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Environmental Authorisation Process to Decommission the Conveyor Belt Servitude, Road and Quarry at Twistdraai East Colliery, Secunda, Mpumalanga Province

Surface Water Report

Project Number:

SAS5544

Prepared for:

Sasol Mining (Pty) Ltd

April 2019

Digby Wells and Associates (South Africa) (Pty) Ltd
Co. Reg. No. 2010/008577/07. Turnberry Office Park, 48 Grosvenor Road, Bryanston, 2191. Private Bag X10046, Randburg, 2125, South Africa
Tel: +27 11 789 9495, Fax: +27 11 069 6801, info@digbywells.com, www.digbywells.com

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Report Type:	**Surface Water Report**
Project Name:	**Environmental Authorisation Process to Decommission the Conveyor Belt Servitude, Road and Quarry at Twistdraai East Colliery, Secunda, Mpumalanga Province**
Project Code:	**SAS5544**

Name	**Responsibility**	**Signature**	**Date**
Daniel Fundisi	Report Writer		15 April 2019
Mashudu Rafundisani	Report Review		15 April 2019

EXECUTIVE SUMMARY

Sasol Mining (Pty) Ltd (*hereinafter* Sasol Mining), is proposing to undertake decommissioning activities at Twistdraai East Shaft which requires both an Environmental Authorisation in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA) and a Water Authorisation in accordance with the National Water Act (Act No. 36 of 1998) (NWA).

The following activities are to be undertaken, which may require environmental authorisation:

- Decommissioning and rehabilitation of an access road and associated culverts which was constructed between the Mynpad Road and the Twistdraai East Shaft which permits access to the Shaft;
- Decommissioning and rehabilitation of the conveyer belt servitude including the access road, water supply pipeline and culverts which was previously utilised to transport coal from Twistdraai Colliery to Sasol Coal Supply;
- It must be noted that the decommissioning of the water supply pipeline will only be undertaken where it daylights and crosses various tributaries. The remaining pipelines which are located beneath ground level will not be disturbed or removed during the decommissioning process.
- Infilling and rehabilitation of a quarry located near the conveyer belt servitude.

A surface water impact assessment is required as there are various water crossings along the conveyor servitude and Twistdraai Road.

Baseline Hydrology

The Mean Annual Precipitation (MAP) for quaternary catchment C12D in which the Twistdraai East Colliery conveyor belt servitude, quarry and road infrastructure are located is 667 mm. Based on historical rainfall data, 90 % of the most frequent rainfall events during the wettest month of January did not exceed 68 mm, while 10 % of the extreme rainfall events will likely be below 179 mm. The potential Mean Annual Evaporation (MAE) for the region is 1 580 mm. Distinct wet and dry seasons are experienced in this quaternary catchment with more rainfall during October to March and less to no rainfall from April to September.

Water Quality

Samples were collected from points on the Klipspruit, upstream and downstream of the conveyor belt as well as at river crossings along the conveyor belt servitude. The conveyor belt servitude crossed tributaries of the Klipspruit and a tributary of the Groot-Bossiespruit. Monitoring points TD1, TD2 are located at the headwaters of the Klipspruit, TD4 and TD6 on a tributary of the Klipspruit, while BL12 and BL13 are located on a tributary of the Groot-Bossiespruit. Water quality results were benchmarked against the Surface Water Quality Reserve for the Waterval River that is included in the Block 3 Water Use Licence (WUL) (No. 08/C12D/ACEFGIJ/1274) that was issued to Sasol Mining (Pty) Ltd; against the South

African Water Quality guidelines or target values (SWQTV) (DWA, 1996) and the SANS 241-1: 2015 drinking water standards (SANS, 2015).

Sites TD1: Surface water quality at the TD1 monitoring site for all assessed parameters, falls within the South African Water Quality Target Values (SWQTV) for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).

Sites TD2 and TD4: EC, SO_4, Mg and E. Coli levels exceed the Water Use License (WUL) limits at both monitoring sites. Nitrate and ammonia at TD4 are higher than the WUL limit, while monitoring point TD2 indicates a higher Ortho-Phosphate level than the WUL limit. All other assessed parameters fall below the WUL limits, SWQTV for livestock watering and the SANS 241-1: 2015 drinking water guidelines. E. Coli levels exceed WUL limits and SANS 241-1: 2015 drinking water standards, while Faecal coliform is within the WUL limit but exceeds SANS drinking water standards at TD2 and TD4 monitoring points.

Sites TD6: Surface water quality at the TD6 site for all assessed parameters, falls within the SWQTV for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).

Site BL12 and BL13: EC, SO4, Mg and Na levels (569 mS/m, 2277 mg/L, 145 mg/L and 815 mg/L, respectively) exceed WUL limits at monitoring point BL12. Similarly, 690 mS/m (EC), 2555 mg/L (SO4), 217 mg/L (Mg) and 764 mg/L (Na), exceed the SANS 241-1: 2015 drinking water standards but are within acceptable levels of the SWQTV for livestock watering at point BL13. The high SO4 and EC levels might be due to contamination from various sources including the operations at the Sasol Coal Supply and the adjacent Fine Ash and Course Dumps in the area. TDS (2840 mg/L, 3720mg/L) is also high at BL12 and BL13 exceeding the SWQTV for livestock watering (<1000mg/L) and the SANS drinking water standard (<1200 mg/L). There is, however, no WUL limit to benchmark TDS against. Cl and Ca are within the WUL limits and SWQTV for livestock watering but exceed the SANS241-1: 2015 drinking water standards, especially at point BL13. E. Coli exceeds WUL limit (0 CFU/100ml) and SANS drinking water standard at point BL12, while faecal coliform is within the WUL limit (126 CFU/100ml) but exceeds SANS drinking water standard.

Surface Water Impact Assessment

The following impacts were identified for the decommissioning, rehabilitation and post closure phases involving the conveyor belt, pipeline, quarry and road. The interactive activities which bring about the identified impacts are also described:

Decommissioning Phase:

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

Interactions bringing about the impact:

- Removal of conveyor belt and road infrastructure from Twistdraai East Shaft to Sasol Coal Supply.

- Removal of water pipeline at river crossing day-lighting points. Removal of mine road infrastructure from the Mynpad to the decommissioned Twistdraai East Shaft.
- Infilling and profiling of quarry 200m from a watercourse

Impact 2: Alteration of channel geometry at river crossings with the conveyor belt and road

Interactions bringing about the impact:

- Movement of vehicles and machinery during removal of conveyor belt, pipeline and road infrastructure at river crossings along the servitudes route.
- Removal of culverts at the road/river crossings along the conveyor belt route.

Impact 3: Contamination of surface water resources causing reduction in water quality

Interactions bringing about the impact:

- Remaining carbonaceous material along conveyor belt route.
- Leakage of oils, fuels and grease from moving vehicles and machinery during removal of infrastructure (road, pipeline, conveyor belt), infilling and rehabilitation of quarry and rehabilitation of disturbed river crossings.

Rehabilitation Phase:

Impact 4: Sedimentation and siltation of nearby watercourses

Interactions bringing about the impact:

- Reshaping or profiling at river crossings with the conveyor belt servitude, access road and water pipeline.
- Infilling and reshaping of the quarry area 200 m from a watercourse.

