ensure implementation of the recommended mitigation/management measures during construction.
- All fuel storage areas should be appropriately bunded and spill kits should be in place, and construction workers trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills;
- Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath;
- Ablutions facility for construction workers and general waste bins should be provided. An accredited contractor should be appointed to properly dispose of the waste;

Table 8-2: Impact significance rating for construction phase

Impact: Siltation of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	***Significance***
Duration	Medium term (3)	Equal to the duration of the construction phase	Minor - negative (54)
Extent	Limited (2)	The impacts will be localized to the nearby water resources from where the silt is being generated and the immediate downstream	
Intensity x type of impact	Moderately high - negative (-4)	This will have moderate impacts resulting reduction in water quality for local downstream users and aquatic life	
Probability	Certain (6)	Without appropriate mitigation there will be significant erosion on the TSF.	
Post-Mitigation			

Impact: Siltation of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	***Significance***
Duration	Short term (2)	As for post-mitigation	Negligible - negative (28)
Extent	Limited (2)	The impact may be limited to the site and its immediate surroundings	
Intensity x type of impact	Moderate - negative (-3)	Mitigation will reduce the impacts	
Probability	Probable (4)	Necessary mitigations will reduce the erosion probability significantly	

Impact: Alteration of stream channel geometry at pipeline river crossing			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	7	The impact will remain long after the life of the Project.	56-Minor (negative)
Intensity	4	Serious medium term environmental effects. Environmental damage is reversible	
Spatial scale	3	The impact will be local extending across the site and to nearby environments	
Probability	4	The impact will likely occur	
Post-mitigation			
Duration	2	The impact will be short term with a duration of less than 1 year if properly mitigated	12-Negligible (negative)
Intensity	2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants	
Spatial scale	2	Limited to the site and its immediate surroundings	
Probability	2	If mitigation measures are correctly implemented, it will be rare / improbable for this impact to occur.	

Impact: Surface Water contamination through oil spills, fuels and other hydrocarbons			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium term (3)	Equal to the duration of the construction phase	Minor - negative (60)
Extent	Municipal (4)	The impacts may be limited to the provincial scale from where the contaminated runoff enters the stream and the downstream	
Intensity	Serious loss (-5)	This may have serious impacts on the downstream water users due to elevated hydrocarbon levels, salts and other dissolved minerals in the surrounding streams	
Probability	Likely (5)	Without appropriate mitigation, the probability of the impact occurring is <65%	
Post-Mitigation			
Duration	Medium term (3)	As for pre-mitigation	Negligible - negative (33)
Extent	Local (3)	As for pre-mitigation	
Intensity	Serious loss (-5)	As for pre-mitigation	
Probability	Probable (4)	It is probable that the impact will occur	

8.1.2 Operational Phase

There are limited surface water impacts that are anticipated during operational phase of this project, except during maintenance of these infrastructures, there may be some potential surface water impacts during these maintenance activities as described in (Table 8-3). This potential impact was also identified during construction phase and the same mitigations provided in section 8.1.1.4 will be applicable to this phase as well.

Table 8-3: Interactions and Impacts of Activity

Interaction	Impact
Chemical spillages arising from moving vehicles and machinery during operation and maintenance of the rail loop, road and pipeline infrastructure	Contamination of surface water through spillage of hydrocarbons such as fuels and oils.

Table 8-4: Impact significance rating for the operation phase

Impact: Contamination of surface water through spillage of hydrocarbons such as fuels and oils			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Impact can occur over the project life if mitigation measures are not in place.	Minor-negative (44)
Extent	Local (3)	Contaminated water quality may affect the quality of the surrounding streams	
Intensity	Serious - negative (-3)	Moderate, short-term effects but not affecting ecosystem functions	
Probability	Likely (4)	It is probable that the impact will occur	
Post-Mitigation			
Duration	Project Life (3)	Medium term (1 – 5 years)	Negligible - negative (32)
Extent	Limited (2)	Limited to the site and its immediate surroundings	
Intensity	Moderate short term (-3)	Moderate, short-term effects but not affecting ecosystem functions	
Probability	Probable (4)	It is probable that the impact will occur	

8.1.3 Decommissioning Phase

Activities during this phase include demolition and removal of the pipeline, rail loop and road infrastructure, rehabilitation of the affected sites, generation and disposal of waste.

Table 8-5: Interactions and impacts of the activity

Interaction	**Impact**
Soil disturbance due to demolition and removal of pipeline, rail loop and road infrastructure	Sedimentation and siltation of watercourses leading to deteriorated water quality.
Spillages of hydrocarbons (oils, fuels and grease) by vehicles and machinery used during demolition and transportation of material from decommissioned infrastructure	Surface water contamination due to hydrocarbon waste spillages
Rehabilitation, profiling and re-vegetation of the sites from where infrastructure has been removed	Improvement of surface water drainage and streamflow regimes close to pre-development conditions

8.1.3.1 *Impact Description: Sedimentation and siltation of watercourses leading to deteriorated water quality*

Removal of infrastructure will expose and disturb the soil and leave it prone to erosion which leads to increased sedimentation and possible siltation of nearby watercourses

8.1.3.2 *Impact Description: Surface water contamination due to hydrocarbon waste spillages*

Water contamination may occur from spillages of hydrocarbons (oils, fuels and grease) by vehicles and machinery used during infrastructure demolition activities and transportation of decommissioned infrastructure.

