mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Environmental Impact Assessment and Environmental Management Plan For Listed Activities Associated with Operations at Cooke Mining Right Area, Sibanye Gold Limited

DMR Reference Number: GP 30/5/1/2/2 (07) MR

January 2016

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 2008) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 of 2008) AS AMENDED (MPRDA).

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DIGBY WELLS
ENVIRONMENTAL

This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft Environmental Impact Assessment and Environmental Management Programme**
Project Name:	**Listed Activities Associated with Operations at Cooke Mining Right Area, Sibanye Gold Limited**
Project Code:	**GOL2376**

Name	**Responsibility**	**Signature**	**Date**
Khosi Dlamini	Report Writer		November 2015
Marcelle Radyn	Project Manager		January 2015

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IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts: -
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Project Overview

The broader West Rand, including Carletonville in the far west to Randfontein in the northeast and including Westonaria centrally, contains an estimated 1.3 billion tonnes of surface gold and uranium tailings with approximately 170 million pounds of recoverable uranium and 11 million ounces of recoverable gold. SGL, as the current majority owner of these resources, plans to exploit it to develop a strong, long life and high yield surface mining business. Key to the successful execution of this business growth and development strategy is the West Rand Tailings Retreatment Project (WRTRP).

Project Applicant

GFI Mining South Africa (Pty) Limited, (Registration Number 2002/031431/07) was, prior to February 2013, a subsidiary within the Gold Fields Group. In early 2013, Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines in the Free State to create SGL (Registration Number 2002/031431/06) and listed them as a fully independent company on both the JSE and the NYSE Stock Exchanges.

In parallel in 2012, Gold One International Limited (Gold One) acquired Rand Uranium Limited (Rand Uranium) and in the same year acquired the Ezulwini Mining Company (Pty) Ltd (Ezulwini) in an agreement with First Uranium Corporation.

Subsequently, in October 2013, SGL acquired the interest held by Gold One in Rand Uranium and Ezulwini. These Gold One assets are now part of Sibanye Gold, and comprise the Cooke Operations (underground mining and reclamation operations), that currently produce gold and uranium.

Table I: Contact details for SGL

Company name:	Sibanye Gold Limited
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Environmental Consultants

Digby Wells was appointed by SGL as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIA processes. The contact details for Digby Wells are set out in Table II.

Table II: Contact Details for Digby Wells

Company name:	Digby Wells Environmental
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Project History

Prior to the creation of SGL, Gold Fields had embarked on a project known as the West Wits Project (WWP), aimed at retreating Tailings Storage Facilities (TSFs) on the West Rand. Its intention was to recover residual gold, uranium and sulfur through a central processing plant, where viable, and storing the residual tailings on a proposed Centralised TSF (CTSF) near South Deep's existing Doornpoort TSF.

Similarly Rand Uranium had embarked on the Cooke Uranium Project (CUP) which endeavoured to treat the Cooke TSF for gold, uranium and sulfur and ultimately deposit the residual tailings on to the proposed Geluksdal TSF. The CUP and WWP were essentially two independent projects with similar broad objectives, processing infrastructure and deposition sites and within a 25 km radius of each other.

Elements of the CUP and WWP projects have been approved and authorised, as indicated in Table III, although not in their entirety. Stakeholders and departments expressed concern over the implementation of two similar projects in proximity to one another and the accumulation of their impacts. It was proposed that these projects be combined to provide a consolidated solution for the region.

The WRTRP therefore integrates the WWP and CUP into one project, where up to 13 current and historical TSFs and current arising tailings will be centrally processed through a new proposed Central Processing Plant (CPP) and the residue deposited onto a new proposed Regional TSF (RTSF). A Return Water Dam (RWD) will be constructed adjacent to the RSTF to contain any potential water runoff, with the water to be treated at an Advanced Water Treatment Facility (AWTF).

As stated, should one of the elements of the WRTRP not be authorised, the entire project would be unable to proceed. In this case SGL will revert back to the CUP and WWP projects and further pursue the approval of the outstanding applications.