Post Closure Phase:

*Impact 5***:** Restoration of good drainage and stream flow regime close to pre-development conditions

Interactions bringing about the impact:

- Water quality monitoring downgradient of river crossings.
- Erosion monitoring at rehabilitated, profiled and re-vegetated surfaces.

Recommendations

Accredited contractors should be utilised for demolition and removal of infrastructure to reduce the risk of waste generation and accidental spillages. Removal of infrastructure at river crossings should conducted during the dry season when water levels and erosion rates are low to minimise stream sedimentation and siltation. Where infrastructure is removed at river crossings, the disturbed channel geometry should be reshaped or profiled to allow for free drainage. Temporary silt fences should be installed at the profiled and re-vegetated river crossings to prevent entrance of sediment into the stream prior to vegetation establishment.

Vehicle movement through watercourses at river crossings should be limited to minimise damage to channel geometry.

The decommissioned quarry should be infilled, top-soiled and re-vegetated to reduce chances of soil erosion, sedimentation, siltation and contamination of nearby watercourses. Re-profiling of the infilled quarry and road surfaces prior to re-vegetation must be undertaken to ensure surface profiles that allow free drainage mimicking pre-mining conditions as much as practically possible. This will ensure improvement of catchment runoff yield benefitting aquatic ecosystems and downstream water users.

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LIST OF ACRONYMS

DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
CFU	Colony Forming Units
CMA	Catchment Management Agencies
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
E. Coli	Escherichia Coli
EMP	Environmental Management Programme
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
NEMA	National Environmental Management Act
NWA	National Water Act
NWRS	National Water Resource Strategy
IGS	Institute of Groundwater Studies
SANS	South African National Standards
SWQTV	Surface Water Quality Target Value
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WMA	Water Management Area
WUL	Water Use License

1 Introduction

Sasol Mining (Pty) Ltd (*hereinafter* Sasol Mining), is the holder of a converted new order mining right, which was consolidated from several prospecting and mining rights (known as the Secunda Complex mining right) with Department of Mineral Resources (DMR) reference number: MP 30/5/1/2/3/2/1/138 MR.

Sasol currently operates six coal mines that supply feedstock for their Secunda (Sasol Synfuels) and Sasolburg (Sasolburg Operations) complexes in South Africa. Sasol's underground mining operations are at Bosjesspruit, Brandspruit, Middelbult, Syferfontein and Twistdraai (all in the Secunda area) and Sigma near Sasolburg which consist of Mooikraal (operational) and Sigma defunct which is in closure.

As part of daily management of the various shaft areas, the Secunda Complex has been subdivided with each of Sasol's shaft areas having its own, separate Environmental Management Programme Report (EMPR). The Twistdraai Colliery's EMPR with DMR reference number: MP 30/5/1/2/3/2/1(138) EM was amended and submitted to the DMR in 2010. The DMR approved the EMPR amendment on 29 February 2012.

The Twistdraai Colliery is made up of three separate shafts, namely:

- Twistdraai West Shaft;
- Twistdraai East Shaft; and
- Twistdraai Central Shaft.

Of these three shafts, two (the Central and West Shafts) have been decommissioned, rehabilitated or renovated for alternative purposes. The Twistdraai East shaft is the last shaft to be decommissioned with most of the infrastructure already having been decommissioned. The decommissioning of the infrastructure located at each of these shafts was undertaken in accordance with its Amended Environmental Management Programme Report (EMPr), approved in 2012 (Ref No. MP 30/5/1/2/3/2/1(138) EM), where listed activities in terms NEMA were not triggered.

2 Project Background

Digby Wells Environmental (hereafter Digby Wells) was appointed by Sasol Mining to undertake a Basic Assessment Process for the decommissioning of the Twistdraai East Colliery conveyor belt servitude, access road and quarry located in Secunda, Mpumalanga Province.

The Twistdraai East Colliery owned by Sasol Mining (Pty) Ltd (Sasol Mining) previously operated as an underground coal mine which supplied coal to Sasol Synfuels until December 2017. The mine is now in the decommissioning phase where infrastructure is currently being demolished and salvaged and the land remediated. The mine is being decommissioned in accordance with its approved Amended Environmental Management Programme Report (EMPr), approved in 2012 (Ref No. MP 30/5/1/2/3/2/1(138 EM).

The infrastructure to be decommissioned at the Twistdraai East Colliery include: an access road connecting the Mynpad Road and the Twistdraai East Colliery; conveyor belt infrastructure together with servitudes along the conveyor belt route from the decommissioned Twistdraai East Shaft to Sasol Coal Supply. Both the road and the conveyor belt were constructed over water courses and wetlands; a quarry which supplied construction material was constructed within 200m of the watercourse; and an underground water pipeline that daylights at river crossings along the conveyor belt route.

This application relates specifically to the remaining decommissioning activities to be undertaken at Twistdraai East Shaft, which requires both an Environmental Authorisation in accordance with the National Environmental Management Act (Act No. 107 of 1998) (NEMA), and a Water Authorisation in accordance with the National Water Act (Act No. 36 of 1998) (NWA).

The proposed project is a decommissioning and rehabilitation project with the aim to ensure all mining infrastructure is removed with minimal impact to the surrounding environment and to ensure the area is rehabilitated to a more natural state, thereby reducing the impact to the environment caused by previous mining activities. The project aims to have an overall positive impact on the surrounding environment.

3 Details of the Specialist

Responsibility	Report Writer
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
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

3.1 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

April 2019

Date

4 Methodology

4.1 Desktop Assessment

The desktop assessment involved the characterisation of the catchment drained by the Klipspruit and its tributaries. Hydrometeorological parameters were evaluated from data obtained from the Water Research Commission 2012 database to determine the Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) and Mean Annual Runoff (MAR) for quaternary catchment C12D where the Twistdraai East Colliery conveyor belt servitude 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 Water Quality

No water quality sampling was undertaken for this study. Water quality information used in this study was obtained from a previous bio-monitoring report for Twistdraai East Colliery (Wet-Earth, 2017). The bio-monitoring report included a section on water quality chemical analysis. The following water quality guidelines were considered by Wet-Earth in their water quality study (Wet-Earth, 2017):

- South African Water Quality Guidelines. 1996. Volume 5: Livestock watering. Department of Water Affairs and Forestry.
- SANS241-1. 2015. South Africa National Standards. Drinking Water. Part 1: Microbial, Physical, Aesthetic and Chemical Determinants. SABS Standard Division.

The current study included the Twistdraai Water Use License (WUL) water quality limits (License Number: 08/C12D/ACEFGIJ/1274) in addition to the aforementioned guidelines.

The laboratory analysis of the surface water samples was undertaken for the following parameters:

- pH and Electrical Conductivity (EC);
- Alkalinity;
- Major anions and cations; and
- Faecal coliform and E. Coli.

4.3 Surface Water Impact Methodology

Potential and existing surface water (quality and quantity) impacts that may result from the proposed project activities, based on the established baseline conditions, were identified. A numerical environmental significance rating methodology that utilises the impact’s probability of occurrence and its severity as factors to determine the significance of a particular environmental risk was utilised. Mitigation measures were then determined for implementation to prevent and/or reduce the identified potential and existing surface water impacts.

