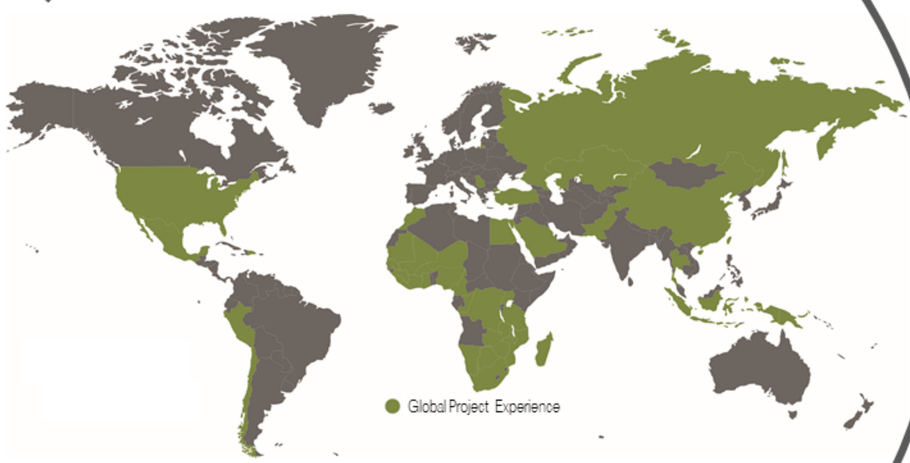

DIGBY WELLS ENVIRONMENTAL

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Proposed Environmental Regulatory Process for the Middeldrift Resources Within the Existing New Clydesdale Colliery Mining Right, Situated in the Magisterial District of Nkangala, Mpumalanga Province

Surface Water Impact Assessment

Prepared for:	**Project Number:**
Universal Coal Development IV	UCD6587
	July 2021

Digby Wells and Associates (South Africa) (Pty) Ltd
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*Non-Executive

This document has been prepared by Digby Wells Environmental.

Report Type:	Surface Water Impact Assessment
Project Name:	Proposed Environmental Regulatory Process for the Middeldrift Resources Within the Existing New Clydesdale Colliery Mining Right, Situated in the Magisterial District of Nkangala, Mpumalanga Province
Project Code:	UCD6587

Name	**Responsibility**	**Signature**	**Date**
Daniel Fundisi	Report writer		July 2021
Mashudu Rafundisani	Technical review		July 2021

EXECUTIVE SUMMARY

Digby Wells Environmental (hereinafter Digby Wells) was appointed by Universal Coal Development IV (Pty) Ltd, New Clydesdale Colliery (hereinafter Universal Coal) to undertake an Integrated Environmental Application Process for the inclusion of the Middeldrift Resources into the Existing Universal Coal Development IV (UCDIV) New Clydesdale Colliery (NCC) Mine. The current report is a surface water assessment which contributes to the requirements of the integrated environmental application process. The intention of the proposed project is to exploit the resources through opencast mining methodologies, with the new activities to be authorised entailing:

- Mining of a pan;
- Construction of a bridge over the Steenkoolspruit to access the Middeldrift resources;
- Diversion of the provincial road which runs through the area of the Middeldrift site; and
- Construction of a new road (linked to the diversion) (approximately 4km long).

The project area is located within quaternary catchment B11E in the Olifants Water Management Area and has a Mean Annual Precipitation (MAP) of 682 mm. The New Clydesdale operations fall within the summer rainfall region of South Africa, where more than 80% of the annual rainfall takes place between the months of October to March. January as the wettest month has a 90th percentile of 192 mm and a 10th percentile of 67 mm. The area experiences a Mean Annual Evaporation (MAE) of 1 950 mm, which is much greater than the MAP leading to distinct wet and dry seasons. The Mean Annual Runoff (MAR) was calculated to be 47.6 mm which accounts for about 7% of the MAP for the area. The highest amount of runoff is experienced in the wettest month of January, with the 90th percentile being 35.6 mm and the 10th percentile, 0.6 mm.

Based on the water quality results analysed by SRK Consulting in 2016, none of the water quality determinants monitored exceeded domestic water quality standards systematically, except for Total Dissolved Solids (TDS) and Sulphate (SO_4) over short periods during the dry season. It was concluded that the low flows (implying less volume of water for the same amount of salt load) contribute to the increase in TDS and SO_4 concentrations, and thus are not likely to contribute significantly to the salinity load entering the Olifants River.

The salt loading of the Steenkoolspruit was estimated from discharge and sampled TDS concentrations (B1H021) to be approximately 23 000 tons/annum, whereas the total TDS load likely to leave the opencast mine is estimated as 62 tons/annum, which is less than 0.5% of the current total salt load in the Steenkoolspruit. The salt load discharged into the Steenkoolspruit as a result of mining in the New Clydesdale Mine was considered minimal.

The recent water quality within the Rietspruit upstream and downstream of the proposed Middeldrift opencast pit indicate that most of the analysed parameters are within the Olifants Resource Quality Objectives in which the proposed project site is located. Exceedances were, however, noted for Turbidity, Chloride (Cl), and Aluminium (Al) both upstream and downstream of the project site. Higher turbidity is likely attributed to livestock animals that agitate the water as they drink water from the Rietspruit during grazing. Cl and Al sources likely include sewage and industrial effluents emanating from the Reedstream Park upstream of the New Clydesdale within the Rietspruit catchment and from Kriel and Thubelihle Towns adjacent to the Steenkoolspruit before its confluence with the Rietspruit.

Storm water management with respect to the proposed Middeldrift Resources indicates the need for a perimeter berm around the opencast pit, which is considered a dirty catchment. The berm will exclude or divert clean water from the clean water catchment around the pit so that it flows downslope to the Steenkoolspruit. The berm should be constructed to contain runoff depths greater than 1m and to stop a peak-runoff rate of 3.52 m^3/s, on average.

The annual average water balance indicates a total inflow volume into the Middeldrift Resources opencast pit of 910 267 m^3/annum emanating from rainfall, runoff and groundwater ingress. A dewatering volume of 58 560 m^3/annum is pumped to Pollution Control Dam 2 (PCD2) situated at the existing NCC operations, while 88 000 m^3/annum is used for dust suppression. There are no water storages that happen at the Middeldrift Opencast pit site.

Recommendations

The following is recommended to mitigate identified impacts:

- Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones;
- If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles by overland flow during site clearing;
- Minimise spillages of carbonaceous material into the river at the bridge crossing during haulage of coal from the Middeldrift Pit to the existing NCC operations;
- Vehicles should regularly be maintained as per the mine’s maintenance program they must be inspected daily before use to ensure there are no leakages underneath;
- Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas at the existing mining operations. Any used oil should be disposed of by accredited contractors;
- Implementation of the proposed stormwater management plan is recommended to reduce siltation and sedimentation in watercourses;
- All operational vehicles should be maintained and washed at designated wash bays of the existing NCC operations;
- All mine waste should be handled and disposed of by an accredited vendor;
- The proposed water quality monitoring program should be consistently implemented to ensure adherence to stipulated water quality standards. This will enable early

detection and management of any water quality problems arising as a result of mining operations and associated activities;

- The water requirements and demands should be clearly stated and regularly reviewed through water balance updates to ensure water uses and losses are accounted for;
- Soil disturbances during decommissioning should be restricted to the relevant footprint area;
- All decommissioning debris must be cleared as soon as practically possible, and it is recommended that demolition of infrastructure be conducted during the dry season to minimise chances of soil erosion to watercourses;
- Movement of heavy vehicles and machinery must be restricted to existing roads to avoid further disturbance of landscapes thus minimising soil erosion;
- In the event of decanting, passive treatment should be applied to neutralise and treat the Acid Mine Drainage (AMD) before being discharged back into freshwater resources. If passive treatment fails, active treatment by a conventional Water Treatment Plant should be considered; and
- Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that supports desired post-mining land use.

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ACRONYMS, ABBREVIATIONS AND DEFINITION

AMD	Acid Mine Drainage
BPGs	Best practice guidelines
DEM	Digital Elevation Model
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
DSM	Digital Surface Model
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EMPr	Environmental Management Programme Report
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman
NEMWA	National Environmental Management: Waste Act (Act 59 of 2008)
MRA	Mining Right Area
LoM	Life of Mine
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
RM3	Rational Method Alternative 3
S&EIR	Scoping and Environmental Impact Reporting
SDF	Standard Design Flood
SS	Suspended Solids
TDS	Total Dissolved Solids
WMA	Water Management Area
WRC	Water Research Commission

1 Introduction

Digby Wells Environmental (hereinafter Digby Wells) was appointed by Universal Coal Development IV (Pty) Ltd, New Clydesdale Colliery (hereinafter Universal Coal) to undertake an Integrated Environmental Application Process for the inclusion of the Middeldrift Resources into the Existing Universal Coal Development IV (UCDIV) New Clydesdale Colliery (NCC) Mine. The current report is a surface water assessment which contributes to the requirements of the integrated environmental application process.

The study was conducted to comply with the following legislation:

- Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014, as amended) (EIA Regulations, 2014) promulgated under the NEMA; and
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA).

2 Project Description

The Project is located in the Kriel district of the Mpumalanga Province. The Middeldrift Resources lie North of the UCDIV Diepspruit Mining Area (an underground mining operation) and Universal Coal is the holder of the Mineral Rights (MR), reference Number MP30/5/1/2/2/492(EM). The Middeldrift Mining Right area is a greenfield area. The Project Area and location of the proposed opencast pit are indicated in Figure 2-1. The intention is to exploit the resources through opencast mining methodologies.

The proposed new activities at the Middeldrift Resources to be authorised will entail:

- Mining of a pan (wetland);
- Construction of a bridge over the Steenkoolspruit to access the Middeldrift Resources;
- Diversion of the provincial road which runs through the area of the Middeldrift site; and
- Construction of a new road (linked to the diversion) (approximately 4km long).

The construction, operation and decommissioning phases of the Project shall comprise of the activities in Table 2-1. These Project activities will be used for the impact assessment.

Table 2-1: Project Activities

Phase	Activity
Construction	Removal of vegetation / topsoil for establishment of mining and linear infrastructure
	Construction of access road and haul roads and diversion of the existing provincial road which runs through the area of the Middeldrift site
Operational	Ventilation fans and infrastructure area containing stockpile areas
	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.
	Removal of rock(blasting)
	Concurrent rehabilitation as mining progresses
Decommissioning	Demolition and removal of infrastructure
	Post-closure monitoring and rehabilitation
	Closure of the mine

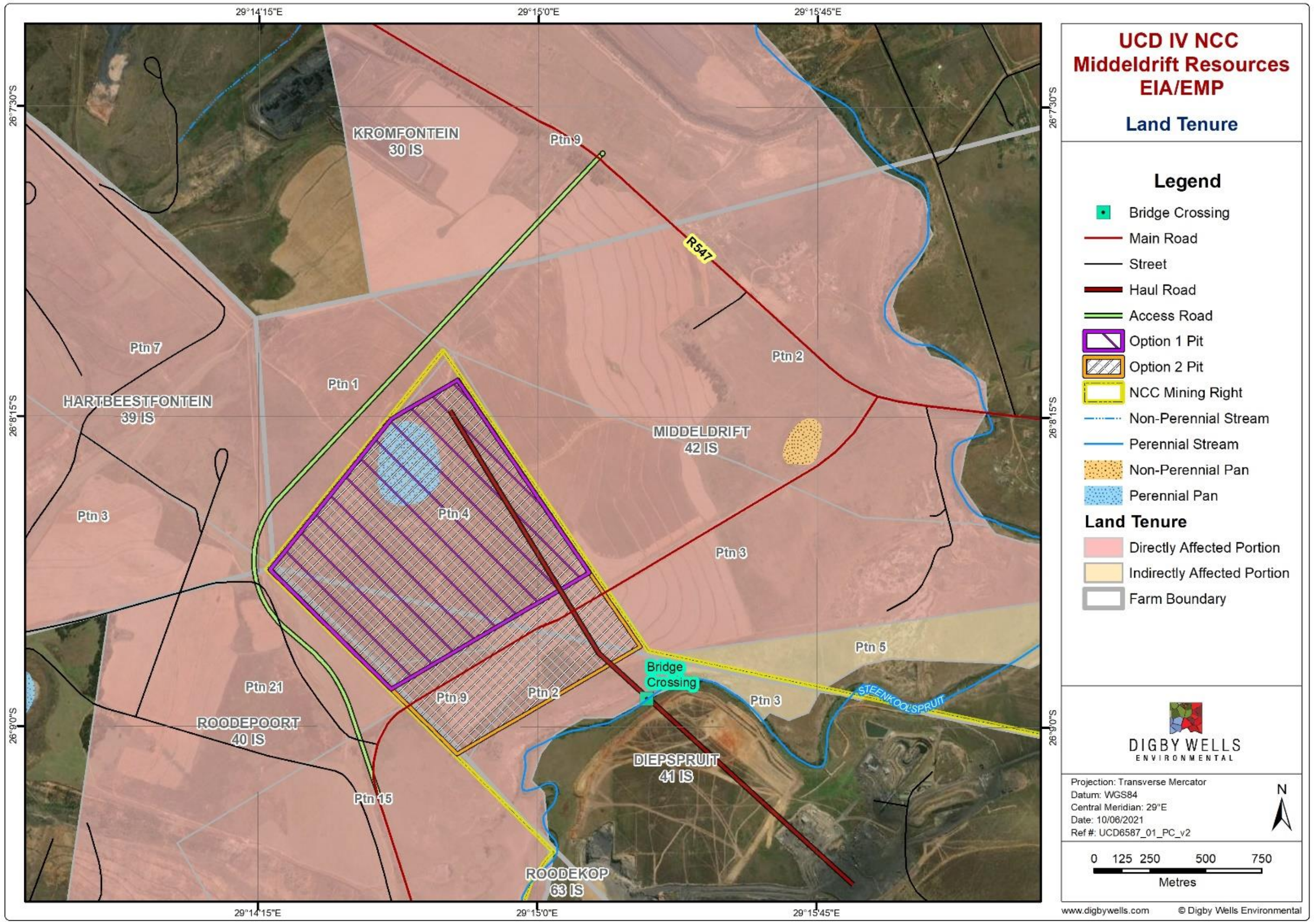


Figure 2-1: Land Tenure Map

3 Legal and Administrative Framework

Applicable legislation, standards and guidelines used in this study are summarised in Table 3-1.