Table III: CUP and WWP Authorisation Status

Authorisation/Application	Cooke Uranium project		West Wits Project	
	Title	**Status**	**Title**	**Status**
Environmental authorisation (under the NEMA)	Environmental Impact Assessment (EIA) For The Proposed Uranium Plant And Cooke Dump Reprocessing Infrastructure	Approved never implemented	Final Environmental Impact Report	Approved never implemented
	Geluksdal TSF and Pipeline EIA & EMPR	Approved never implemented		
Water use licence (under the NWA)	Geluksdal TSF and Pipeline IWULA and IWWMP	Suspended upon further investigation	Integrated Water Use Licence Application Proposed new Centralised Tailings Storage Facility and associated infrastructure	Pending approval
	Geluksdal Pipeline General Authorisation	Approved never implemented		
EMP Amendment (under the MPRDA)	Environmental Impact Assessment (EIA) For The Proposed Uranium Plant And Cooke Dump Reprocessing Infrastructure	Approved never implemented	Amendment: Driefontein, Kloof and South Deep Mine West Wits Project Environmental Management Programmes	Suspended upon further investigation
	Geluksdal TSF and Pipeline EIA & EMPR	Suspended upon further investigation		
Authorisation change request	CoR226 Authorisation Change Request -049	Approved never implemented	Unknown	

Project Description

There is a long history of gold and uranium mining in the broader West Rand area which has resulted in tailings containing in excess of 170 million pounds of uranium and 11 million ounces of gold. SGL, through the unbundling from Gold Fields and the acquisition of Gold One and Ezulwini, currently owns the majority of the tailings in the area and its gold and uranium resources.

The key to capitalising these resources successfully relies on the execution of the WRTRP. The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, environmental studies, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The implementation of the WRTRP will be done in phases to achieve the objectives of the ultimate project. The Ultimate Project and the Initial Implementation are detailed below.

Ultimate Project

SGL's historical TSF holdings in the West Rand can be divided into four Mining Rights: the Cooke, Ezulwini, Kloof and Driefontein Mining Rights. Each of these Mining Rights (other than Ezulwini) contains a number of historical TSFs which will ultimately be reclaimed during the life of the WRTRP:

- Kloof Mining Right area: Kloof 1 TSF, Kloof 2 TSF, Leeudoorn TSF, Libanon TSF, Venterspost North and Venterspost South TSFs. Venterspost North and South TSFs will be processed with the concurrent construction of Module 2 floatation and gold plants of the CPP. The remainder of the TSFs will be processed once Module 3 has been constructed. It must be noted that although the reclamation of Venterspost North and South TSFs are not part of this EIA, the inclusion of the TSFs into the Kloof Mining Right area is part of this EIA and Section 102 amendment submitted to the DMR;
- Driefontein Mining Right area: Driefontein 1, 2, 3, 4 and 5 TSF. Once the Driefontein 3 and 5 TSFs have been reclaimed, the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 TSFs, will be processed through the CPP;
- Cooke Mining Right area: C4S TSF, Cooke TSF and the Millsite Complex (38, 39 and 40/41 and Valley) TSFs. Millsite Complex will be processed with the concurrent construction of Module 2 floatation and gold plants; and
- Ezulwini Mining Right area: No TSFs fall within the Ezulwini Mining Right. Uranium will be processed at the Ezulwini Plant and new pipelines will be constructed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 million tonnes per month (Mt/m) (1 Mt/m from Driefontein 3 TSF, followed sequentially by Driefontein 5 and C4S TSFs and 0.5 Mt/m from Cooke TSF). Reclamation and processing capacity will ultimately ramp up to 4 Mt/m over an anticipated period of 8 years. At the 4 Mt/m tailings retreatment capacity, each of the Mining Right areas will be reclaimed and processed simultaneously.

The ultimate WRTRP involves the construction of a large-scale CPP for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases/modules to treat eventually up to 4 Mt/m of tailings inclusive of current underground arisings. The resultant tailings will be deposited on a TSF with a modern engineering design called the RTSF.