The surface water impact assessment was completed in the manner described in the subsections below.

4.3.1 Impact Rating

The methodology utilised to assess the significance of impacts is discussed in detail below. The significance rating formula is as follows:

Significance = Consequence x Probability

Where

Consequence = Type of Impact x (Intensity + Spatial Scale + Duration)

And

Probability = Likelihood of an Impact Occurring

In addition, the formula for calculating consequence:

***Type of Impact** = **+1** (Positive Impact) or **-1** (Negative Impact)*

The weighting assigned to the various parameters for positive and negative impacts is provided for in the formula and is presented in Table 4-1. The probability consequence matrix for impacts is displayed in Table 4-2, with the impact significance rating described in Table 4-3.

Table 4-1: Surface Water Impact Assessment Parameter Ratings

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
7	High significant impact on the environment. Irreparable damage to highly valued species, habitat or ecosystem. Persistent severe damage. Irreparable damage to highly valued items of great cultural significance or complete breakdown of social order.	Noticeable, on-going social and environmental benefits which have improved the livelihoods and living standards of the local community in general and the environmental features.	International The effect will occur across international borders.	Permanent: No Mitigation The impact will remain long after the life of the Project.	Certain/ Definite. There are sound scientific reasons to expect that the impact will definitely occur.
6	Significant impact on highly valued species, habitat or ecosystem. Irreparable damage to highly valued items of cultural significance or breakdown of social order.	Great improvement to livelihoods and living standards of a large percentage of population, as well as significant increase in the quality of the receiving environment.	National Will affect the entire country.	Beyond Project Life The impact will remain for some time after the life of a Project.	Almost certain/Highly probable It is most likely that the impact will occur.
5	Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread positive benefits to local communities which improves livelihoods, as well as a positive improvement to the receiving environment.	Province/ Region Will affect the entire province or region.	Project Life The impact will cease after the operational life span of the Project.	Likely The impact may occur.

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts (Type of Impact = -1)	***Positive Impacts (Type of Impact = +1)***			
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense social benefits to some people. Average to intense environmental enhancements.	Municipal Area Will affect the whole municipal area.	Long term 6-15 years.	Probable Has occurred here or elsewhere and could therefore occur.
3	Moderate, short-term effects but not affecting ecosystem functions. Rehabilitation requires intervention of external specialists and can be done in less than a month. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some.	Local Extending across the site and to nearby settlements.	Medium term 1-5 years.	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.

Rating	Intensity		Spatial scale	Duration	Probability
	Negative Impacts ***(Type of Impact = -1)***	***Positive Impacts*** ***(Type of Impact = +1)***			
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by very few of population.	Limited Limited to the site and its immediate surroundings.	Short term Less than 1 year.	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the Project but has happened elsewhere. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures.
1	Limited damage to minimal area of low significance that will have no impact on the environment. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level social and environmental benefits felt by very few of the population.	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month.	Highly unlikely/None Expected never to happen.

Table 4-2: Probability Consequence Matrix for Impacts

Significance

Probability																																						
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 Threshold Limits

Score	Description	Rating
109 to 147	A very beneficial impact which 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	An important positive impact. The impact is insufficient by itself to justify the implementation of the Project. These impacts will usually result in positive medium to long-term effect on the social and/or natural environment.	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the social and/or natural environment.	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. 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 social and/or natural environment.	Negligible (negative)
-36 to -72	An important negative impact which 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 social and/or natural environment.	Minor (negative)
-73 to -108	A serious negative impact which may prevent the implementation of the Project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe effects.	Moderate (negative)
-109 to -147	A very serious negative impact which 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.	Major (negative)

4.4 Assumptions and Limitations

- No water quality sampling was undertaken in this study. Only a descriptive summary of findings from a previous report is provided (Wet-Earth, 2017).
- It was assumed that the water quality write-up in the Wet-Earth (2017) report was accurate and representative of the site conditions.

5 Study Site

A site visit was conducted on the 3rd of December 2018 to physically assess the conditions of the conveyor belt route, road, pipeline and the quarry to be decommissioned. The site locality and the infrastructure to be decommissioned are presented in Figure 5-1.

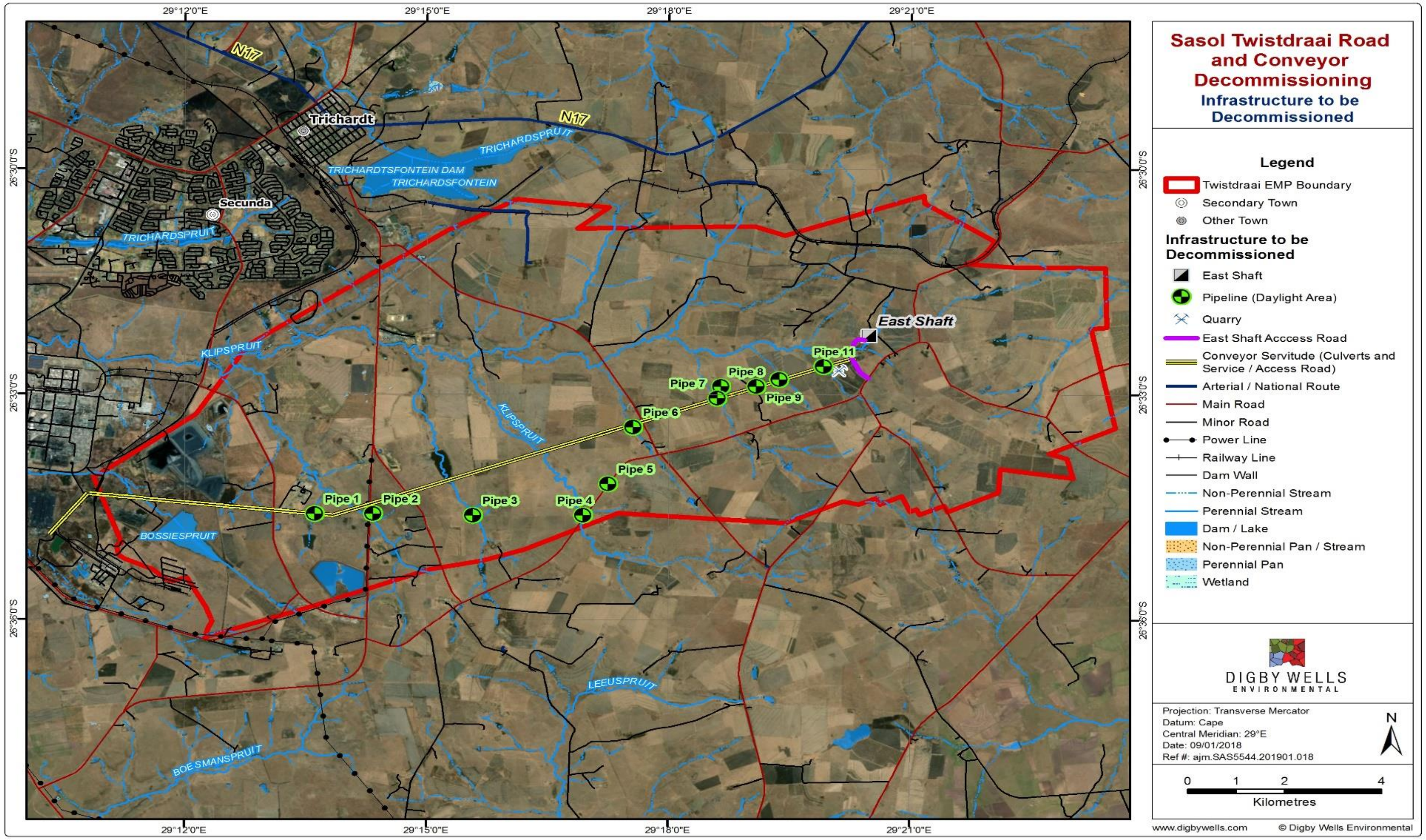


Figure 5-1: Twisdraai East locality and infrastructure to be decommissioned

The assessment was conducted in relation to the surrounding environment including watercourses. Photograph 5-1 to Photograph 5-7 provide a general overview of the assessed areas.