Table 3-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law	Applicability
National Water Act (Act 36 of 1998) (NWA) NWA makes provision for water resource management, protection of the quality of water resources and recognising the need for the integrated management of all aspects of water resources to achieve sustainable use of water.	Legal requirement on the use of water for mining and related activities aimed at the protection of water resources
DWS[1] Best Practice Guideline – G1: Storm Water Management Plan (SWMP); and General Notice GN 704 These are guidelines provided by the Department of Water and Sanitation (DWS) for storm water control which addresses the following principles: • Delineation of clean and dirty areas contributing to runoff (based on the final layout plans) Temporary drainage installations designed, constructed, and maintained for recurrence periods of at least a 50-year, 24-hour event; and • Site specific assessments to establish the appropriate mitigation measures and surface water monitoring programme.	Pollution prevention and minimisation of impacts on surface water resources to comply with the NWA
SANS) 241: 2015 for Drinking Water and the Resource Water Quality Objectives (RWQOs) for Management Unit 7 of the Witbank Dam Catchment (DWS, 2016) SANS 241-1 consists of standards under the general title *Drinking water*: *Part 1: Microbiological, physical, aesthetic and chemical determinands; and* *Part 2: Application of SANS 241-1*. RWQOs are water quality limits defined by the National Water Act as “clear goals relating to the quality of the relevant water resources.” RWQOs are given as numeric or descriptive in-stream (or aquifer) water quality objectives typically set at a finer resolution (spatial or temporal) to provide greater detail upon which to base the management of water quality	Mining and related activities for the Middeldrift Resources Project will likely have water quality impacts which should be monitored

[1] Previously the Department of Water Affairs (DWA)

Legislation, Regulation, Guideline or By-Law	Applicability
<u>National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (December 2014)</u> NEMA, as amended, was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The EIA Regulations, Government Notice (GN) Regulation (R) 982 were published on 04 December 2014 and promulgated on 08 December 2014 together with the Listing Notices. The regulations were subsequently amended by GNR 327 published on 7 April 2017. The following regulations were amended: GN R326, (EIA Regulations) GN R 327 (Listing Notice 1); GN R325 (Listing Notice 2) and GN R324 (Listing Notice 3) of 7 April 2017.	The Middeldrift Resources Project involves activities that have the potential to pollute and/or degrade the natural environment, hence consideration of the NEMA would assist to avoid certain environmental impacts, or, where they cannot be altogether avoided, minimise or remedy them as much as practically possible

4 Assumptions, Limitations and Exclusions

This section provides assumptions, limitations and exclusions considered in undertaking this surface water assessment study.

- Baseline hydrological assessment, surface water quality, floodlines, conceptual storm water management plan, water balance and impact assessment constitute the scope of the current study; and
- It was assumed that no infrastructure will be constructed on the Middeldrift site except the proposed opencast pit and that the infrastructure at the existing NCC mine will be utilised for all other mining processes.

5 Details of Specialists

Details of the specialists involved in the current study are summarised below:

Responsibility	**Report Writer**
Full Name of Specialist	Daniel Fundisi

Highest Qualification	MSc Hydrology
Years of experience in specialist field	10
Registration(s):	Pr.Sci.Nat. (SACNASP); Reg. Number: 400034/17
Responsibility	**Technical Review**
Full Name of Specialist	Mashudu Rafundisani
Highest Qualification	BSc Honours
Years of experience in specialist field	8
Responsibility	**Final Review**
Full Name of Specialist	Andre van Coller
Highest Qualification	MSc Geohydrology
Years of experience in specialist field	14

5.1 Declaration of Main 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

Full Name and Surname of the specialist

Digby Wells Environmental

Name of company

28 June 2021

Date

6 Methodology

The methodology followed in this study is described in the following subsections:

6.1 Baseline Hydrology

The Mean Annual Precipitation (MAP) and Mean Annual Runoff (MAR) was estimated from analysing rainfall and runoff data retrieved from the Water Resources Commission of South Africa 2012 study (WRC, 2020). The data covers a historical period of 89 years (1920 to 2009), hence making it adequate to calculate the above-mentioned hydro-meteorological parameters for the A41E quaternary catchment. The analysis was used to present the rainfall-runoff interaction and giving details on the climate of the project area.

6.2 Water Quality Assessment

Water samples were collected upstream and downstream to obtain the baseline water quality around the project area before the project starts. The samples were sent to a South African National Accreditation System (SANAS) accredited lab to be analysed and interpreted. The results were analysed based on the guidelines by the Department of Water and Sanitation (DWS) for livestock watering, irrigation, and aquatic ecosystems, only the guidelines for the water uses relevant to the project area were selected.

6.3 Floodlines Determination

6.3.1 Peak Flows

Catchment delineation was undertaken in Global Mapper using a Digital Elevation Model (DEM) generated from 5 m contours (National Geospatial Institute, 2013) augmented by Advanced Land Observing Satellite (ALOS) World 3D – 30m (AW3D30) global digital surface model (DSM) data (JAXA, 2015) for the study area. The ALOS dataset is stored in a raster GeoTIFF format referenced to the Hartebeesthoek 94 Datum (WGS84 ellipsoid).

Widely used and recommended methods including the Rational Method Alternative 3 (RM3), Standard Design Flood (SDF) and the Midgley & Pitman (MIPI) were used to calculate the 1:50-year and 1:100-year peak flows for delineated catchments at the project site (SANRAL, 2013). Design rainfall depths were determined using the Design Rainfall Programme for South Africa and the modified Hershfield equation as input to the RM3 and SDF methods, respectively.

6.3.2 Hydraulic Modelling

Hydraulic modelling was conducted in HEC-RAS 6 which allows pre-processing within the in-built RAS Mapper module. A Digital Terrain Model (DTM) was generated from the 5m DEM to make the topographic data compatible with RAS Mapper. The pre- processing involved generation of the channel geometry, including the river network, banks, flow paths and cross sections.

The HEC-RAS model simulates total energy of water by applying basic principles of mass, continuity, and momentum as well as roughness factors between all cross sections (US Army Corps of Engineers, 1995). A height is calculated at each cross-section, which represents the level to which water will rise at that section, given the calculated initial peak flows for the 1:50-year and 1:100-year events on all river sections.

Analyses are performed by modelling flows at the sub-catchment outlet of stream or channel sections first, moving upstream. Manning's Roughness Coefficient (n) for the channels were set at 0.02, and those for riverbanks were determined to be 0.03 representing natural channels with weeds, reeds and brush on the banks (Chow, 1959).

Please note that the study only determined indicative floodlines, hence can only be used for environmental purposes and not for detailed engineering designs.

6.4 Conceptual Stormwater Management Plan

The conceptual Stormwater Management Plan was undertaken based on the Government Notice 704 (GN704) of the NWA guidelines. Clean and dirty water catchments were separated based on proposed functional uses of areas on the project site. The location and size of the berms and stormwater infrastructure were assessed and determined using the Personal Computer Storm Water Management Model (PCSWMM). The afore-mentioned rainfall-runoff model has the ability to simulate a single-event or long-term runoff quantities and it can also simulate stormwater source control technologies to better manage water quantity and water quality (James, 2010). PCSWMM simulates the rainfall-runoff process by using material and water flow between environmental sectors. The processes are assigned into compartments, namely, atmospheric, surface, transport and groundwater compartment and it delineates catchments based on the DEM data (Muhammad & Guna, 2016).

The model used the characteristics of the catchment area such as average slope, permeability and the calculated design rainfall depth to model storm flows diverted to the containment structures or flowing through the outlets. As mentioned, that the PCSWMM simulates rainfall runoff processes through materials and environmental sectors, hence the influence of paved areas was also integrated by specifying the percentage of the impervious area within the delineated sub-catchments.

6.5 Water Balance

A water balance ensures the appropriate management of water and accounts for water use in the catchment. The water balance for New Clydesdale Colliery was determined using a Water

Flow Diagram (WFD) developed by Digby Wells specialists in consultation with a representative of Universal Coal. The WFD details the water sources, transfers and flow within the site, abstractions, storages, and discharges, all of which make up the water balance. The WR2012 climate data pertaining to hydrological inputs such as rainfall, runoff and evaporation were calculated and used as inputs into the water balance. Other water uses/requirements were either calculated or obtained from reports of the existing NCC operations. An excel-based static water balance was developed from the results of the hydrological assessment to account for water sources, uses, losses and storage for the proposed Middeldrift opencast pit expansion which will be integrated into the existing NCC mining operations.

6.6 Surface Water Impact Assessment

Potential surface water impacts (quality and quantity) that may result from the proposed mining activities, based on the established baseline conditions, were identified. The detailed impact assessment methodology is presented in Appendix A.

7 Findings and Discussion

7.1 Hydrological Setting

The water resources of South Africa are divided into quaternary catchments, which are regarded as the principal water management units in the country (Department of Water Affairs and Forestry, 2011). These catchments represent the fourth order of the hierarchical classification system, in which the primary catchments are the major units. The primary drainages are further grouped into or fall under Water Management Areas (WMA). The Department of Water and Sanitation (DWS) has established nine WMAs as contained in the National Water Resource Strategy 2 (2013) in terms of Section 5 subsection 5 (1) of the National Water Act, 1998 (Act No. 36 of 1998).

The proposed coal mine falls within primary drainage region B of the Olifants WMA and the B11E quaternary catchment, Sub-Quaternary Reaches (SQRs) B11E-01353 and B11E-01297 (the Rietspruit and Steenkoolspruit). The Rietspruit SQR is a second order stream approximately 24 km in length, which drains from south-west along and joins the Steenkoolspruit SQR east of the Project Area boundary. The Steenkoolspruit SQR is a third order stream, approximately 18 km in length and flows along the east and north of the project area boundary before joining the Olifants River.

The major water use activities found within the quaternary catchment are mining and agriculture, there are also several small man-made dams within the mines and farms (Gyamfi, et al., 2016).

Characteristic of the catchments in this area is the strong relationship between surface water and a shallow, interflow groundwater source (SRK Consulting, 2016). Deeper groundwater does not reveal direct connection to the streams in the upper reaches of these catchments. Responses to rainfall are rapid, with discharges reaching peak flows within 24 hours and dissipating within four to five days, despite the relatively flat topography (SRK Consulting, 2016).

Figure 7-1 indicates the B11E quaternary catchment and freshwater resources associated with the study area.