8.1.3.3 *Impact Description: Improvement of surface water drainage and streamflow regimes close to pre-development conditions*

Rehabilitation, profiling and re-vegetation of the sites from where infrastructure has been removed will help improve drainage and streamflow regimes. Runoff contributing areas which were disturbed during mine operation activities would be restored back to pre-mining conditions as much as is practically possible.

8.1.3.4 *Management/ Mitigation Measures*

- Use of accredited contractors for removal of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages;
- In the event of any accidental spillages, quick clean-ups should be conducted before contaminants spread to the surrounding natural environment.
- Ensure that the surface profiles of affected sites are rehabilitated to promote free surface runoff drainage and avoid ponding of water within the rehabilitated area.
- Rehabilitated sites should be re-vegetated to reduce erosion and subsequent sedimentation and siltation of nearby watercourses.

Table 8-6: Impact Rating for the Decommissioning Phase

Impact: Siltation of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium term (3)	Siltation impact may occur for as long as the decommissioning takes place	Minor - negative (50)
Extent	Local (3)	The impacts will be localized to the nearby water resources from where the silt is being generated and the immediate downstream	

Impact: Siltation of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity x type of impact	Moderately high - negative (-4)	This will have moderate impacts resulting reduction in water quality for downstream users and aquatic life	
Probability	Likely (5)	Without appropriate mitigation, it is likely (<65%) that erosion may occur during this phase	
Post-Mitigation			
Duration	Medium term (2)	As for pre-mitigation	Negligible - negative (12)
Extent	Local (2)	As for pre-mitigation	
Intensity x type of impact	Moderate - negative (2)	Mitigation will reduce the impacts	
Probability	Probable (2)	Necessary mitigations will reduce the erosion probability significantly	

Impact: Surface water contamination due to hydrocarbon waste spillages			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	2	The impact will likely occur during the closure phase only	45-Minor (negative)
Intensity	3	This will have medium-term impacts resulting in a reduction in water quality for immediate downstream users and the aquatic life	
Spatial scale	4	The impact extends across the site and to nearby settlements	
Probability	5	Without appropriate mitigation, it is probable that this impact will occur	
Post-mitigation			
Duration	2	The impact will likely only occur during the closure phase	12-Negligible (negative)
Intensity	2	With the recommended mitigation measures in place, the impact intensity will be low.	

Impact: Surface water contamination due to hydrocarbon waste spillages			
Dimension	**Rating**	**Motivation**	**Significance**
Spatial scale	2	The impacts will be localised to the nearby water resources from where the silt is being generated to the immediate downstream	
Probability	2	If the recommended mitigation measures are correctly implemented, it will be rare / improbable for this impact to occur.	

Impact: Improvement of surface water drainage and streamflow regimes close to pre-development conditions			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The positive impact will cease if vegetation establishment is not fully achieved	84-Moderate (positive)
Intensity	4	Positive improvement to the receiving environment will be realised	
Spatial scale	3	Extending across the site and to nearby settlements in the region	
Probability	7	The impact will definitely occur	
Post-mitigation			
Duration	7	The positive impact will remain permanently when vegetation is successfully re-established	112-Major (positive)
Intensity	6	Noticeable, on-going environmental benefits which will improve the environment in general and water resources in particular.	
Spatial scale	3	Extending across the site and to nearby settlements in the region	
Probability	7	The impact will definitely occur	

9 Cumulative Impacts

The project area covers three quaternary catchments, though most activities will take place at A41E. There are several rivers upstream of the project area that feed into the Limpopo River from South Africa and Botswana side; all these rivers possibly contribute in the quality and quantity of the water in the Limpopo River. It is important to note that several surface waters use upstream of the project area exists, this include irrigation, mining, domestic uses and livestock watering. These existing activities/ land uses could potentially have a risk to the surface water resource quality at downstream reaches.

10 Monitoring Programme

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented.

The monitoring plan is summarised in Table 10-1.

Table 10-1: Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Erosion of exposed soils that may lead to siltation or sedimentation on the rivers.	Erosion should be prevented and monitored during site clearance and construction of diversion road, rail loop and during pipeline installation to ensure that sediment evacuation into watercourses is minimised or prevented. Post closure monitoring should also be undertaken on all rehabilitated sites until to ensure complete vegetation establishment. Temporary silt fences should be installed where runoff enters the stream and maintained until vegetation establishment is achieved.	Weekly during construction and fortnightly, post closure until vegetation is fully established on rehabilitated sites	Environmental Practitioner

11 Conclusions

Temo Coal Mining proposes to develop a rail loop, water pipeline and a diversion of a road across A41E, A42J and A42H quaternary catchments. In this section the findings of the study regarding the project area will be summarised below.