The conveyor belt infrastructure had been removed for most (approximately 17 km) of the route (Photograph 5-1). In some parts along the route, the conveyor belt was still lying on the ground during site assessment on the 3rd of December 2018 as indicated in Photograph 5-2.

Photograph 5-1: Conveyor belt removed from 17 km of the conveyor route

Photograph 5-2: Conveyor belt lying on the ground at a river crossing

The stream channel geometry is observably altered in most river crossings along the conveyor belt route as can be seen in Photograph 5-3 and Photograph 5-4.

Photograph 5-3: Altered stream channel geometry and silted river at a crossing

Photograph 5-4: Altered stream channel geometry and silted river at a crossing

The Twistdraai gravel road, quarry and the pipeline daylight points to be decommissioned and rehabilitated were also assessed during the site visit. These facilities are presented in Photograph 5-5 and Photograph 5-7. Coordinates of the pipeline daylighting points are presented in Table 5-1. As mentioned, the pipeline will be cut-off at these daylighting positions while the embedded sections underground will not be removed.

Photograph 5-5: Gravel road from Mynpad to the Twistdraai East Shaft area

Photograph 5-6: Quarry area to be rehabilitated

Photograph 5-7: Water pipeline to be decommissioned

Table 5-1: Pipeline daylighting position along the Twistdraai conveyor route

Stream Number	Coordinates	
	X	Y
1	29 40 792	-0 22 569
2	29 40 900	-0 23 772
3	29 40 870	-0 25 825
4	29 40 834	-0 28 091
5	29 40 068	-0 28 613
6	29 38 671	-0 29 126
7	29 37 956	-0 30 863
8	29 37 932	-0 30 939
9	29 37 671	-0 31 664
10	29 37 502	-0 32 141
11	29 37 179	-0 33 054

6 Baseline Hydrology

6.1 Catchment Description

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 project is located in the Vaal Major Water Management Area 5 (WMA 5), within quaternary catchment C12D. The Klipspruit is a perennial tributary of the Waterval River which traverses the Twistdraai East Colliery mining right boundary.

The regional setting showing quaternary catchments including the C12D and the geographical surroundings of the Twistdraai East Colliery conveyor belt servitude, quarry and road are indicated in Figure 6-1.

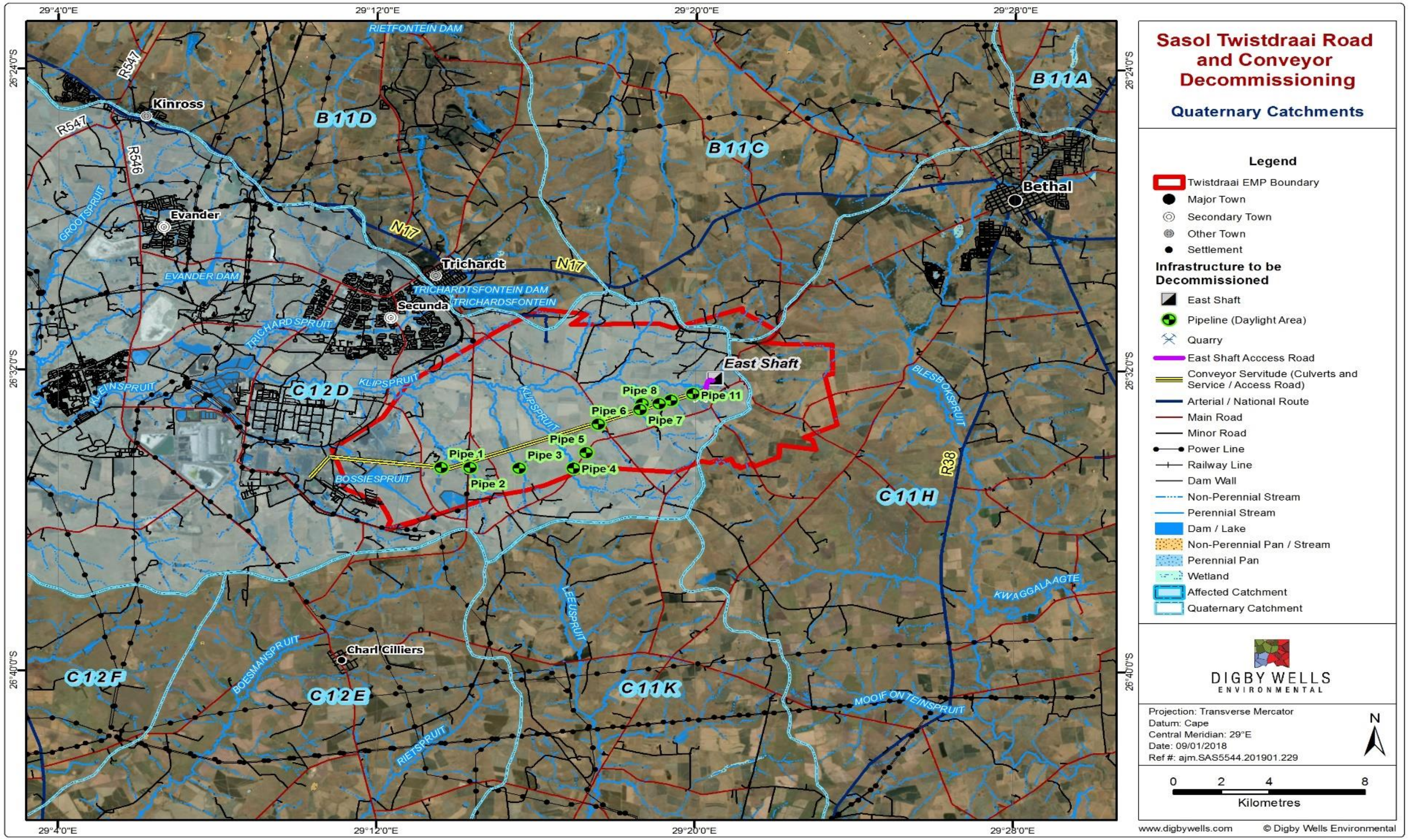
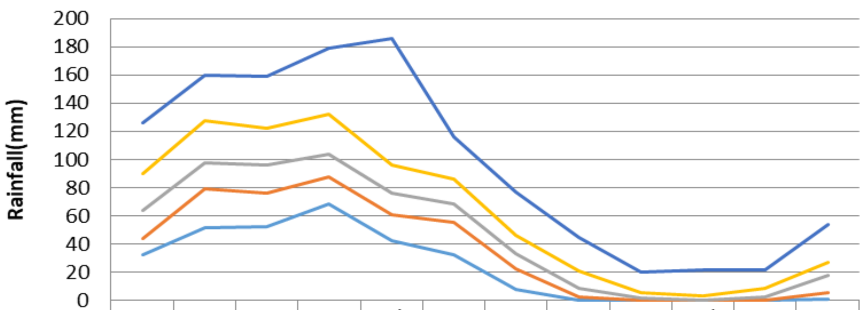