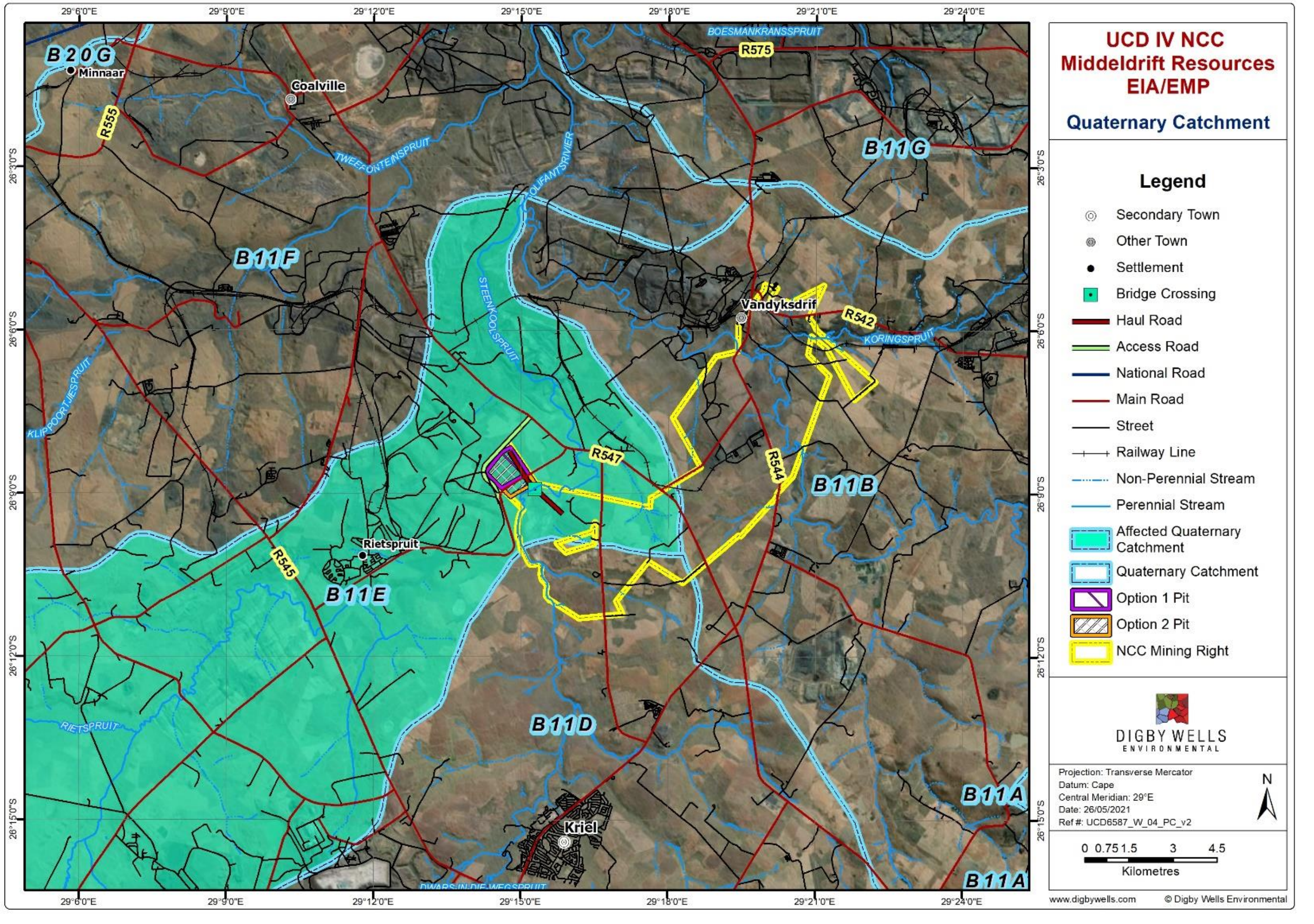
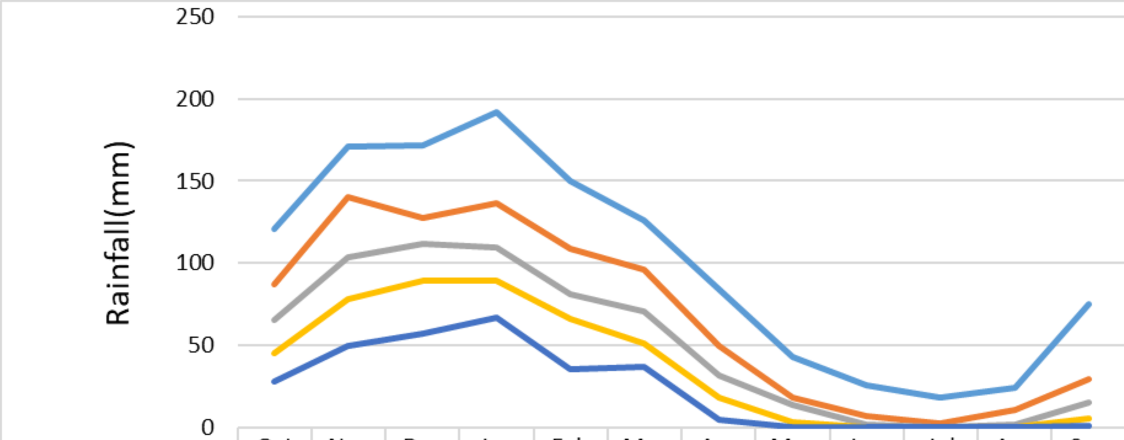


Figure 7-1: Hydrological Setting of Quaternary Catchment B11E

7.1.1 Rainfall, Runoff and Evaporation

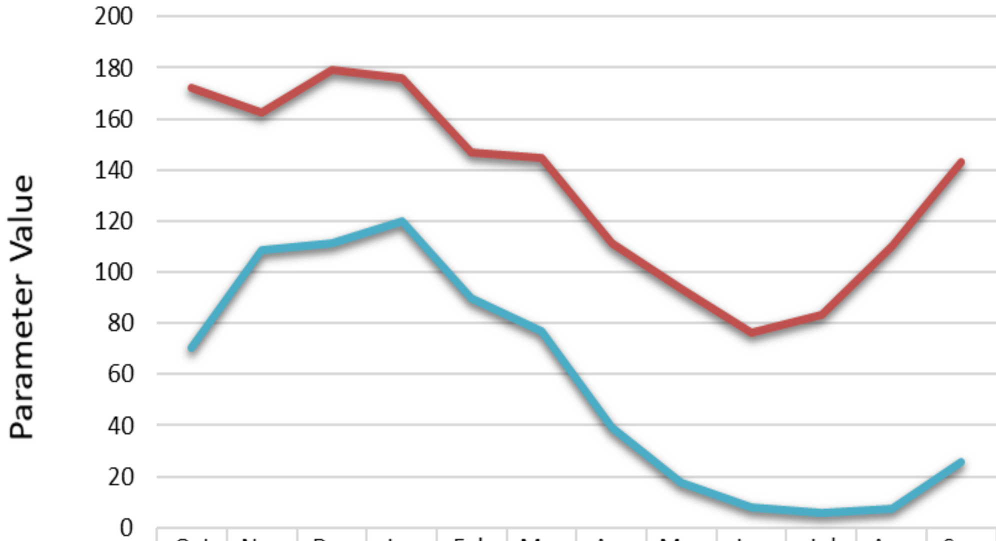
The project area is located within quaternary catchment B11E in the Olifants WMA 2 and has a Mean Annual Precipitation (MAP) of 682 mm. The proposed Middeldrift Resources fall within the summer rainfall region of South Africa, where more than 80% of the annual rainfall takes place between the months of October to March. Figure 7-2 depicts the likely monthly distribution of rainfall in the catchment. January as the wettest month has a 90th percentile of 192 mm and 10th percentile of 67 mm.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Percentile	121	171	171	192	150	126	84	43	26	18	25	75
70 Percentile	87	140	127	136	108	96	50	19	7	3	11	29
50 Percentile	65	104	112	110	81	71	32	14	2	0	2	15
30 Percentile	45	78	89	89	66	51	18	3	0	0	0	6
10 Percentile	28	50	57	67	36	37	5	0	0	0	0	1

Figure 7-2: The Monthly Rainfall Distribution within the Quaternary Catchment B11E

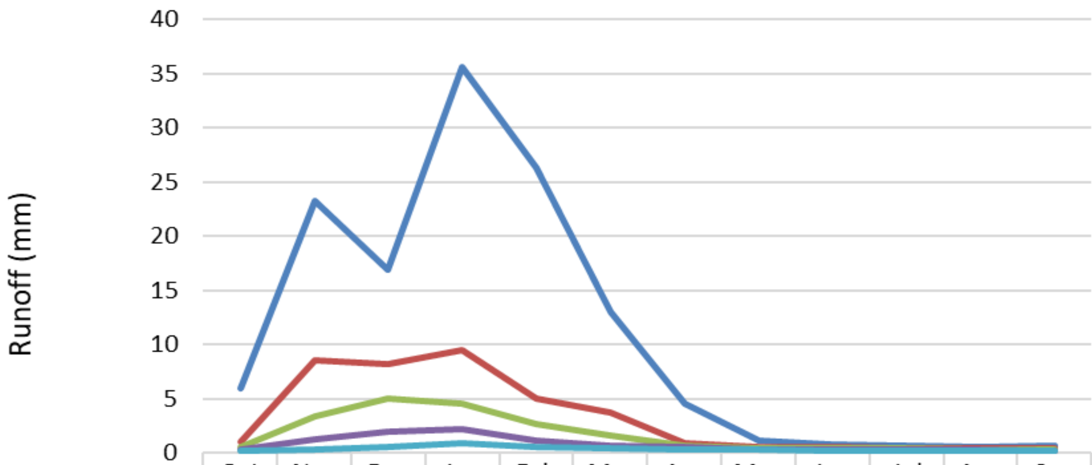
The area experiences a high Mean Annual Evaporation (MAE) of 1 950 mm, which is much greater than the MAP giving rise to distinct wet and dry seasons. The MAP and MAE are likely to be distributed as shown in Figure 7-3.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	172	163	179	176	147	145	111	94	76	83	110	143
Rainfall(mm)	70	108	111	120	90	77	39	17	8	6	7	26

Figure 7-3: Monthly Evaporation and Rainfall within the Quaternary Catchment B11E

The Mean Annual Runoff (MAR) was calculated to be 47.6 mm and accounts for approximately 7% of the MAP in the area. As depicted in Figure 7-4, the highest amount of runoff is experienced in the wettest month of January with the 90th percentile being 35.6 mm while the 10th percentile is 0.6 mm.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Perecentile	6,0	23,3	16,9	35,6	26,3	13,1	4,5	1,1	0,7	0,6	0,5	0,7
70 Percentile	1,0	8,5	8,2	9,4	5,0	3,7	0,9	0,6	0,5	0,5	0,4	0,4
50 Percentile	0,5	3,3	5,0	4,5	2,7	1,6	0,6	0,5	0,4	0,4	0,4	0,3
30 Percentile	0,3	1,3	1,9	2,2	1,1	0,6	0,5	0,3	0,3	0,3	0,3	0,2
10 Percentile	0,2	0,3	0,6	0,9	0,6	0,4	0,3	0,3	0,2	0,2	0,2	0,2

Figure 7-4: Monthly Runoff within the Quaternary Catchment B11E

7.2 Land Use

The current land uses in the region include coal mining, farming, power generation facilities and small residential communities. The dominant land use within the project area is cultivated land. Other land uses within the project area include grassland and small areas are occupied by thickets/dense bush and wetland/ water areas.

7.3 Baseline Water Quality

7.3.1 Sampling Points

Four surface water points were planned for sampling but only two (NCDSW2 and NCDSW3) were successfully sampled. Sampling point NCDSW1 was not accessible and NCDSW4 was dry during the site visit conducted on the 12th of February 2021. The sampling points are presented in Figure 7-5. Water quality descriptions of existing DWS monitoring points were included in this report since these points were considered relevant to the current project and these descriptions were obtained from a previous report (SRK Consulting, 2016). Locations of the DWS points are also shown in Figure 7-5.