The tailings material will be centrally treated in the CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulfuric acid, an important reagent required for uranium leaching. The CPP footprint will ultimately occupy approximately 75 hectares when fully constructed. The CPP will be developed in phases to treat eventually up to 4 Mt/month of tailings and current underground arisings. The CPP will eventually comprised the following:

- Gold Plants;
- Flotation plants and associated infrastructure;
- Uranium Processing Plants;
- Multiple Roasters and associated infrastructure;
- Acid Plant and associated infrastructure;
- Uranium and sulfide concentrate storage facilities;
- Loading facilities for uranium concentrate; and
- Water storage facilities.

A new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original WWP and CUP (the proposed Geluksdal TSF is associated with the CUP). The “deposition area” on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

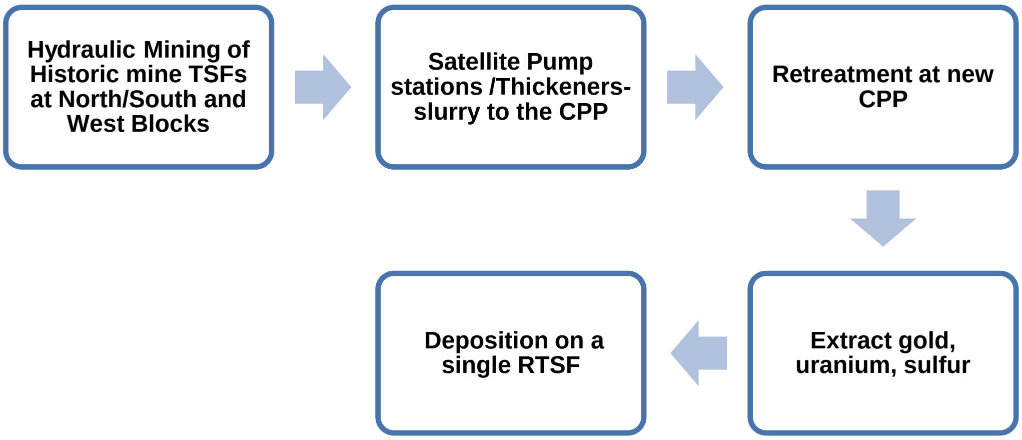

Figure I: Summary of WRTRP

The AWTF will be located adjacent to the RTSF and will treat the return water generated from the RTSF and essentially replace the normal return water systems conventionally adopted with a view to optimising capital and aligning the WRTRP with SGL's overall water management strategy. The AWTF uses three stages to create an overall water recovery of 93% with the solid waste discharged as stable pellets at an approximate water content of only 5%. The water will be treated to potable water standards and discharged into the Leeuspruit, subject to IWUL conditions.

Initial Implementation

To ensure the successful start-up phase, the upfront capital required for the WRTRP will be limited; only essential infrastructure will be developed during Initial Implementation. This entails the design and construction of:

- The hydraulic mining infrastructure at the Driefontein 3 and 5 TSFs, C4S TSF, including slurry and water pump stations;
- Driefontein and Cooke Mining Right area overland inter connecting pipe works and thickeners;
- Process water supply and storage;
- The CPP Module 1 comprising:
  - Gold Plant;
  - Flotation Plant;
  - Uranium Plant,
  - Acid Plant; and
  - A roaster.
- The RTSF, RWD and AWTF.

This first module of the CPP will receive two reclaimed slurry streams and will retreat up to 1.0 Mt/m from the Driefontein 3 and 5 TSFs, C4S TSF in sequence over 11 years. In addition to and concurrently with the Driefontein 3 and 5 and C4S TSFs, up to 0.5 Mt/m of the Cooke TSF will be mined for a period of 16 years. The resultant tailings from the CPP will be deposited onto the first phase of the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50 k tonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.