Figure 6-1: Regional setting of the Twistdraai East Colliery conveyor belt, pipeline, quarry and road

6.2 Hydrometeorology

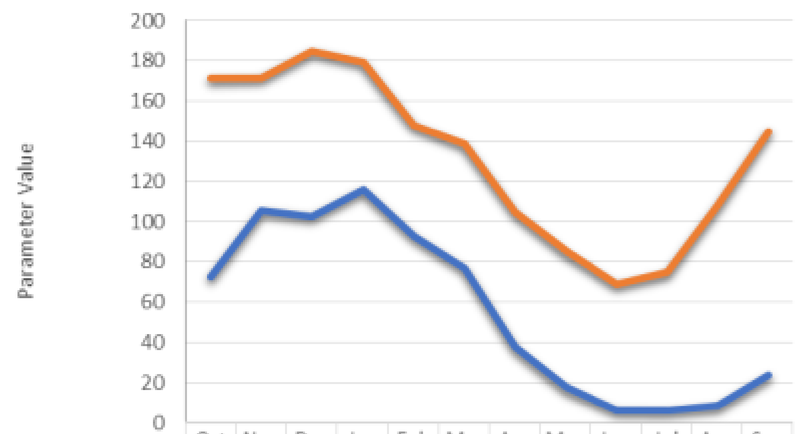
The MAP for quaternary catchment C12D in which the Twistdraai East Colliery conveyor belt and road are located is 667 mm. This MAP is likely to be distributed as indicated in Figure 6-2. 90 % of the most frequent rainfall events in the wettest month of January did not exceed 68 mm, while 10 % of the extreme rainfall events will likely be below 179 mm. The potential MAE for the region is in the order of 1 580mm which is more than twice as much as the MAP for the area (Figure 6-3). This indicates the existence of seasonal rainfall in this quaternary catchment with more rainfall being received from October to March and less rainfall from April to September.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E90	33	52	53	68	42	32	7	0	0	0	0	1
E70	44	79	76	88	61	55	22	3	0	0	0	5
E50	63	98	96	104	76	68	33	8	1	0	2	17
E30	90	128	122	132	96	86	46	21	6	3	8	27
E10	126	159	159	179	186	116	77	44	20	21	22	53

E10 represents the 10th percentile of rainfall events.

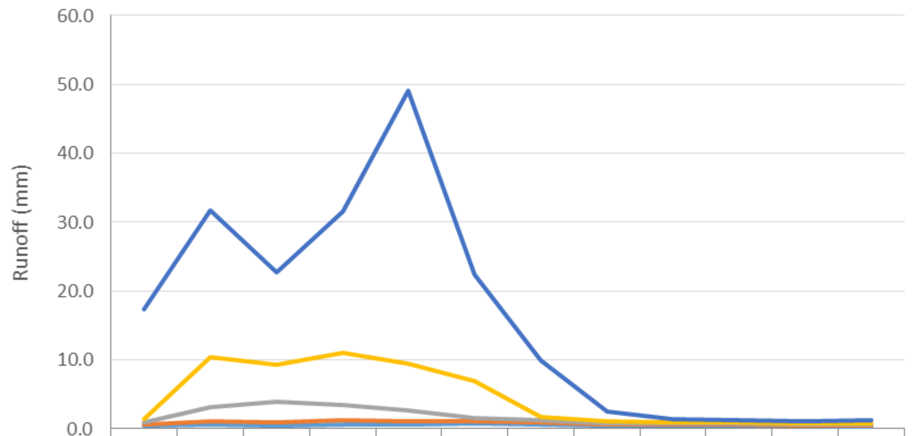
Figure 6-2: Rainfall distribution for quaternary catchment C12D



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	171	172	185	179	148	138	105	85	69	74	108	145
Rainfall(mm)	72	105	102	116	93	77	37	17	7	6	8	24

Figure 6-3: Rainfall and evaporation trends for quaternary C12D

Naturalised MAR depth for the Twistdraai East Colliery area was calculated to be 70.57 mm. This runoff depth is approximately 11 % of the MAP and is likely to be distributed as indicated in Figure 6-4.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
E90	0.5	0.6	0.5	0.7	0.6	0.7	0.6	0.5	0.5	0.4	0.4	0.4
E70	0.6	1.1	1.0	1.2	1.1	1.0	0.9	0.7	0.6	0.6	0.5	0.5
E50	0.9	3.1	3.9	3.4	2.6	1.5	1.2	0.8	0.7	0.7	0.7	0.6
E30	1.3	10.4	9.3	11.0	9.4	6.9	1.7	1.1	0.9	0.9	0.8	0.7
E10	17.3	31.7	22.7	31.6	49.1	22.4	9.9	2.4	1.3	1.2	1.0	1.2

Figure 6-4: Runoff distribution for quaternary catchment C12D

7 Water Quality

The water quality information was obtained from a previous monitoring report for the Twistdraai East Colliery (Wet-Earth, 2017). Samples were collected from points on the Klipspruit, upstream and downstream of the conveyor belt as well as at river crossings along the conveyor belt servitude. The conveyor belt servitude crossed tributaries of the Klipspruit and a tributary of the Groot-Bossiespruit. Monitoring points TD1, TD2 are located at the headwaters of the Klipspruit, TD4 and TD6 on a tributary of the Klipspruit, while BL12 and BL13 are located on a tributary of the Groot-Bossiespruit. Locations of monitoring points are indicated in Figure 7-1. Water quality was benchmarked against the South African Water Quality guidelines or target values (SWQTV) (DWA, 1996), SANS 241-1: 2015 drinking water standards (SANS, 2015) and the Surface Water Quality Reserve for the Waterval River that is included in the Block 3 Water Use Licence (WUL) (No. 08/C12D/ACEFGIJ/1274) that was issued to Sasol Mining (Pty) Ltd.