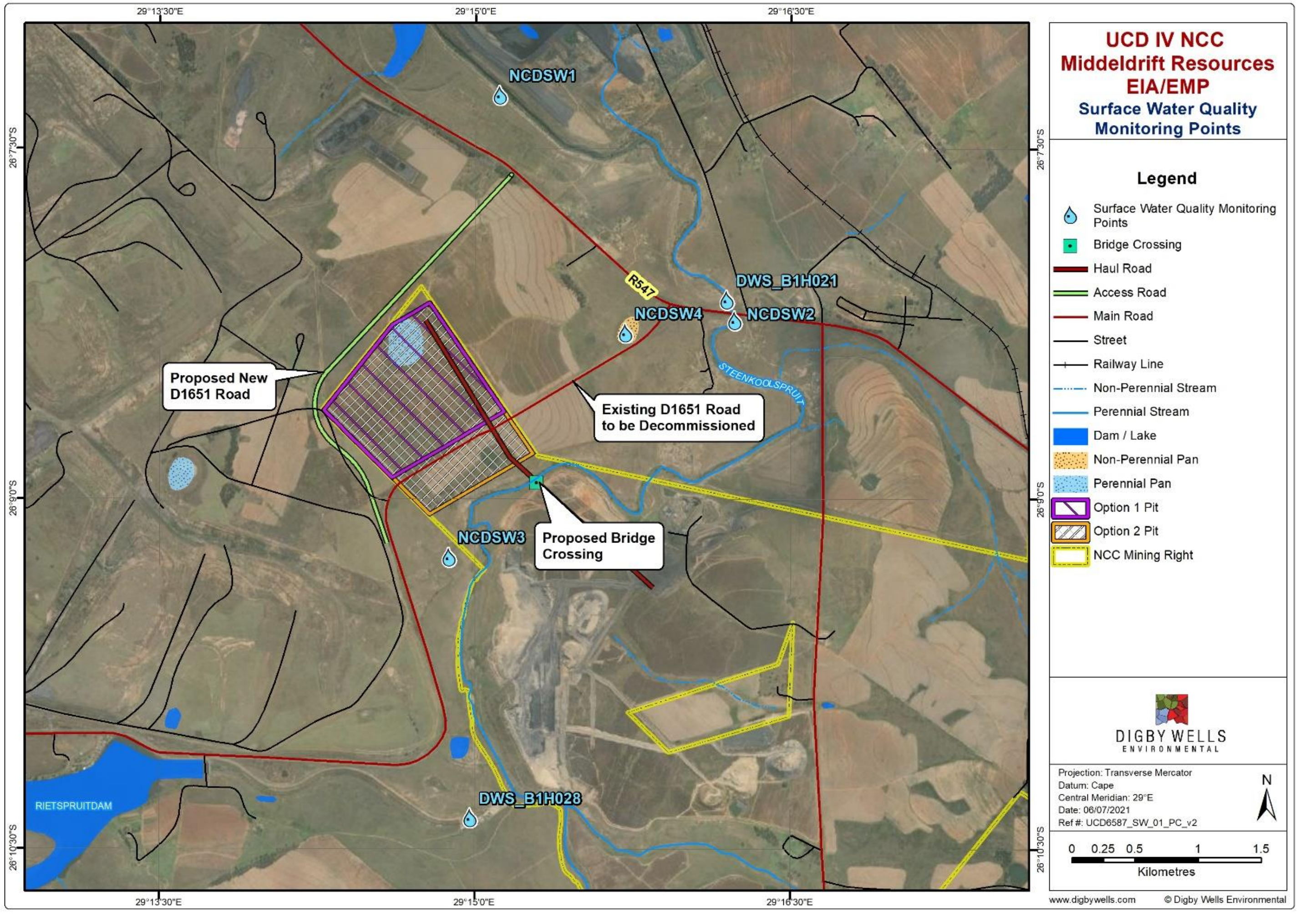


Figure 7-5: Surface Water Quality Sampling Points at New Clydesdale Project Site

7.3.2 Historical Water Quality

Baseline water quality sampling was undertaken by Digby Wells in 2011, while monthly sampling was undertaken by Universal Coal from 2014 to 2016 at various locations in the Steenkoolspruit and smaller tributaries in proximity to the study area (SRK Consulting, 2016).

Based on the water quality results analysed by SRK Consulting (2016), none of the water quality determinants monitored exceeded domestic water quality standards systematically, except for Total Dissolved Solids (TDS) and Sulphate (SO_4) over short periods during the dry season. It was concluded that the low flows (implying less volume of water for the same amount of salt load) contribute to the increase in TDS and SO4 concentrations, and thus are not likely to contribute significantly to the salinity load entering the Olifants River (SRK Consulting, 2016).

The salt loading of the Steenkoolspruit was estimated from discharge and sampled TDS concentrations (B1H021) to be approximately 23 000 tons/annum, whereas the total TDS load likely to leave the opencast mine is estimated as 62 tons/annum, which is less than 0.5% of the current total salt load in the Steenkoolspruit. The salt load discharged into the Steenkoolspruit as a result of mining in the New Clydesdale Mine was considered minimal (SRK Consulting, 2016).

7.3.3 Recent Water Quality Conditions

The recent water quality within the Rietspruit upstream and downstream of the proposed Middeldrift opencast pit are presented in Table 7-1. Most of the analysed parameters are within the Olifants Resource Quality Objectives (RWQO) in which the proposed project site is located. Exceedances were, however, noted for Turbidity, Chloride (Cl), and Aluminium (Al) both upstream and downstream of the project site. Higher turbidity is likely attributed to livestock animals that agitate the water as they drink water from the Rietspruit during grazing. Cl and Al sources likely include sewage and industrial effluents emanating from the Reedstream Park upstream of the New Clydesdale Colliery within the Rietspruit catchment and from Kriel and Thubelihle Towns adjacent to the Steenkoolspruit before its confluence with the Rietspruit.

Table 7-1: Current water quality for the proposed New Clydesdale development

Parameters	Units	Olifants Resource Quality Objectives	NCDSW2 (Downstream)	NCDSW3 (Upstream)
pH - Value @ 25 ºC	pH meter units	5.9 - 8.8	7.7	7.8
Electrical Conductivity in mS/m @ 25°C	mS/m	≤ 111	47.7	46.7
Total Dissolved Solids @ 180°C	mg/l	N/S	424	422
Turbidity in N.T.U	NTU	≤ 10	37	32

Parameters	Units	Olifants Resource Quality Objectives	NCDSW2 (Downstream)	NCDSW3 (Upstream)
Total Alkalinity as $CaCO_3$	mg/l	≥ 60	104	104
Chloride as Cl	mg/l	≤ 0.05	21	20
Sulphate as SO_4	mg/l	500	104	100
Fluoride as F	mg/l	≤ 3.00	0.4	0.4
Nitrate as N	mg/l	≤ 4.00	3.7	0.5
Sodium as Na	mg/l	N/S	31	30
Potassium as K	mg/l	N/S	7.8	7.6
Calcium as Ca	mg/l	N/S	32	31
Magnesium as Mg	mg/l	N/S	17	18
Aluminium as Al	mg/l	≤ 0.150	0.484	0.425
Boron as B	mg/l	N/S	0.063	0.065
Copper as Cu	mg/l	≤ 0.08	<0.010	<0.010
Iron as Fe	mg/l	N/S	0.866	0.751
Manganese as Mn	mg/l	≤ 1.300	0.127	0.124
Zinc as Zn	mg/l	≤ 14.4	<0.025	<0.025

7.4 Floodlines Determination

7.4.1 Delineated Catchments

One catchment was delineated for the Steenkoolspruit and the 1:50-year and 1:100-year peak flows were calculated for this catchment. The delineated catchment can be seen in Figure 7-6.

7.4.1 Design rainfall depths and Peak Flows

Design Rainfall Depths for the 1:2-year to 1:100-year return periods were calculated using the Design Rainfall Software for South Africa (Smithers and Schulze, 2000). The rainfall depths are presented in Table 7-2. Rainfall depths with durations equal to the time of concentration (Tc) of the Steenkoolspruit catchment were used to calculate peak flows using the RM3 method. The recalibrated modified Hershfield equation was used to determine precipitation depths used in the SDF method (Alexander, 2002). SDF peak flows were considered an over-estimate for the site possibly due to higher and regionally calibrated runoff coefficients not representative of the NCC site. RM3 flood peaks which were more conservative than those of the MIPI method were used in HEC-RAS for hydraulic modelling. Calculated peak flows are presented in Table 7-3.

Table 7-2: 24-Hour Design rainfall depths for NCC region

	Return Period (T/years)					
Duration	**2year**	**5year**	**10year**	**20year**	**50year**	**100year**
5 m	8.5	11.9	14.4	17.1	21.1	24.5
10 m	12.3	17.1	20.8	24.8	30.5	35.4
15 m	15.3	21.3	25.8	30.7	37.9	43.9
30 m	19.6	27.2	33	39.3	48.4	56.1
45 m	22.6	31.4	38.1	45.3	55.8	64.8
1 h	25	34.7	42.2	50.2	61.8	71.7
1.5 h	28.8	40.1	48.7	57.9	71.4	82.8
2 h	31.9	44.4	53.9	64.1	79	91.6
4 h	38	52.8	64.1	76.2	94	109
6 h	42	58.4	71	84.4	104	120.6
8 h	45.2	62.8	76.3	90.7	111.8	129.6
10 h	47.8	66.4	80.6	95.9	118.2	137.1
12 h	50	69.5	84.4	100.4	123.7	143.5
16 h	53.7	74.7	90.7	107.8	132.9	154.2
20 h	56.8	79	95.9	114	140.6	163
24 h	59.5	82.7	100.4	119.4	147.1	170.6

Table 7-3: Peak flows for the Steenkoolspruit adjacent to the NCC project site

Catchment	**Method**					
	RM3		**SDF**		**MIPI**	
	1:50yr	1:100yr	1:50yr	1:100yr	1:50yr	1:100yr
	(m^3/s)					
Steenkoolspruit	959.03	1340.65	1128.07	1438.08	915.59	1156.54

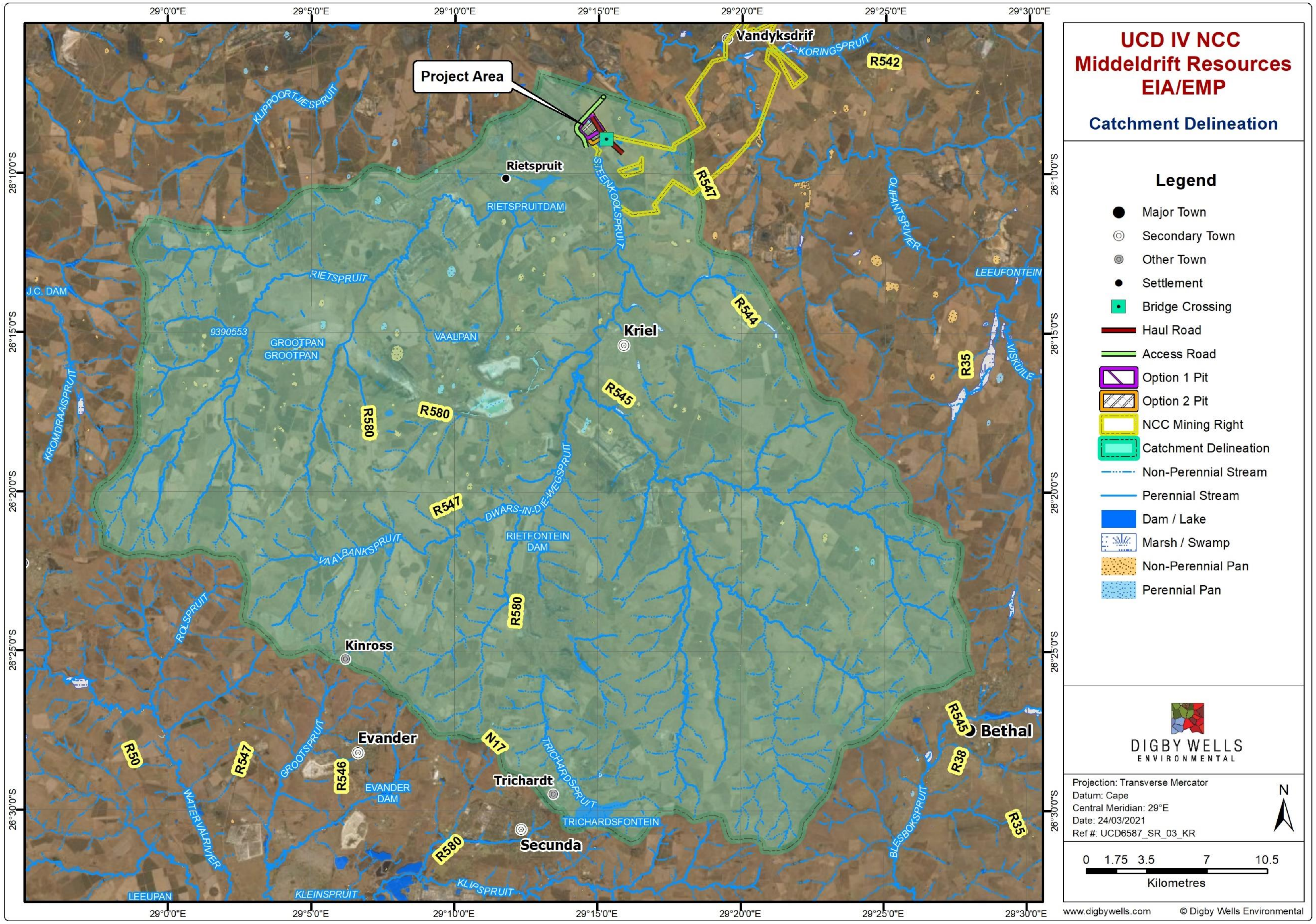


Figure 7-6: The delineated Steenkoolspruit catchment

7.4.2 Floodlines

The 1:50-year and 1:100-year floodlines indicate that the proposed infrastructure including the Middeldrift Opencast Pit are outside the flood waterway (See Figure 7-7).