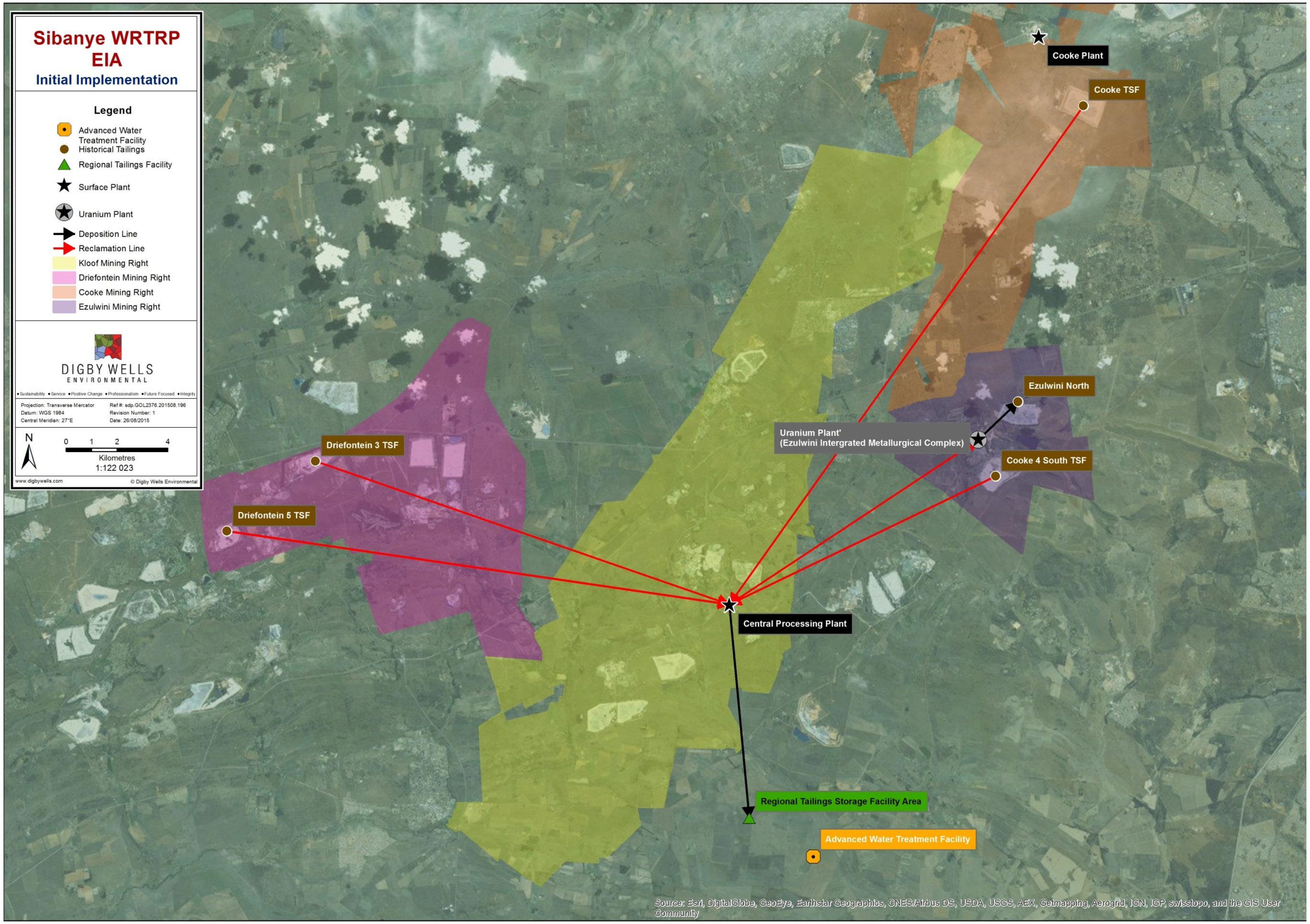

Figure II: Initial Implementation Phase

Cooke Mining Right Area

The focus of this application is the authorisation of those activities associated with the Initial Implementation of the WRTRP that occur within the Cooke Mining Right or are to be included in the Cooke Mining Right. Authorisation for this component of the Initial Implementation phase (Cooke) will require the amendment of the Cooke Mining Right, Mining Work Programme (MWP) and EMP to cover the reclamation of the TSFs from Cooke for processing at the CPP and the deposition of the resultant tailings on the RTSF. The Cooke Mining Right will be amended to include the following activities:

- The inclusion of Cooke 4 South (C4S) TSF into the Cooke Mining Right Area (Currently held under prospecting right GP 307 PR);
- The reclamation of Cooke and C4S TSFs;
- The construction and operation of:
  - The Cooke Thickener;
  - The Cooke Bulk Water Storage Facility (BWSF); and
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The intention of this Scoping Report is, therefore, to identify these activities within the current and expanded Cooke Mining Right area and to understand the potential impacts they may have on the receiving environment as well as determine the necessary studies that must be undertaken to classify and rank these impacts, both positive and negative, during the EIA phase.

This application serves to amend the approved Cooke EMP (2013) under Mining Right GP (07) MR to include the proposed hydraulic mining activities as detailed above.

Project Alternatives

Alternatives for the various aspects of the WRTRP have been assessed during the pre-feasibility of the Project. The alternatives considered includes location, technology and processes of the CPP, RTSF and associated RWD and AWTF, the pipeline dimensions and routes, the location and capacities of the BWSFs, thickeners and reclamation of the TSFs. The alternatives for the above activities have been detailed in the scoping reports for the respective Mining Right areas. This scoping report only details the alternatives considered specifically for the Cooke Mining Right area.

Site Alternatives

The property on which the reclamation activities for the Cooke TSF are proposed to occur is limited to the Cooke Mining Right area. The activities associated with the reclamation activities including the temporary storage and subsequently the thickening of the reclaimed tailings is restricted to the proximity of the Cooke Mining Right area.

The proposed pipeline servitudes for the Cooke TSF activities and the storage facilities have already been authorised, and thus SGL is expected to utilise the existing servitudes.

Additionally, the hydraulic mining activities including the associated thickening and water abstraction for the C4S TSF are limited to occur within proximity of the C4S TSF.

Mining Alternative

The historical TSFs will be reclaimed for processing through the CPP. There are limited alternatives to the reclamation process as the TSFs that will be reprocessed are composed of slimes material rather than courser sand. TSFs composed of sand can be reclaimed using mechanical methods (front end loaders and dump trucks), however this is not efficient when reclaiming slimes material. The TSFs associated with the WRTRP will be reclaimed hydraulically, using high pressure water guns. This process also reduces the potential for dust generation as the material is kept wet and reduces traffic as the slurry is pumped rather than transported by road to the plant.

Cooke Thickener, C4S Thickener and BWSF Site Alternatives

The Cooke Thickener and BWSF have been located adjacent to each other to minimise the required footprints, as well as aiding in the operational and maintenance efficiency during the Operational Phase. The Cooke Thickener and BWSF have been located adjacent to the Cooke TSF. The exact location has not yet been finalised due to the potential presence of dolomitic areas and sink holes. Geotechnical work is underway to identify these risk areas prior to the EIA commencement. The site specific location will be investigated and selected based on potential sensitivities, as well as being sited to avoid depressions and sink holes.

Another thickener is proposed to be constructed north of the C4S TSF to thicken the reclaimed slurry before it is pumped to the CPP for processing. This thickener is proposed to be located north of the C4S TSF along the C4S TSF to the CPP pipeline route.

Pipeline Route Alternatives

The pipeline routes leading from the Cooke Thickener to the CPP and from the Cooke 1 Shaft to the Cooke TSF have been authorised. The pipeline route leading from the Cooke Thickener stretches in a southern direction, across the N12, past the Ezulwini North Dump, around the eastern boundary of the C4S TSF, stretch in a south westerly direction, over the R28, across a river and to the CPP. No alternatives for this have been considered however since the proposed routes have already been approved.

The proposed route from the Cooke TSF to the Cooke Thickener has not been authorised. The pipeline is proposed to run from the western boundary of the Cooke TSF to the existing pipeline route adjacent to the thickener. An alternative to this would entail the pipeline extending from the eastern boundary of the Cooke TSF, around the northern boundary of the Cooke TSF and connecting to the existing pipeline route west of the Cooke TSF. This alternative however proves to be longer and less economically viable as opposed to the first alternative.