Figure 7-1: Twistdraai East surface water quality monitoring points

A summary of the water quality results obtained from the Wet-Earth report is provided in Table 7-1 and discussed below (Wet-Earth, 2017):

- **Sites TD1:** Surface water quality at the TD1 monitoring site for all assessed parameters, falls within the SWQTV for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).
- **Sites TD2 and TD4:** EC, SO_4, Mg and E. Coli levels exceed the WUL limits at both monitoring sites. Nitrate and ammonia TD4 are higher than the WUL limit, while monitoring point TD2 indicates a higher Ortho-Phosphate level than the WUL limit. All other assessed parameters fall below the WUL limits, SWQTV for livestock watering and the SANS 241-1: 2015 drinking water guidelines. E. Coli levels exceed WUL limits and SANS 241-1: 2015 drinking water standards, while Faecal coliform is within the WUL limit but exceeds SANS drinking water standards at TD2 and TD4 monitoring points (See Table 7-1).
- **Sites TD6:** Surface water quality at the TD6 site for all assessed parameters, falls within the SWQTV for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).
- **Site BL12 and BL13:** EC, SO4, Mg and Na levels (569 mS/m, 2277 mg/L, 145 mg/L and 815 mg/L, respectively) exceed WUL limits at monitoring point BL12. Similarly, 690 mS/m (EC), 2555 mg/L (SO4), 217 mg/L (Mg) and 764 mg/L (Na), exceed the SANS 241-1: 2015 drinking water standards but are within acceptable levels of the SWQTV for livestock watering at point BL13. The high SO4 and EC levels might be due to contamination from various sources including the operations at the Sasol Coal Supply and the adjacent Fine Ash and Course Dumps in the area. TDS (2840 mg/L, 3720mg/L) is also high at BL12 and BL13 exceeding the SWQTV for livestock watering (<1000mg/L) and the SANS drinking water standard (<1200 mg/L). There is, however, no WUL limit to benchmark TDS against. Cl and Ca are within the WUL limits and SWQTV for livestock watering but exceed the SANS241-1: 2015 drinking water standards, especially at point BL13. E. Coli exceeds WUL limit (0 CFU/100ml) and SANS drinking water standard at point BL12, while faecal coliform is within the WUL limit (126 CFU/100ml) but exceeds SANS drinking water standard. (See Table 7-1).

Table 7-1: Water quality summary benchmarked to WUL limits, DWS and SANS guidelines

Parameter (Units, mg/L, unless specified)	SANS 241-1: 2015	SWQTV (DWAF, 1996) Livestock Watering	WUL (No: 08/C12D/ACEFGIJ/1274)	TD2	TD4	BL12	BL13
pH	5 - 9.7	NS	5.8 - 9.0	8.2	7.7	7.9	7.73
EC (mS/m)	<170	NS	100	122	103	569	690
TDS	<1200	<1000	NS	647	-	2840	3720
Total Alkalinity, $CaCO_3$	NS	NS	NS	444	424	240	-
Chloride, Cl	<300	<1500	1000	71	17	351	633
Sulphate, SO4	<500	<1000	100	188	133	2277	2555
Calcium, Ca	300	<1000	700	69	58	261	388
Magnesium, Mg	<100	<500	50	99	75	145	217
Sodium, Na	<200	<2000	60	52	58	815	764
Fluoride, F	<1.5	<2	NS	0.2	0.4	1.5	-
Nitrate, NO3	11	<100	1.5	1.1	2	0.2	-
Nitrite, NO2	0.9	NS	NS	<0.05	0.2	<0.05	-
Ortho-Phosphate, P	NS	NS	0.065	0.3	<0.1	<0.1	-
Faecal Coliform	0	NS	126	3	8	7	-
E. Coli	0	NS	0	2	7	2	-
Ammonia, N	<1.5	NS	0.054	<0.1	0.6	0.2	-
Key:	-	-	-	-	-	-	-
Red	Exceeds WUL Limit (No. 08/C12D/ACEFGIJ/1274)						
Green	Exceeds SANS Drinking water standard						
NS	No Standard						

8 Surface Water Impact Assessment

The surface water impact assessment was completed in the manner described in Section 4.3.

8.1 Identified Potential Surface Water Impacts and Mitigations

Potential surface water impacts were assessed for the decommissioning, rehabilitation and post closure phases of the Twistdraai East conveyor belt servitude, access road and quarry. It was observed that the greater part (17 km) of the conveyor belt was already removed at the time of site visit on the 3rd of December 2018 in accordance with the approved existing Twistdraai Colliery EMP. Residual impacts of the removed 17 km conveyor infrastructure and those resulting from the removal of the remaining 1.2 km were considered. Impacts that may be caused by the decommissioning of the road along the conveyor servitude, pipeline at river crossing daylighting points, the access road from the Mynpad Road to the decommissioned Twistdraai East Shaft and the quarry were identified and mitigation measures proposed.

8.1.1 Decommissioning Phase

Activities during the decommissioning phase that have potential impacts on the surface water resources are described (Table 8-1) and appropriate management/mitigation measures are provided below. Impact significance ratings are presented in Table 8-2.

Table 8-1: Interaction and impacts of Activity

Interaction	Impact
Removal of all infrastructure along the conveyor belt servitude from Twistdraai East Shaft to Sasol Coal Supply. Removal of water pipeline at river crossing day-lighting points. Removal of mine road infrastructure from the Mynpad to the decommissioned Twistdraai East Shaft. Infilling and reprofiling of quarry 200m from a watercourse	Sedimentation and siltation of nearby watercourses leading to deteriorated water quality
Movement of vehicles and machinery during removal of all infrastructure within the conveyor belt servitude including pipeline and road infrastructure at river crossings. Removal of culverts at the road/river crossings along the conveyor belt route and access road to the Twistdraai East Colliery.	Alteration of channel geometry at the conveyor belt/river and road/river crossings
Remaining carbonaceous material along conveyor belt route. Leakage of oils, fuels and grease from moving vehicles and machinery during removal of infrastructure (road, pipeline, infrastructure within conveyor belt servitude), infilling and rehabilitation of quarry and rehabilitation of disturbed river crossings.	Contamination of surface water resources causing reduction in water quality

8.1.1.1 Impact Description: Sedimentation and siltation of nearby watercourses leading to deteriorated water quality

Disturbance of soils occur during the removal of all infrastructure located within the conveyor belt servitude including road infrastructure the water pipeline at river crossing day-lighting points. Soils are also disturbed during the removal of mine road infrastructure from the Mynpad to the decommissioned Twistdraai East Shaft and during the infilling of the quarry approximately 200 m from a watercourse. Most of the disturbed soils will likely be washed by runoff into nearby watercourses resulting in sedimentation, siltation and deteriorated surface water quality.

8.1.1.2 Impact Description: Alteration of stream channel geometry at conveyor belt and road river crossings

Movement of vehicles and machinery during the removal of the infrastructure located within the conveyor belt servitude including pipeline and road infrastructure, result in the alteration of channel bed and banks at the river crossings. Removal of culverts at the road/river crossings along the conveyor belt route as well as the access road to the Twistdraai East Shaft will also disturb stream channel geometry.

8.1.1.3 Impact Description: Contamination of surface water resources leading to deteriorated water quality

Surface water contamination will likely occur from the remaining carbonaceous material along conveyor belt route and from leakage of hydrocarbons (oils, fuels and grease) from moving vehicles and machinery during removal of infrastructure (road, pipeline, infrastructure located within the conveyor belt servitude), during infilling of quarry and rehabilitation of disturbed river crossings.