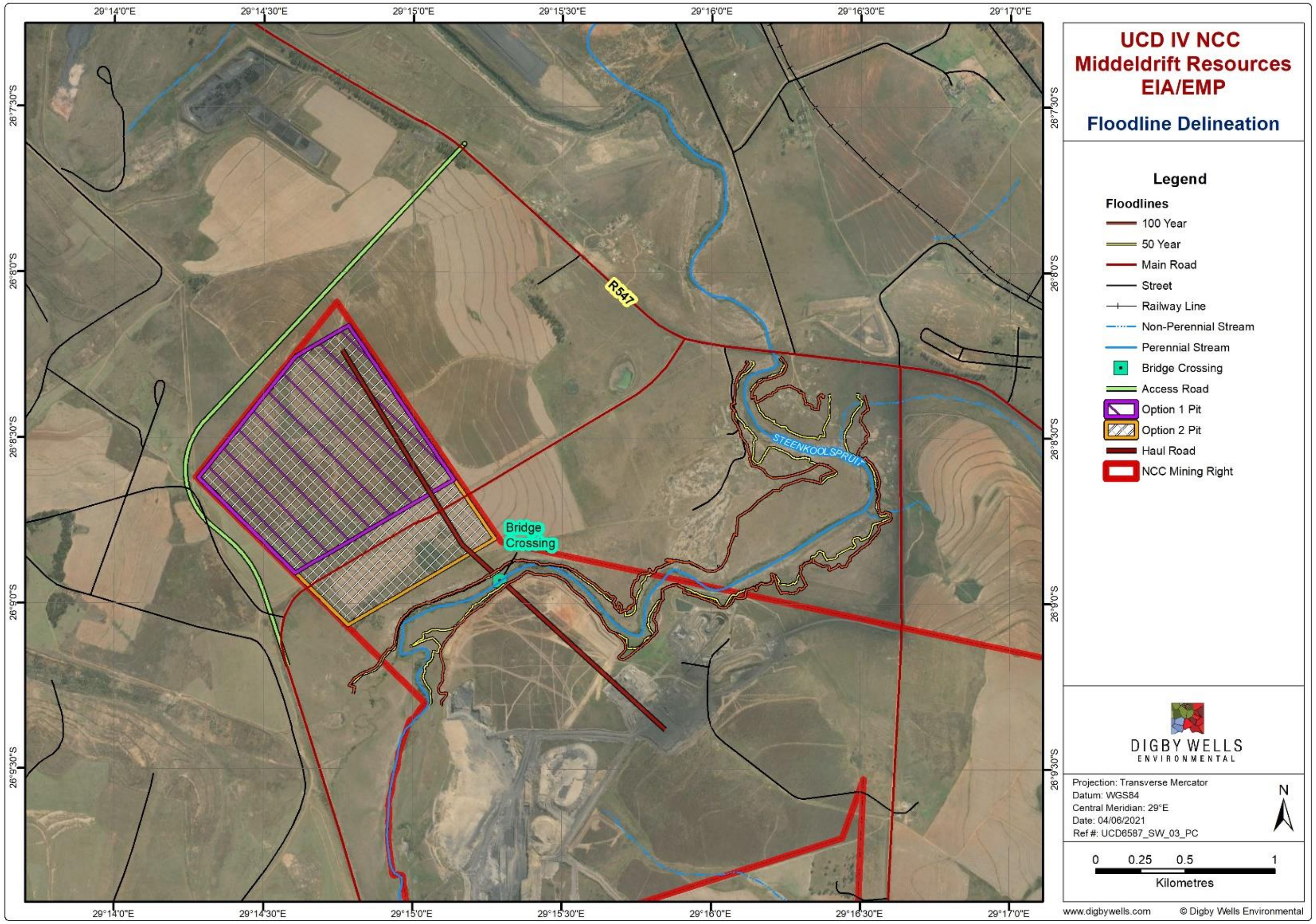


Figure 7-7: Floodlines for the Steenkoolspruit adjacent to the Middeldrift Resources project site

7.5 Storm Water Management Plan

Storm water management with respect to the proposed Middeldrift Resources opencast pit is shown in Figure 7-8. The storm water management plan indicates a perimeter berm around the opencast pit, which is considered a dirty catchment. The berm will exclude or divert clean water from the clean water catchment around the pit so that it flows downslope to the Steenkoolspruit. The berm should be constructed to divert runoff depths greater than 1m and to stop a peak-runoff rate of 3.52 m^3/s, on average (Table 7-4).

Table 7-4: Results of the modelled clean catchment around the Middeldrift pit

Description	Slope (%)	Precip. (mm)	Infiltr. (mm)	Runoff Depth (mm)	Runoff Volume (ML)	Peak Runoff (m3/s)	Runoff Coefficient
Clean catchment	0.01	132.23	81.64	100.35	64.56	3.52	0.42

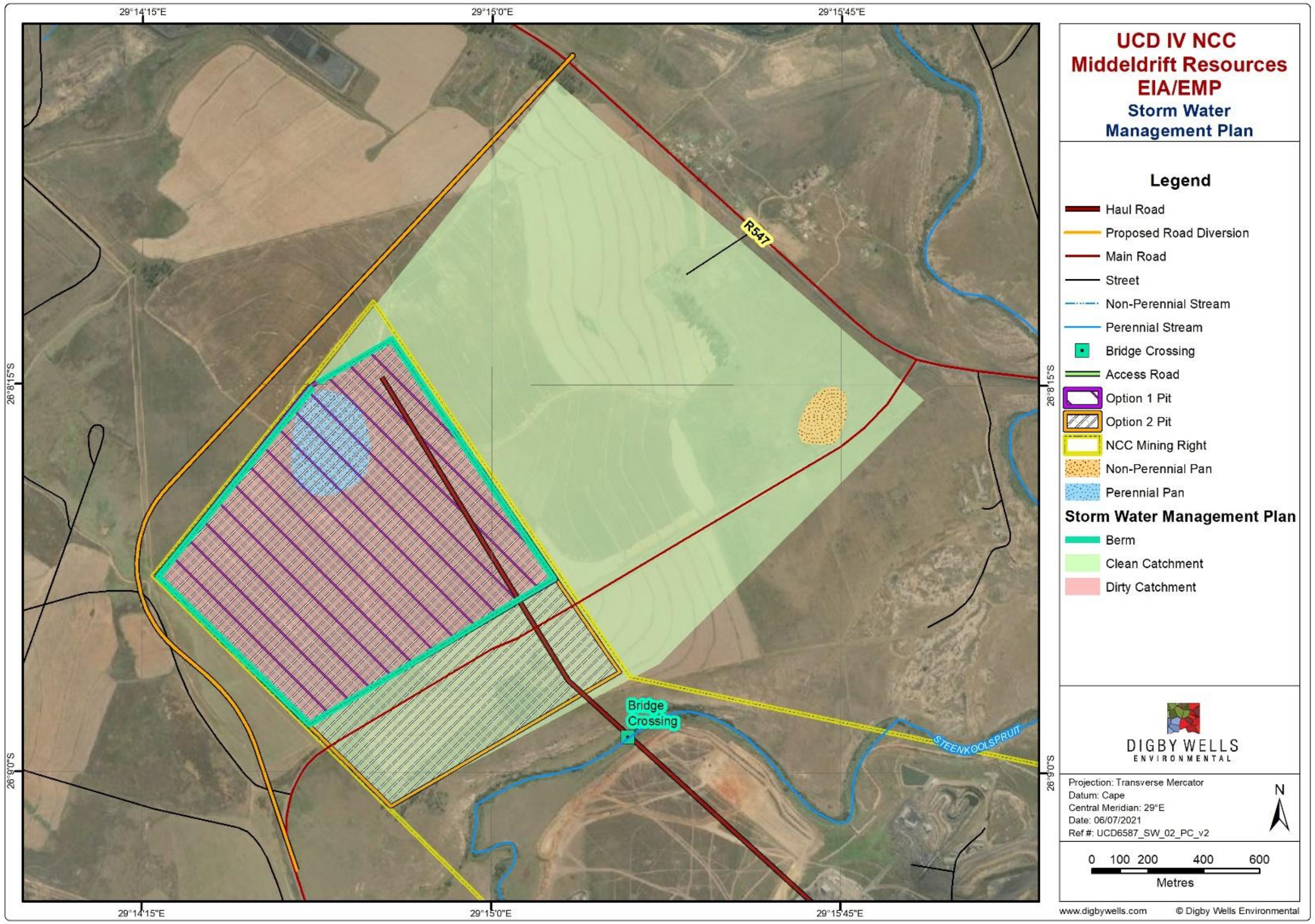


Figure 7-8: Storm water management plan for the proposed new pit at the New Clydesdale Colliery

7.6 Water Balance

A water balance was compiled for the proposed Middeldrift Resources opencast Pit to be integrated into the existing mine-wide water balance at the New Clydesdale Colliery. Rainfall and evaporation data used to calculate water volumes directly falling into the pit and that evaporating out of the pit were obtained from the WR2012 database and it is presented in Table 7-5 and Table 7-6, respectively.

Table 7-5: Monthly rainfall for quaternary catchment B11E

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
72.08	111.04	109.94	115.86	90.95	75.83	41.80	16.81	7.55	6.48	7.16	22.94

Table 7-6: Monthly potential evaporation for quaternary catchment B11E

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
172.37	162.62	179.09	175.89	146.63	144.71	111.29	93.70	76.11	83.31	110.33	142.95

7.6.1 Assumptions and Constants

Constant values and assumptions considered during the water balance development are presented in Table 7-7.

Table 7-7: Assumptions and constants used in the water balance calculations

Description	Value	Unit	Source/comment
MAP	0.682	m	WR2012 database
MAE	1.95	m	WR2012 database
Runoff coefficient	0.4	%	Field observations
Pit runoff surface area	456 000	m^2	Measured from Google Earth
Middeldrift pit surface area	1 045 191	m^2	Measured from layout plan
Dust suppression	88 000	m^3/annum	IWWMP report (Headwaters, 2018)
Groundwater Inflow rate	200	m^3/day	Hydrogeological report (Digby Wells, 2021)
Seepage	2	%	Assumed to be 2% of pit inflows
Pumping from pit to existing PCD2	160	m^3/day	IWWMP report (Headwaters, 2018)

7.6.2 Water Balance Results

The annual, monthly and daily average water balances are presented in Figure 7-9 to Figure 7-11, respectively. The annual average water balance indicates a total inflow volume into the Middeldrift Opencast pit of 910 267 m^3/annum emanating from rainfall, runoff and groundwater ingress. A dewatering volume of 58 560 m^3/annum is pumped to Pollution Control Dam 2 (PCD2) situated at the existing NCC operations, while 88 000 m^3/annum is used for dust suppression. There are no water storages that happen at the Middeldrift Resources opencast pit site.