Another pipeline is proposed to be constructed from the Cooke 4 shaft to the C4S TSF to transport water abstracted from the shaft for use during the reclamation activities. This pipeline is proposed to be 1.22 km long. This pipeline requires authorisation which is to be applied for as part of this application.

The option of not implementing the activity

There is also the option of not implementing the project, also known as the "No-go option". If the historical TSFs are not reclaimed, potential contamination restricts the possibility of viable alternative land uses. The historical TSFs will remain in situ and their leachates could potentially seep into the surrounding watercourses, thus compromising their quality. Subsequently, the downstream water users would also be affected by this. None of the envisioned benefits as described in Section 7 will come to fruition. These benefits include environmental clean-up, job opportunities, investment into the local and regional economy, treatment of currently impacted water and a reduction in the health impacts posed by the historical TSFs. The potential for Acid Mine Drainage within the area will also increase if the TSFs are not reclaimed.

Public Participation Process

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent.

Taking cognisance of the project's regional locality and complexity, the PPP ensured early information availability and also enabled open dialogue with I&APs in an effort to understand I&APs concerns. Prior to and during the Scoping Phase this was embodied by a combination of focus group and open house meetings undertaken to facilitate the participation from various sectors of society.

The Scoping Reports were made available at seven public libraries throughout the West Rand, as well as on the Digby Wells website, for a period of 30 days from 15 September 2015 to 15 October 2015. In addition, focus group meetings and public meetings were held from 6 October 2015 to 14 October 2015. Comments received from I&APs were recorded and responses provided, as outlined in this EIA and EMP report.

Summary of the Cooke Mining Right Area Environment

The WRTRP area is located in the Upper Vaal WMA 8 within the quaternary catchments C23E, C23J, C23D, C22J and A21D. The Cooke Mining Right area falls within the quaternary catchments C22A and C23D. The C23D quaternary catchment area is 510 km^2 and has an MAR of 9.12 Mm^3. Runoff emanating from this quaternary catchment drains in a south westerly direction into the Wonderfonteinspruit which is the largest river in the quaternary catchment.

Water samples were taken at the surface water resources within the WRTRP area and tested against the Vaal Dam Catchment RWQO. It was noted that the surface water resources have elevated concentrations of nitrate, sulphates, chlorides, ammonia and fluoride. This is an indication of the degree to which the rivers within proximity of the project area have been impacted. The river systems in this area have been highly modified. The modification of these systems is largely attributed to the location of the sources of the associated river systems, which are located within urban and industrial areas and associated impacts to instream and riparian conditions have resulted in the large modification of the systems. It was noted that the Present Ecological Status of the river systems within the project area ranged between Class D and Class E. The monitoring location of the Wonderfonteinspruit directly downstream of the 1 m pipeline is represented by monitoring point C2H080. From the results the SANS drinking water standards for Sulfate had been exceeded, with the measured Sulfate quality being 322 mg/L.

The wetland systems found within the area are mostly valley bottom systems which mostly correlate to the rivers and their tributaries of which a majority are largely modified. These systems are both channelled and unchannelled. The project area is characterised by the valley bottom systems associated with the Wonderfonteinspruit, Leeuspruit, Loopspruit and other tributaries. There are also multiple pan systems occurring at multiple parts in the landscape.

The land type present within the project area is dominated by red, well drained soils (Ab) which potentially occur 90 % per land type. Other common land types found within the project area include shallow stony soils and rocks (Fb) and mixed soils characterised by shallow Mispah soils, wet soils and heavy clay soils (Bb) which potentially occur 59 % per land type. Deep red and shallow stony soils (Ba) are also present on site with an expected occurrence of 47 % per land type.