11.1 Baseline Hydrology

Lephalale experiences hot summers and mild winters. The month of November recorded the highest maximum temperature of 36°C while the lowest maximum temperature of 24°C was recorded during the month of July. The quaternary catchment A41E has an area of 816 km^2 with mean annual precipitation (MAP) of 440.07 and Mean Annual Runoff (MAR) of 121mm. The A42J has an area of 1027 km^2 with runoff of 1254mm whilst catchment A42H has an area of 1057 Km^2 with MAR of 145mm. As classified in WR2012 manual, the A41E, A42 J and A42H quaternary catchments fall within 1D evaporation zone, in which the monthly evaporation data has been estimated. The average annual potential evaporation for the 3-quaternary catchments is 1949 mm, thereby rendering the area as a semi-arid environment

11.2 Land and Water Uses

The A41E catchment is a largely undeveloped catchment with limited water resources and limited water use. There are no significant dams in this catchment. A significant portion of the water used in the area is sourced from underground aquifers due to the low assurance of the run-of-river yields. The main land use in the A41E catchment is agricultural involving livestock and game ranching with one section of the area being occupied by an existing mine. The catchments A42J and A42H are surrounded by residential and industrial areas.

The identified uses of water within the catchments include 87% agricultural activities and 13% collectively constituting industrial, mining, power generation and domestic uses.

11.3 Surface Water Impact Assessment

The following impacts were identified for the construction, operational and decommissioning phases involving the rail loop, water pipeline and a diversion of a road. The interactive activities which bring about the identified impacts are also described:

11.3.1 Construction Phase

Impact 1: Siltation of surface water resources leading to deteriorated water quality.

Interactions bringing about the impact:

- Exposure of soils due to clearance of vegetation and excavations during road diversion, pipeline installation and rail loop construction.

Impact 2: Alteration of channel geometry and occurrence of streambank erosion at pipeline river crossing

Interactions bringing about the impact:

- Excavation to install an underground water pipeline across a stream.

Impact 3: Contamination of water quality through oil spills, fuels and other hydrocarbons.

Interactions bringing about the impact:

- Storage and handling of hydrocarbon materials such as oils, fuels and grease.

11.3.2 Operational Phase

Impact 1: Contamination of surface water through spillage of hydrocarbons such as fuels and oils

Interactions bringing about the impact:

- Chemical spillages arising from moving vehicles and machinery during operation and maintenance of the rail loop, road and pipeline infrastructure.

11.3.3 Decommissioning Phase

Impact 1: Sedimentation and siltation of watercourses leading to deteriorated water quality.

Interactions bringing about the impact:

- Soil disturbance due to demolition and removal of pipeline, rail loop and road infrastructure.

Impact 2: Surface water contamination due to hydrocarbon waste spillages

Interactions bringing about the impact:

- Spillages of hydrocarbons (oils, fuels and grease) by vehicles and machinery used during demolition and transportation of material from decommissioned infrastructure.

Impact 3: Improvement of surface water drainage and streamflow regimes close to pre-development conditions

Interactions bringing about the impact:

- Rehabilitation, profiling and re-vegetation of the sites from where infrastructure has been removed.

12 Recommendations

12.1 Construction Phase

Clearing of vegetation and excavations should be confined within the project footprint, such as the pipeline river crossing and the route for the road diversion. If possible, construction activities must be prioritized during the dry months of the year (May-October) to limit mobilization of sediments or hazardous substances during site clearance. It is also recommended to re-vegetate the backfilled and reshaped underground pipeline route after installation to minimise erosion and sedimentation of nearby watercourses. All fuel storage areas should be appropriately bunded and spill kits should be in place, and construction workers trained in the use of spill kits, to contain and immediately clean up any potential leakages or spills. Ablutions facility for construction workers and general waste bins should be provided. An accredited contractor should be appointed to properly dispose of the waste. An appointed Environmental Control Officer (ECO) must always be available to ensure implementation of the recommended mitigation/management measures during construction

12.2 Operational Phase

Vehicles should regularly be maintained as per the developed maintenance program. This should also be inspected daily before use to ensure there are no leakages underneath. Surface water quality monitoring should continue to enable detection of the water quality impacts and therefore ensure that necessary mitigation measures are immediately implemented.

12.3 Decommissioning Phase

Use of accredited contractors for removal of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages. In the event of any accidental spillages, quick clean-ups should be conducted before contaminants spread to the surrounding natural environment.

It is vital to ensure the surface profiles of affected sites are rehabilitated to promote free surface runoff drainage to avoid ponding of water within the rehabilitated area. Rehabilitated sites should be re-vegetated to reduce erosion and subsequent sedimentation and siltation of nearby watercourses