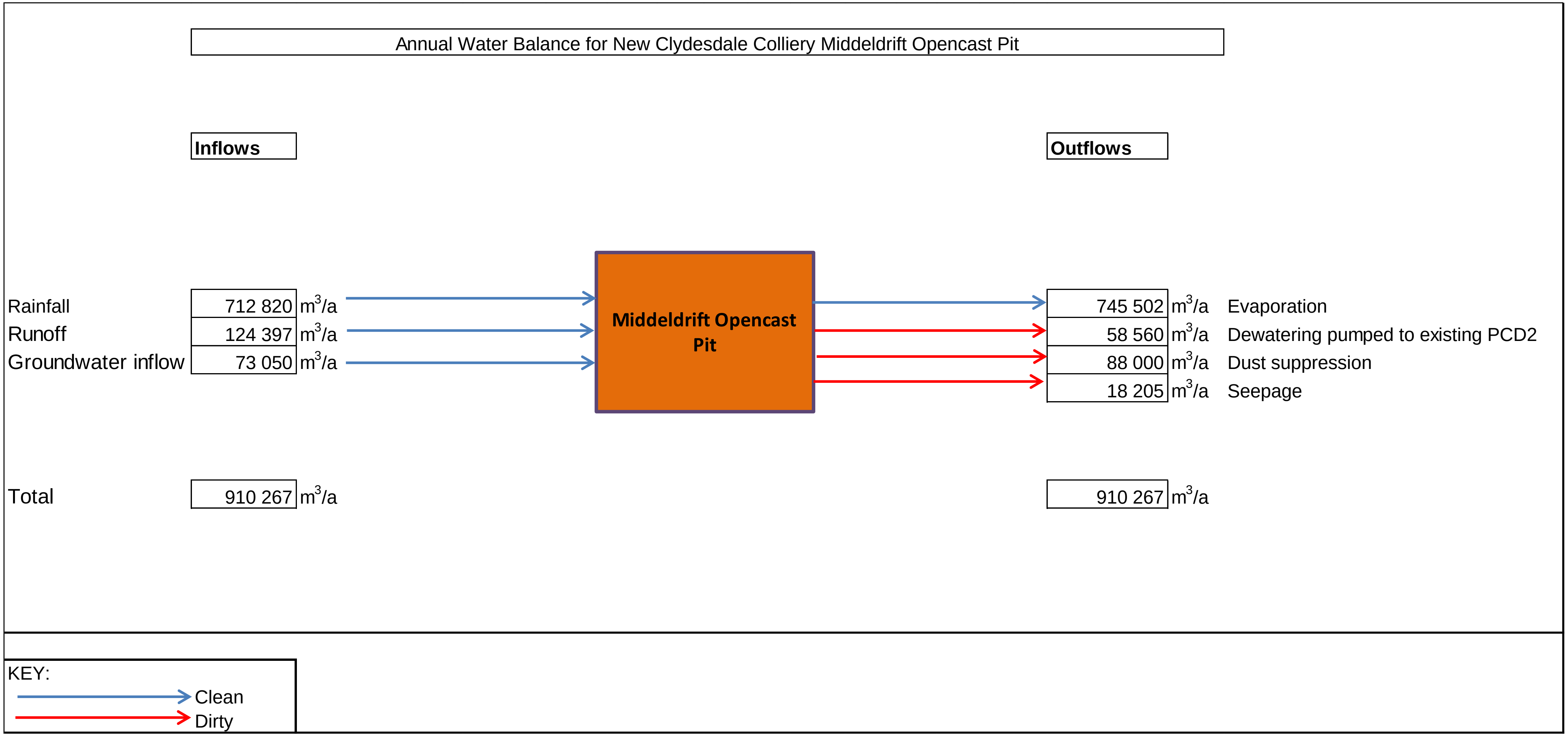


Figure 7-9: Annual average water balance for the Middeldrift Opencast Pit at New Clydesdale Colliery

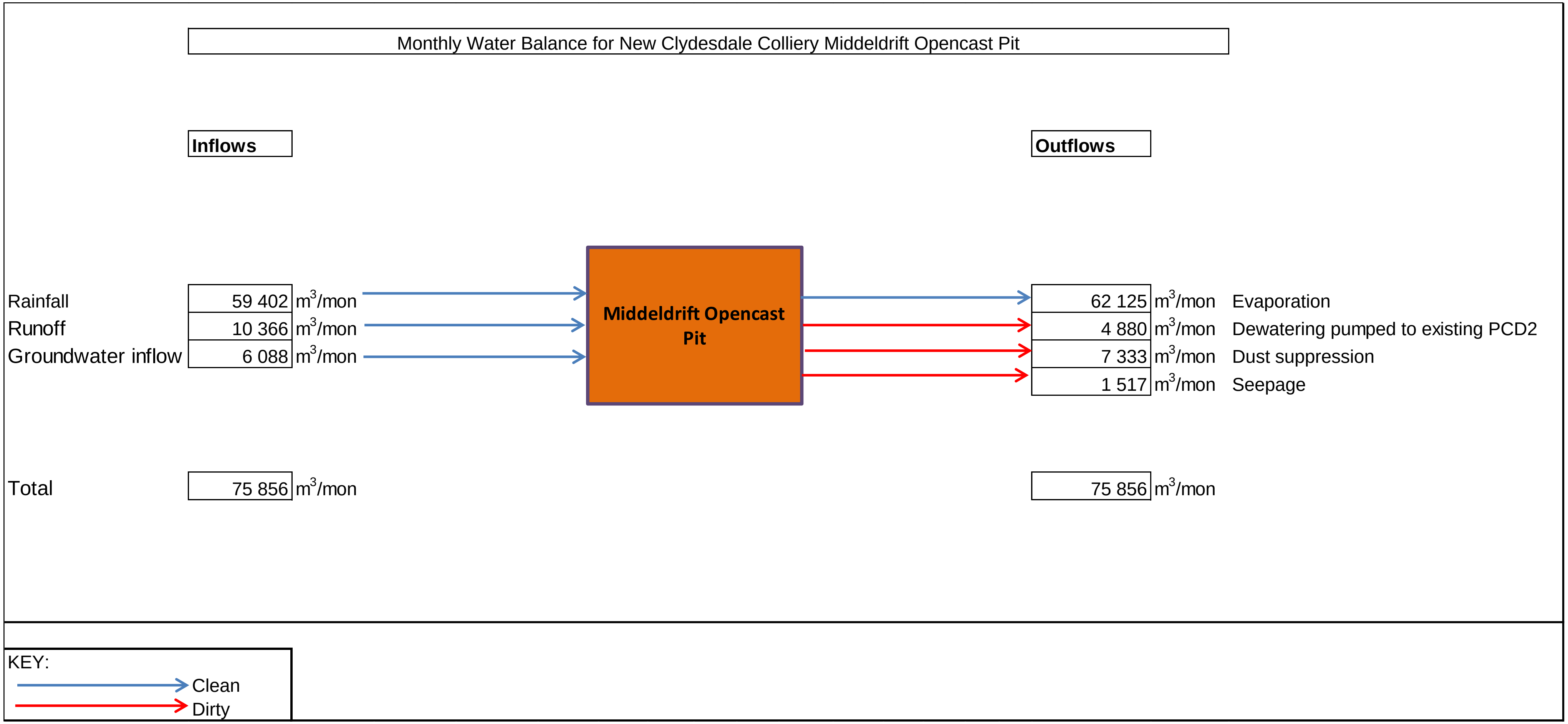


Figure 7-10: Monthly average water balance for the Middeldrift Opencast Pit at New Clydesdale Colliery

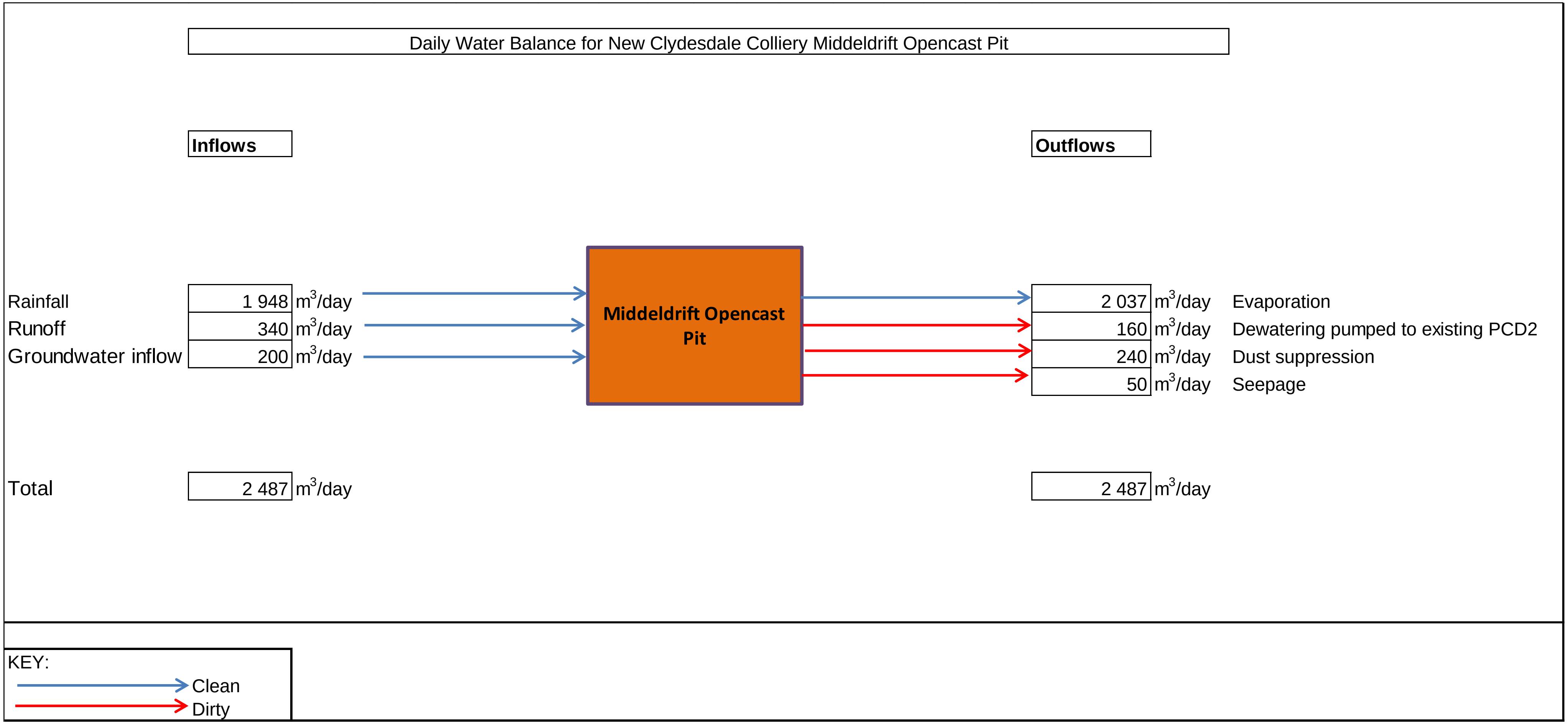


Figure 7-11: Daily average water balance for the Middeldrift Opencast Pit at New Clydesdale Colliery

8 Surface Water Impact Assessment

Surface water impacts were assessed for all the three phases of the project, namely, the construction, operation and decommissioning phases.

8.1 Construction Phase

Activities with potential impacts on surface water resources and their mitigation or management measures are listed and described in the table provided below (Table 8-1) and the impact significance rating is given in Table 8-2.

Table 8-1: Interactions and the impacts of activities in the Construction phase

Interaction	Impacts
Vegetation clearance for road diversion and a bridge/culvert connecting proposed new pit to the existing mine. Ripping off part of an existing road which will be decommissioned	Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality
Handling of hydrocarbons (e.g. fuels, oils and grease) during land preparation using heavy machinery and vehicles	Reduced surface water quality due to contamination from hydrocarbon waste

8.1.1.1 *Impact Description: Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality*

Vegetation serves as land cover which protects the soil from being eroded during rainfall events. Vegetation cover allows water to seep into vegetation, allowing water to flow at a slow speed and preventing soil from being washed off. Clearing vegetation exposes the soil to the possibility of erosion during a rainfall event or when water flows on that area, therefore increasing the volume of suspended solids in adjacent water resources. Furthermore, the movement of vehicles during construction increases the amount of dust particles which also reduce the quality of nearby surface water resources.

8.1.1.2 *Impact Description: Reduced surface water quality due to contamination from hydrocarbon waste*

Contamination of water could potentially occur due to the spillage of chemicals such as hydrocarbons during loading and transportation. Contamination can also occur due to stockpiling of topsoil during construction and the first stage of box cut development. The quality of water determines what it can be used for, for example, reduced water quality will affect its availability for uses such as domestic use, livestock watering or irrigation depending on the nature and level of impurities in it.

8.1.1.3 *Management/Mitigation Measures*

The recommended management/mitigation measures are as follows:

- Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones;
- If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments, dust generation and hazardous substances from construction vehicles used during site clearing;
- Hydrocarbon and hazardous waste storage facilities must be appropriately bunded to ensure that leakages can be contained. Spill kits should be in place and construction workers should be 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 and should be inspected daily before use to ensure there are no leakages underneath; and
- Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas at the existing NCC mining operations. Any used oil should be disposed of by accredited contractors.

Table 8-2: Impact Significance Rating for Construction Phase

Dimensions	Rating	Motivation	Significance
Impact: Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality			
Duration	5	The impact will likely occur during construction and decommissioning phases	90-Moderate (Negative)
Intensity	5	The impact will have serious, long-term impact on the ecosystem	
Spatial scale	5	The impacts will go beyond the specified project area	
Probability	6	It's highly probable that it will occur	
Post-mitigation			
Duration	5	The impact will likely occur throughout the project's life	36-Negligible (negative)
Intensity	2	The impacts will have minor effects on water resources	
Spatial scale	2	The impacts will be limited to the project site	

Dimensions	Rating	Motivation	Significance
Probability	4	Probable: Has occurred here or elsewhere and could therefore occur.	