8.1.1.4 Management/Mitigation Measures

- Accredited contractors should be utilised for demolition and removal of infrastructure to reduce the risk of waste generation and accidental spillages;
- Removal of infrastructure should be conducted during the dry season to reduce chances of soil erosion and sedimentation;
- Vehicle movement through watercourses at river crossings should be limited to minimise damage to channel geometry.
- Where infrastructure is removed at river crossings, the disturbed channel geometry should be profiled to allow free drainage. Silt fences should be installed at profiled and re-vegetated river crossings to prevent entrance of sediment into the stream prior to vegetation establishment.
- The decommissioned quarry should be infilled, top-soiled and re-vegetated to reduce chances of soil erosion, sedimentation and siltation of nearby watercourses; and

- Re-profiling of the infilled quarry and road surfaces prior to revegetation must be undertaken to ensure surface profiles that allow free drainage. This will ensure improvement of catchment yield to pre-mining conditions in the surrounding watercourses.

Table 8-2: Impact significance rating for the decommissioning phase

Impact: Sedimentation and siltation of nearby watercourses leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	6	The impact will remain long after the decommissioning phase.	52-Minor (negative)
Intensity	4	Serious medium term changes to the water quality. 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: Alteration of stream channel geometry at conveyor belt and road river crossings			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	6	The impact will remain long after the decommissioning phase.	52-Minor (negative)
Intensity	4	Serious medium term environmental effects. Environmental damage is reversible	

Impact: Alteration of stream channel geometry at conveyor belt and road river crossings			
Dimension	**Rating**	**Motivation**	**Significance**
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: Contamination of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	5	The impact will remain for some time after the decommissioning process.	48-Minor (negative)
Intensity	4	Serious medium term environmental effects which can affect aquatic ecosystems	
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	8-Negligible (negative)
Intensity	1	Limited damage to minimal area of low significance that will have no impact on the environment	
Spatial scale	1	Limited to specific isolated parts of the site	

Impact: Contamination of surface water resources leading to deteriorated water quality			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	2	If mitigation measures are correctly implemented, it will be rare/improbable for this impact to occur	

8.1.2 Rehabilitation Phase

Activities during the rehabilitation phase that have potential impacts on the surface water resources are described (Table 8-3) and appropriate management/mitigation measures are provided below. Impact significance ratings are presented in Table 8-4.

Table 8-3: Interaction and impacts of Activity

Interaction	Impact
Reshaping or profiling at river crossings with the conveyor belt servitude, access road and water pipeline. Infilling and reshaping of the quarry area 200 m from a watercourse.	Sedimentation and siltation of nearby watercourses

8.1.2.1 Impact Description: Sedimentation and siltation of nearby watercourses

Interactions bringing about the above negative impact include the reshaping, or profiling of disturbed riverbeds and banks at river crossings with the conveyor belt access road and pipeline daylighting points; infilling and reshaping of the quarry area 200 m from a watercourse. This impact is expected to be low negative, especially after implementation of mitigation measures.

8.1.2.2 Management/Mitigation Measures

The following mitigation measures are recommended:

- River geometry at affected crossings should be profiled, decommissioned quarry should be infilled and reshaped. Reseeding of exposed rehabilitated surfaces should be undertaken to reduce soil evacuation and sedimentation in nearby watercourses.
- Prior to vegetation establishment, seeded areas should have temporary silt fences installed to keep soils from being washed into nearby watercourses.

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

Impact: Sedimentation and siltation of nearby watercourses			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	2	Short term impact: Less than 1 year	32-Negligible (negative)
Intensity	3	Moderate, short-term effects on bio-physical environment but not affecting ecosystem functions.	
Spatial scale	3	The impact will be local extending across the site and to nearby environments	
Probability	4	Impact occurrence is probable	
Post-mitigation			
Duration	2	The impact will be short term until vegetation is established	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.	

8.1.1 Post Closure Phase

Activities during the Post Closure phase that have potential impacts on the surface water resources are described (Table 8-5). This impact is positive, therefore, no management/mitigation measures are required. Impact significance ratings are presented in Table 8-6.

Table 8-5: Interaction and impacts of Activity

Interaction	Impact
Water quality monitoring downgradient of river crossings; Erosion monitoring at rehabilitated, profiled and re-vegetated surfaces.	Restoration of good drainage and runoff regime close to pre-development conditions

8.1.1.1 Impact Description: Restoration of good drainage and runoff regime close to pre-development conditions

Water quality monitoring downgradient of river crossings for suspended solids and other contaminants will help to detect increases of suspended sediments in watercourses. Erosion monitoring at rehabilitated, profiled and re-vegetated surfaces will assist to effect timeous correction of any observed erosion processes before they aggravate.

Table 8-6: Impact significance rating for the post closure phase

Impact: Restoration of good drainage and runoff regime 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 Surface Water Monitoring Plan

9.1 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.

Monitoring is currently being conducted by Institute of Groundwater Studies (IGS) and Wet-Earth at the Twistdraai East Shaft and along servitudes that are being decommissioned. The current monitoring plan provides a programme to detect any surface water impacts likely to occur during the decommissioning of the conveyor belt servitude, access road, quarry and pipeline, and subsequent rehabilitation of all associated sites within the Twistdraai mining right area. Post closure monitoring must be undertaken for at least three (3) years after the project has ceased, or until rehabilitation has reached a sustainable state with no further changes to the environment, as recommended by the Department of Water and Sanitation (DWS). The monitoring points for the decommissioning of the facilities are indicated in Figure 7-1. Monitoring frequencies are described in this monitoring plan. All water quality results should be benchmarked to the WUL standards and the South African Water Quality guidelines: (Livestock watering, Aquatic Ecosystems, Irrigation and Drinking water) to determine the impact of the proposed Twisdraai East decommissioning activities on the quality of water (positive/negative).

The surface water monitoring plan is summarised in Table 9-1.

Table 9-1: Surface Water Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure water quality monitoring as per proposed monitoring programme (See Figure 7-1). Parameters should include but not limited to; pH, Electrical Conductivity, Sulphate, Calcium, Magnesium, Sodium, Nitrate, Ammonia, Chloride, Aluminium and Total Suspended Solids	Monthly monitoring for at least three (3) years after the project has ceased, or until rehabilitation has reached a sustainable state with no further changes to the environment, as is standard practice to detect residual impacts.	Environmental Practitioner
Sedimentation	Inspect conveyor belt/road/pipeline river crossings and rehabilitated quarry to ensure no entrance of sediment into the watercourse, especially after rain events. Temporary silt fences should be installed and maintained until vegetation establishment	Fortnightly, until the establishment of vegetation on the river banks at all river crossings	Environmental Practitioner

9.2 Proposed Surface Water Monitoring Points

Surface water quality monitoring should be conducted at Twistdraai East Colliery at river crossings along the conveyor route. Coordinates of the surface water monitoring points are presented in Table 9-2.