Dimensions	Rating	Motivation	Significance
Impact Description: Reduced surface water quality due to contamination from hydrocarbon waste			
Duration	6	The impact will occur beyond the project life	76-Moderate (Negative)
Intensity	7	The impact will have serious, long-term impact on water resources and the aquatic ecosystem	
Spatial scale	6	The impacts will go beyond the project area, it will also affect areas downstream	
Probability	4	There is high possibility of the impacts occurring.	
Post-mitigation			
Duration	4	The impacts will occur only during the life the project	36-Negligible (negative)
Intensity	3	The intensity of the impacts will be at minimum	
Spatial scale	2	The impacts will be felt mostly around the project area	
Probability	4	Probable: Has occurred here or elsewhere and could therefore occur.	

8.2 Operational Phase

Activities that might have potential impacts on surface water resources during the operational phase are indicated in Table 8-3 while Table 8-4 further indicates the impact significance rating. This Section also describes the recommended mitigation/managements measures to limit the effects of the identified impacts.

Table 8-3: Interactions and impacts of activities in the operational phase

Interaction	Impacts
Opencast pit excavation during the mining process, removal and transportation of stripped topsoil and discard to designated dumps and stockpile areas.	Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality
Spillages and leakages of fuels, oils and grease and other hazardous waste from mining operations including use of machinery and vehicles	Contamination of surface water resources leading to deteriorated water quality
Onsite water storage resulting from interception of runoff and precipitation in the proposed opencast pit	Reduced catchment runoff and reduction of streamflow regime in the Steenkoolspruit

8.2.1.1 Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality

Opencast pit excavation during the mining process, removal and transportation of stripped topsoil and discard to designated dumps and stockpile areas.

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

Operating vehicles and machinery, transportation of hydrocarbon material and other waste may become sources of contamination through spills and leakages. Dirty water runoff from haul road containing suspended hydrocarbon residues will have negative impacts on the receiving surface waterbodies thereby leading to reduced water quality.

8.2.1.3 Impact Description: Reduced catchment runoff and reduction of streamflow regime in the Steenkoolspruit

Runoff and rainfall interception by the opencast pit will reduce the amount of water that reports to nearby water resources thereby affecting their streamflow regimes. This will likely result in less water available for downstream water users and aquatic ecosystems. The reduction in runoff will, however, be in the order of 0.06% of the contributing greater Steenkoolspruit catchment.

8.2.1.4 Management/Mitigation Measures

The recommended management/mitigation measures are as follows:

- Implementation of the proposed stormwater management plan is recommended to reduce siltation and sedimentation of watercourses;

- All mining personnel should be trained and educated on proper handling of hydrocarbons and any potentially hazardous materials;
- All operational vehicles should be maintained and washed at designated wash bays at the existing NCC operations;
- All mine waste should be handled and disposed of by an accredited vendor;
- The proposed water quality monitoring program should be consistently implemented to ensure compliance to DWS water quality guidelines. This will enable early detection and management of any water quality problems arising as a result of mining and associated activities;
- Minimise spillages of carbonaceous material into the river at the bridge crossing during haulage of coal from the Middeldrift Pit to the existing NCC operations; and
- The water requirements and demands should be clearly stated and regularly reviewed through water balance updates to ensure water uses and losses are accounted for.

Table 8-4: Impact Significance Rating for Operational Phase

Dimensions	Rating	Motivation	Significance
Impact: Sedimentation and siltation of water sources due to increased soil erosion leading to reduced water quality			
Duration	5	The impact will likely occur during construction and decommissioning phases	90-Moderate (Negative)
Intensity	5	The impact will have serious, long-term impact on the ecosystem	
Spatial scale	5	The impacts will go beyond the specified project area	
Probability	6	It's highly probable that it will occur	
Post-mitigation			
Duration	5	The impact will likely occur throughout the project's life	36-Negligible (negative)
Intensity	2	The impacts will have minor effects on water resources	
Spatial scale	2	The impacts will be limited to the project site	
Probability	4	Probable: Has occurred here or elsewhere and could therefore occur.	

Dimensions	Rating	Motivation	Significance
Impact Description: Reduced surface water quality due to contamination from hydrocarbon waste			
Duration	6	The impact will occur beyond the project life	95-Moderate (Negative)
Intensity	7	The impact will have serious, long-term impact on water resources and the aquatic ecosystem	
Spatial scale	6	The impacts will go beyond the project area, it will also affect areas downstream	
Probability	5	Project Life: The impact will cease after the operational life span of the Project.	
Post-mitigation			
Duration	4	The impacts will be long-term during the course of the project	36-Negligible (negative)
Intensity	3	The intensity of the impacts will be at minimum	
Spatial scale	2	The impacts will be felt mostly around the project area	
Probability	4	Probable: Has occurred here or elsewhere and could therefore occur.	

Dimensions	Rating	Motivation	Significance
Impact: Reduced catchment runoff and reduction of streamflow regime in the Steenkoolspruit			
Duration	5	Impacts will occur for the lifespan of the project	70-Minor (Negative)
Intensity	4	The impact will affect the availability of freshwater resources therefore affecting habitats	
Spatial scale	5	Impacts will be felt downstream mostly	
Probability	5	The impacts will likely take place	
Post-mitigation			
Duration	5	Impacts will occur during the project's life span	

Dimensions	Rating	Motivation	Significance
Intensity	2	Limited impacts on the water resources and minimum damage to habitats	36-Negligible (Negative)
Spatial scale	2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants	
Probability	4	The impact will highly occur during extreme circumstances	

8.3 Decommissioning Phase

Table 8-5 indicates activities with potential impacts on surface water resources during the decommissioning and closure phase. In addition, this Section also details the ways in which these impacts can be mitigated or managed. Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that supports desired post-mining land use.

Table 8-6 indicates the impact significance rating for the decommissioning phase.

Table 8-5: Interactions and Impact Activity

Interaction	Impacts
Demolition and removal of mine infrastructure including decommissioning of access and haul roads thereby disturbing the soil	Sedimentation and siltation of watercourses subsequently affecting water quality and flow of streams
Leakage and spillage of hydrocarbons from moving vehicles and machinery during decommissioning activities	Contamination of water resources due to chemical contamination such as hydrocarbons as result of mishandling
Rewatering of backfilled mine pit and reaction of sulphur compounds with water and oxidation	Contamination of water resources from decant of Acid Mine Drainage (AMD) at low-lying riverine areas
Re-vegetation and re-profiling of backfilled landscapes	Allowing free drainage and possible increase of streamflow regimes

8.3.1.1 Impact Description: Sedimentation and siltation of water sources therefore affecting water quality and flow of streams

Infrastructure demolition and removal will result in debris and exposure of the soil, which may be transported to the nearest surface water resources through runoff. Thus, sedimentation and siltation of watercourses might result from such activities and consequently affecting the streamflow volumes and quality of receiving water resources.

8.3.1.2 Impact Description: Contamination of water resources due to hydrocarbon waste

Leakage and spillage of hydrocarbons from moving vehicles and machinery during decommissioning activities.

8.3.1.3 Impact Description: Allowing free drainage and possible increase of streamflow regimes

Mine closure and rehabilitation which include revegetation and re-profiling of backfilled landscapes will allow free drainage as much as practically possible to benefit the post mining land uses. However, it should be noted that pre-mining land uses are not likely to be achieved. However, a positive impact will occur as water freely flows to nearby watercourses possibly increasing streamflow regimes.

8.3.1.4 Impact Description: Contamination of soil and water resources from potential decant of AMD and movement of contamination plumes due to the re-watering of the backfilled pit

AMD occur when water reacts with pyrite, both coal and the host rock contain pyrite, it is however more abundant in the coal layers (McCarthy, 2011). During rehabilitation, the blasted rock layer is replaced with soil and vegetation. When rainfall infiltrates and penetrates through the soil into the backfill, it reacts with the pyrite in the backfill material, thus water becomes acidified and starts decanting.

8.3.1.5 Management/Mitigation Measures

The following measures are recommended:

- Soil disturbances during decommissioning should be restricted to the relevant footprint area;
- All decommissioning debris must be cleared as soon as practically possible, and it is recommended that demolition of infrastructure be conducted during the dry season to minimise chances of soil erosion to watercourses;
- Movement of heavy vehicles and machinery must be restricted to existing roads to avoid further disturbance of landscapes thus minimising soil erosion;
- In the event of decanting, passive treatment should be applied to neutralise and treat the AMD before being discharged back into freshwater resources. If passive treatment fails, active treatment by a conventional Water Treatment Plant should be considered; and
- Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that supports desired post-mining land use.

Table 8-6: Impact Significance Rating for the Decommissioning Phase

Dimensions	Rating	Motivation	Significance
Impact: Sedimentation and siltation of water sources therefore affecting water quality and flow of streams			
Duration	6	Beyond Project Life: The impact will remain for some time after the life of a Project.	78-Moderate (negative)
Intensity	4	The impacts will affect the flow and quality of streams thereby endangering the aquatic environment	
Spatial scale	3	The impact will affect areas beyond the project area	
Probability	6	The impact is highly likely to take place	
Post-Mitigation			
Duration	2	The impact will only be limited during the specified phase after mitigation measures	28-Negligible (Negative)
Intensity	2	There will be minor and manageable impacts on water resources and the environment	
Spatial scale	3	Local: Extending across the site and to nearby settlements	
Probability	4	The chances of the impact occurring are low, unless its extreme events	

Dimensions	Rating	Motivation	Significance
Impact: Contamination of water resources due to hydrocarbon waste			
Duration	4	The impacts of chemical contamination will occur beyond the specified phase	66- Minor (Negative)
Intensity	4	The impacts will moderately affect the quality of water resources thereby affecting the aquatic environments downstream of the project area	
Spatial scale	3	The impacts may be felt downstream of the project area	
Probability	6	There are high chances of the impact occurring	
Post-Mitigation			

Dimensions	Rating	Motivation	Significance
Duration	4	The impacts may occur for a long term, 6 – 15 years	36- Negligible (Negative)
Intensity	3	Minor effects on ecosystems will occur and will be reversible internally or with minimal assistance from external experts	
Spatial scale	2	The impact will be localised within the project area	
Probability	4	The impact will probably occur	

Dimensions	Rating	Motivation	Significance
Impact: Allowing free drainage and possible increase of streamflow regimes			
Duration	7	The positive impact will last long after the project life	126+ Major (Positive)
Intensity	6	Streamflow regimes will likely increase and aquatic ecosystems will be sustained, hence, beneficial to the environment	
Spatial scale	5	The impacts will go beyond the project area to downstream water users	
Probability	7	The impact will definitely take place	

Dimension	Rating	Motivation	Significance
Impact: Water contamination from Acid Mine Drainage decant into surface water resources			
Duration	7	The impact will likely remain beyond the life of the project	96-Moderate (negative)
Intensity	5	High significant impact on the environment. Irreparable damage to highly valued species, habitat or ecosystem	
Spatial scale	4	The impacts will be localised to the immediate surroundings of the mine site	
Probability	6	It is most likely that the impact will occur	

Dimension	Rating	Motivation	Significance
Post-mitigation			
Duration	6	The impact will occur beyond the Life of Mine	40-Minor (negative)
Intensity	2	With mitigation the AMD impact will have low to moderate intensity	
Spatial scale	2	Limited to the site and its immediate surroundings	
Probability	4	It is probable that the impact will occur	

8.4 Cumulative Impacts

Mines have a huge impact on water resources, both on the availability and quality. In coal mines, a significant amount of water is used for mining and processing, and dust suppression, thus having huge impacts on the availability of water. Furthermore, water availability is also reduced with deteriorating water quality because of dirty runoff from mines and contamination from decant water after mine closure. Despite the efforts to recycle water in this industry, a significant amount of water is needed to ensure effective operation, therefore, water requirements and water consumption remain high.

The project area is situated in the upper Olifants River catchment, where similar mining activities are being conducted. Reports of pollution within river systems in this part of the Olifants catchment are recorded. In fact, Olifants River catchment is considered one of the most polluted in Southern Africa (Le Roux, et al., 2012). Extreme caution and care should, therefore, be taken to avoid exacerbating the water challenges already being experienced prior to the proposed Middeldrift mining activities.

Water quality should closely and rigorously be monitored within the surrounding surface water resources to ensure adherence to South African Target Water Quality Guidelines. The proposed mitigation measures will ensure overall minimum cumulative impacts on the Olifants River.

8.5 Unplanned and Low Risk Events

Unplanned events accounts for accidental occurrences during the project life of mine. For instance, pipeline leakages or bursting, overflow of dams, spillage or leakage of potential pollutant substances. Such accidents could have negative impacts on nearby surface water resources because runoff from these contaminated surfaces will contaminate the freshwater systems, therefore affecting water quality. Table 8-7 summarises the risks of unplanned events and provides management measures.

Table 8-7: Unplanned events, impacts and mitigation measures

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Hazardous chemicals spillage: pipeline bursts or leakage, dam overflows	Surface water contamination	Monitoring/management programs should incorporate emergency response plans for unplanned events. In cases of chemical spillages and leakages, pipe bursts or leakage such response plans and spill kits should be accessible to responsible monitoring or management personnel. Material Safety Data Sheets (MSDS) should be on standby throughout the project life to ensure proper and safe handling and disposal of chemical products. Regular and continuous monitoring and inspection of wastewater facilities are of utmost importance to identify concerns such as breaches and potential failures, overflows, or seepages.
Accidental spillage or overflows of sewage effluent	Surface water contamination and eutrophication of surface water resources	Immediate and proper clean-ups should be practised to minimise contamination of water resources

9 Environmental Management Plan

This section summarises the proposed activities, the potential impacts of the proposed activities and the environmental aspects affected and associated mitigation measures.

Table 9-1: Environmental Mangement Plan

Activity/ies	Potential Impacts	Aspects Affected	Phase	Mitigation Measure	Mitigation Type	Time period for implementation
• Vegetation clearing; • Construction of infrastructure including the culvert, haul road and diversion of the provincial road; and • Loading and transportation of materials including topsoil and discard to designated dumps and stockpile areas,	• Sedimentation and siltation of water sources due to increased soil erosion	Surface Water quantity and Quality	Construction	• Strategically clear all vegetation within the development site and limit disturbing the soil; • Encourage the use of existing access roads and minimise creating new ones as to limit soil disturbances; • Avoid stockpiling close to the drainage lines and construction must be done mostly during drier periods to minimise erosion; and • Maintain vehicles and machinery regularly to avoid leakages.	Control by implementing proposed stormwater management plan to minimise impacts on the environment	During the construction phase
• Flow of dirty water from haul roads and blasting sites; and • Hydrocarbon spillages and leakages from equipment, moving heavy vehicles and machinery.	• Siltation of water resources due to increased dust and soil erosion; and • Hydrocarbon contamination of water resources	Surface Water Quality and Quantity	Operational	• Installation of effective drainage systems with sediments filtration material is recommended to reduce siltation and sedimentation in watercourses; • Ensure that water quality complies with DWS guidelines before discharging it to watercourses; • Storage facilities for hydrocarbon fuels, oils and grease must be equipped to contain leakages and spills and must be on impermeable surface (concrete or paved) and should be an enclosed area built in accordance with the SANS1200; • All mining personnel must be trained and educated on proper handling and disposal of hazardous material; • All operational vehicles should be maintained and washed in a single designated area and all the runoff water should be diverted to the PCD and all mine waste should be handled by a trained contractor; • Water quality monitoring should be effectively implemented to ensure adherence to the stipulated water quality standards, and through this, any water quality problems arising because of the mine can be detected and dealt with early; • The water requirements should be clearly stated and frequently reviewed as to not compromise the Reserve; and • Recycling and reusing of mine water are highly recommended to reduce the abstraction of freshwater resources.	Control by implementation of proposed SWMP and regular monitoring of water quality and quantity to minimise the negative impacts of mining and related activities; and Regular maintenance of SWMP to ensure effective functioning of storm water structures.	During the operational phase

Activity/ies	Potential Impacts	Aspects Affected	Phase	Mitigation Measure	Mitigation Type	Time period for implementation
• Decommissioning and removal of mine infrastructure will result in the disturbance of soils thereby accelerating soil erosion; • Handling hydrocarbon material and potential leakage and spillage from moving vehicles and machinery; and • Backfilling, re-profiling and revegetation of disturbed landscapes.	• Sedimentation and siltation of watercourses subsequently affecting water quality and flow of streams; • Contamination of water resources due to chemical contamination such as hydrocarbons as result of mishandling; • Contamination of water resources from decant of Acid Mine Drainage (AMD) at low-lying riverine areas; and • Allowing free drainage and possible increase of streamflow regimes.	Water Quality and Water quantity	Decommissioning	• Soil disturbances during decommissioning should be restricted to the relevant footprint area; • All decommissioning debris must be cleared as soon as practically possible, and it is recommended that demolition of infrastructure be conducted during the dry season to minimise chances of soil erosion to watercourses; • Movement of heavy vehicles and machinery must be restricted to existing roads to avoid further disturbance of landscapes thus minimising soil erosion; • In the event of decanting, passive treatment should be applied to neutralise and treat the AMD before being discharged back into freshwater resources. If passive treatment fails, active treatment by a conventional Water Treatment Plant should be considered; and • Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that is close to pre-mining conditions.	Monitoring of water quality and quantity post-closure; and Rehabilitation of disturbed landscapes monitoring and maintenance of rehabilitated areas until vegetation has fully been established.	During the decommissioning phase

10 Surface Water Monitoring Programme

The monitoring program assists with the early detection of water contamination thereby allowing mitigation or management strategies to be implemented at an early stage, thus minimising the significance of potential impacts on water resources. Table 10-1 presents the proposed water resources monitoring plan to ensure sustainability of mining activities within the New Clydesdale Colliery. The frequency of mitigation, timing of implementation and the responsible persons in ensuring the implementation of the EMP are indicated.

Table 10-1: Surface Water Monitoring Plan

Monitoring Element	Comment	Frequency	Responsibility
Water quality	Ensure water quality monitoring as per sampled and proposed monitoring locations (See Figure 7-5). Parameters should include but not limited to pH; Electrical Conductivity; major cations (K, Ca, Mg & Na); trace metals (Al, Fe, Zn, Cu, Mn, Co, Se, Mo, Cd, Ni, Cr (VI), Pb, Hg & As); Anions (NO_3, NO_2, NH_4, Cl, F, SO_4, PO_4); Total Dissolved Solids; Total Suspended solids. It is also recommended to monitor water quality within the mine water dams or water containment facilities at the existing NCC operations to determine the concentration levels in case of an overflow or need for discharge.	Monthly monitoring during construction, operation, decommissioning and for at least five (5) years after closure, or until rehabilitation has reached a sustainable state with no further changes.	Environmental Officer
Sedimentation	Inspect construction sites, sites where infrastructure is demolished and rehabilitated sites for traces of erosion to ensure no entrance of sediment occurs into nearby watercourses, especially after rainfall events. Temporary silt fences, soil stabilization blankets should be installed and maintained until vegetation is established.	After rainfall event, until the establishment of vegetation on all rehabilitated sites	Environmental Officer

Monitoring Element	Comment	Frequency	Responsibility
Water quantity and water balance	Monitoring or measuring of all the water inflows into the mine, reticulation within the mine and the outflows from the mine. This can be achieved by installing automatic flow meters to ensure real time measurements of water.	In operational areas where automatic flow meters are in place, daily records need to be kept	Environmental Officer
Physical structures and Storm Water Management Plan (SWMP) performance	Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions.	Continuous process and yearly formal report	Environmental Officer
	Storm water channels, and existing mine dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance.		

11 Stakeholder Engagement Comments Received

No comments received from stakeholders.

12 Recommendations

The following is recommended to mitigate identified impacts:

- Clearing of vegetation must be limited to the development footprint, and the use of any existing access roads must be prioritised so as to minimise creation of new ones;
- If possible, construction activities must be prioritised to the dry months of the year to limit mobilisation of sediments and hazardous substances from construction vehicles by overland flow during site clearing;
- Vehicles should regularly be maintained as per the mine’s maintenance program they must be inspected daily before use to ensure there are no leakages underneath;
- Drip trays must be used to capture any oil leakages. Servicing of vehicles and machinery should be undertaken at designated hard park areas at the existing mining operations. Any used oil should be disposed of by accredited contractors;
- Implementation of the proposed stormwater management plan is recommended to reduce siltation and sedimentation in watercourses;

- All operational vehicles should be maintained and washed at designated wash bays of the existing NCC operations;
- All mine waste should be handled and disposed of by an accredited vendor;
- The proposed water quality monitoring program should be consistently implemented to ensure adherence to stipulated water quality standards. This will enable early detection and management of any water quality problems arising as a result of mining operations and associated activities;
- The water requirements and demands should be clearly stated and regularly reviewed through water balance updates to ensure water uses and losses are accounted for;
- Soil disturbances during decommissioning should be restricted to the relevant footprint area;
- All decommissioning debris must be cleared as soon as practically possible, and it is recommended that demolition of infrastructure be conducted during the dry season to minimise chances of soil erosion to watercourses;
- Movement of heavy vehicles and machinery must be restricted to existing roads to avoid further disturbance of landscapes thus minimising soil erosion;
- In the event of decanting, passive treatment should be applied to neutralise and treat the AMD before being discharged back into freshwater resources. If passive treatment fails, active treatment by a conventional Water Treatment Plant should be considered; and
- Backfilled, top-soiled areas should be re-profiled and revegetated to allow free drainage that supports desired post-mining land use.
- Minimise spillages of carbonaceous material into the river at the bridge crossing during haulage of coal from the Middeldrift Pit to the existing NCC operations.

13 Reasoned Specialist Opinion

Provided all the recommended mitigation and management measures are implemented, there is no hydrological reason why the NCC project may not proceed.

14 Conclusions

The project area is located within quaternary catchment B11E in the Olifants Water Management Area and has a MAP of 682 mm. The New Clydesdale operations fall within the summer rainfall region of South Africa, where more than 80% of the annual rainfall takes place between the months of October to March. January as the wettest month has a 90th percentile of 192 mm and a 10th percentile of 67 mm. The area experiences a MAE of 1 950 mm, which is much greater than the MAP leading to distinct wet and dry seasons. The MAR was calculated to be 47.6 mm which accounts for about 7% of the MAP for the area. The highest amount of runoff is experienced in the wettest month of January, with the 90th percentile being 35.6 mm and the 10th percentile, 0.6 mm.

Based on the water quality results analysed by SRK Consulting in 2016, none of the water quality determinants monitored exceeded domestic water quality standards systematically, except for TDS and SO_4 over short periods during the dry season. It was concluded that the low flows (implying less volume of water for the same amount of salt load) contribute to the increase in TDS and SO_4 concentrations, and thus are not likely to contribute significantly to the salinity load entering the Olifants River.

The salt loading of the Steenkoolspruit was estimated from discharge and sampled TDS concentrations (B1H021) to be approximately 23 000 tons/annum, whereas the total TDS load likely to leave the opencast mine is estimated as 62 tons/annum, which is less than 0.5% of the current total salt load in the Steenkoolspruit. The salt load discharged into the Steenkoolspruit as a result of mining in the New Clydesdale Mine was considered minimal.

The recent water quality within the Rietspruit upstream and downstream of the proposed Middeldrift opencast pit indicate that most of the analysed parameters are within the Olifants Resource Quality Objectives in which the proposed project site is located. Exceedances were, however, noted for Turbidity, Cl, and Al both upstream and downstream of the project site. Higher turbidity is likely attributed to livestock animals that agitate the water as they drink water from the Rietspruit during grazing. Cl and Al sources likely include sewage and industrial effluents emanating from the Reedstream Park upstream of the New Clydesdale within the Rietspruit catchment and from Kriel and Thubelihle Towns adjacent to the Steenkoolspruit before its confluence with the Rietspruit.

Storm water management with respect to the proposed Middeldrift opencast pit indicates the need for a perimeter berm around the opencast pit, which is considered a dirty catchment. The berm will exclude or divert clean water from the clean water catchment around the pit so that it flows downslope to the Steenkoolspruit. The berm should be constructed to contain runoff depths greater than 1m and to stop a peak-runoff rate of 3.52 m^3/s, on average.

The annual average water balance indicates a total inflow volume into the Middeldrift Opencast pit of 910 267 m^3/annum emanating from rainfall, runoff and groundwater ingress. A dewatering volume of 58 560 m^3/annum is pumped to PCD2 situated at the existing NCC operations, while 88 000 m^3/annum is used for dust suppression. There are no water storages that happen at the Middeldrift Opencast pit site.

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Appendix A: Impact Assessment Methodology

Impact Rating Methodology

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 A-1. The probability consequence matrix for impacts is displayed in Table A-2, with the impact significance rating described in Table A-3.

Table A-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.
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.
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.

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Table A-2: Probability Consequence Matrix for Impacts

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 A-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)