Table 9-2: Twisdraai East surface water monitoring points

Monitoring Point	Description	Coordinates	
		Latitude	Longitude
TD1	Upstream of conveyor belt starting point on an unnamed Klipspruit tributary	-26.5425556	29.344056
TD2	500 m from start of conveyor belt on the same unnamed Klipspruit tributary	-26.544266	29.330721
TD4	6km from end of conveyor belt at a crossing with Klipspruit tributary	-26.577662	29.23834
TD6	Downstream of river crossing, 1 km from Sasol Mining Conveyor Belt Training Area	-26.5623611	29.22150
BL 12	Downgradient of conveyor belt on tributary of Bossiespruit	-26.5775556	29.139833
BL 13	Point on the Brandspruit (Tributary of Groot-Bossiespruit) downgradient of the conveyor belt	-26.562508	29.142686
SW1	Conveyor-river crossing 845 m from Bossiespruit Dam	-26.573554	29.190318
SW2	At Farm Dam on Klipspruit tributary	-26.569822	29.253891
SW3	Point on Klipspruit 2km before Farm Dam	-26.563227	29.273145
SW4	Klipspruit Tributary downstream of conveyor/river crossing closer to decommissioned Twistdraai Central Shaft	-26.573155	29.230692
SW5	Klipspruit tributary downstream of conveyor/river crossing	-26.550523	29.309701
SW6	Klipspruit close to quarry on Klipspruit	-26.541309	29.332801
SW7	Klipspruit close to decommissioned access road	-26.540558	29.338276

Collected surface water samples should be analysed for the following (Table 9-3) chemical parameter suite:

Table 9-3: Chemical parameter analysis suite

Parameter	Unit
pH	pH unit
Electrical conductivity (EC)	mS/m
Sulphate (SO_4)	mg/l
Chloride (Cl)	mg/l
Sodium (Na)	mg/l
Magnesium (Mg)	mg/l
Calcium (Ca)	mg/l
Total Suspended Solids (TSS)	mg/l
Aluminium (Al)	mg/l
Ammonium (NH_4+)	mg/l
Nitrate (NO_3)	mg/l

10 Conclusions

Based on the discussion above, the following conclusions were drawn:

10.1 Baseline Hydrology

The mean annual precipitation (MAP) for quaternary catchment C12D in which the Twistdraai East Colliery conveyor belt, quarry, pipeline and road infrastructure are located is 667 mm. 90 % of the most frequent rainfall events during the wettest month of January will not exceed 68 mm, while 10 % of the extreme rainfall events will likely be below 179 mm. The potential mean annual evaporation (MAE) for the region is in the order of 1 580 mm. Distinct wet and dry seasons are experienced in this quaternary catchment with more rainfall during October to March and less to no rainfall from April to September.

10.2 Water Quality

- **Sites TD1:** Surface water quality at the TD1 monitoring site for all assessed parameters, falls within the SWQTV for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).
- **Sites TD2 and TD4:** EC, SO_4, Mg and E. Coli levels exceed the WUL limits at both monitoring sites. Nitrate and ammonia TD4 are higher than the WUL limit, while monitoring point TD2 indicates a higher Ortho-Phosphate level than the WUL limit. All other assessed parameters fall below the WUL limits, SWQTV for livestock watering

and the SANS 241-1: 2015 drinking water guidelines. E. Coli levels exceed WUL limits and SANS 241-1: 2015 drinking water standards, while Faecal coliform is within the WUL limit but exceeds SANS drinking water standards at TD2 and TD4 monitoring points.

- **Sites TD6:** Surface water quality at the TD6 site for all assessed parameters, falls within the SWQTV for livestock watering and the SANS 241-1:2015 drinking water standards (Wet-Earth, 2017).
- **Site BL12 and BL13:** EC, SO4, Mg and Na levels (569 mS/m, 2277 mg/L, 145 mg/L and 815 mg/L, respectively) exceed WUL limits at monitoring point BL12. Similarly, 690 mS/m (EC), 2555 mg/L (SO4), 217 mg/L (Mg) and 764 mg/L (Na), exceed the SANS 241-1: 2015 drinking water standards but are within acceptable levels of the SWQTV for livestock watering at point BL13. The high SO4 and EC levels might be due to contamination from various sources including the operations at the Sasol Coal Supply and the adjacent Fine Ash and Course Dumps in the area. TDS (2840 mg/L, 3720mg/L) is also high at BL12 and BL13 exceeding the SWQTV for livestock watering (<1000mg/L) and the SANS drinking water standard (<1200 mg/L). There is, however, no WUL limit to benchmark TDS against. Cl and Ca are within the WUL limits and SWQTV for livestock watering but exceed the SANS241-1: 2015 drinking water standards, especially at point BL13. E. Coli exceeds WUL limit (0 CFU/100ml) and SANS drinking water standard at point BL12, while faecal coliform is within the WUL limit (126 CFU/100ml) but exceeds SANS drinking water standard.

10.3 Surface Water Impact Assessment

The following impacts were identified for the decommissioning, rehabilitation and post closure phases involving the conveyor belt, pipeline, quarry and road. The interactive activities which bring about the identified impacts are also described:

10.3.1 Decommissioning Phase

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

Interactions bringing about the impact:

- Removal of conveyor belt and road infrastructure from Twistdraai East Shaft to Sasol Coal Supply.
- Removal of water pipeline at river crossing day-lighting points. Removal of mine road infrastructure from the Mynpad to the decommissioned Twistdraai East Shaft.
- Infilling and rehabilitation of quarry 200 m from a watercourse

Impact 2: Alteration of channel geometry at river crossings with the conveyor belt and road

Interactions bringing about the impact:

- Movement of vehicles and machinery during removal of conveyor belt, pipeline and road infrastructure at river crossings along the servitudes route.
- Removal of culverts at the road/river crossings along the conveyor belt route.

Impact 3: Contamination of surface water resources causing reduction in water quality

Interactions bringing about the impact:

- Remaining carbonaceous material along conveyor belt route.
- Leakage of oils, fuels and grease from moving vehicles and machinery during removal of infrastructure (road, pipeline, conveyor belt), infilling and rehabilitation of quarry and rehabilitation of disturbed river crossings.

10.3.2 Rehabilitation Phase:

Impact 1: Sedimentation and siltation of nearby watercourses

Interactions bringing about the impact:

- Reshaping or profiling at river crossings with the conveyor belt servitude, access road and water pipeline.
- Infilling and reshaping of the quarry area 200 m from a watercourse.

10.3.3 Post Closure Phase:

Impact 4: Restoration of good drainage and stream flow regime close to pre-development conditions

Interactions bringing about the impact:

- Water quality monitoring downgradient of river crossings.
- Erosion monitoring at rehabilitated, profiled and re-vegetated surfaces.

11 Recommendations

Accredited contractors should be utilised for demolition and removal of infrastructure to reduce the risk of waste generation and accidental spillages. Removal of infrastructure at river crossings should conducted during the dry season when water levels and erosion rates are low. Where infrastructure is removed at river crossings, the disturbed channel geometry should be reshaped or profiled to allow for free drainage. Temporary silt fences should be installed at the profiled and re-vegetated river crossings to prevent entrance of sediment into the stream prior to vegetation establishment.

Vehicle movement through watercourses at river crossings should be limited to minimise damage to channel geometry.

The decommissioned quarry should be infilled, top-soiled and re-vegetated to reduce chances of soil erosion, sedimentation, siltation of nearby watercourses. Re-profiling of the infilled quarry and road surfaces prior to re-vegetation must be undertaken to ensure surface profiles that allow freely draining runoff mimicking pre-mining conditions as much as practically possible. This will ensure improvement of catchment runoff yield benefitting aquatic ecosystems and downstream water users.

12 References

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