The Cooke TSF site falls within the Ab7 land type which is dominated by freely draining deep red soils, most likely to be the Hutton soil form. The C4S TSF is situated in the Fb5 land type (Shallow rocky Soils, Mispah). The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Fb5 land type to the Ab7 land type. With regards to land capability, it moves from the Class VI (moderate grazing) to the Class II land capability (intensive cultivation). The Cooke TSF site was noted to be within the Class II land capability (intensive cultivation/arable), while the C4S TSF is situated in the Class VI land capability.

The project area falls within four vegetation types namely: Carltonville Dolomite Grassland; Gauteng Shale Mountain Bushveld; Rand Highveld Grassland and Soweto Highveld Grassland. According to the PRECIS, no Red Data species are expected to occur within the QDS grids for each of the sites: 2627AD; 2627BC and 2627DA. The SSC which are likely to occur on site are recorded in Table 9-23.

A suitable habitat is present within the project area for the occurrence of a number of different species of amphibians. The Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) however is expected on site due to the available habitat. The avifaunal species expected to occur within the project area which fall within the Red data species list and are detailed in Table 9-25.

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Karst topography is characterised by underground drainage systems with sinkholes, dolines and caves.

This geological feature is one of the motivating factors in implementing the proposed project. Many of the historical TSFs are at risk as the potential for sinkholes is high in some areas.

Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger area under consideration here.

Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg. Only one potential stonewalled site has been identified in the routing option for the powerlines on the farm Doornpoort 347 IQ Portion 73. No other archaeological sites have been identified within the development footprint of the proposed infrastructure.

Potential Impacts

The potential impacts, potential mitigation and management measures for the impacts and the significance rating prior to and post mitigation have been provided in the sections within this document per environmental aspect and activity. The potential impacts contained in this report are specific to the activities associated with the Cooke Mining Right area and do not assess all of the activities and impacts, positive and negative, associated with the Ultimate WRTRP. It is important to note the impacts and benefits of the Ultimate WRTRP, as well as the Mining Right specific impacts and benefits; the WRTRP requires each of the Mining Right area infrastructure and activities, should one element of the project not be approved, the entire WRTRP will not proceed.

With Regards to the Ultimate WRTRP, it is important to note that the presence of historical TSFs on the landscape are a permanent source of pollution on the surrounding environment. The TSFs are a source of dust generation which then reduce ambient air quality, as well as impacting on surrounding soils, wetlands and surface water resources due to the mobilised contaminants. In addition, the leaching and seepage of contaminants have significant impacts on the groundwater resources, specifically as the historical TSFs are located on sensitive dolomitic aquifers. The reclamation of these historical TSFs will result in long term positive impacts as the permanent pollution source is removed from the regional landscape, although reclamation activities will result in operational impacts. The operational impacts of the reclamation processes for the Cooke and C4S TSFs will be detailed in the sections which follow.

Activities associated with the RTSF complex and the CPP may also have negative as well as positive impacts on the receiving environment. The RTSF and CPP may be pollution and contamination sources for the surrounding areas, with the AWTF having a positive impact on the surrounding water resources through the treatment of mine affected water. This EIA report associated with the Cooke Mining Right area does not include the activities associated with the RTSF complex and CPP or the AWTF, however it is pertinent to note the potential negative and positive impacts associated with the Ultimate WRTRP, including the reclamation of numerous TSFs throughout the West Rand.

The activities associated with the Cooke Mining Right area, which may result in potential impacts, include the following:

- The reclamation of the Cooke and C4S TSFs;
- The construction and operation of the Cooke Thickener and BWSF; and
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

A summary of the most significant impacts prior to and post implementation of mitigation measures is provided in the table below.

Table IV: Significant Impacts Associated with the WRTRP

Activity	Potential Impact	Aspects Affected	Significance	Significance
Construction Phase				
Site clearing for the construction of pipelines, thickeners and pump stations	Loss of topsoil resource	Soil	Moderate (Negative)	Minor (Negative)
Site clearing for the Construction of Infrastructure	Increase in sedimentation due to exposed surfaces	Surface Water	Minor (Negative)	Negligible (Negative)
Site clearing for the Construction of Infrastructure	Mixing of upstream clean water runoff with dirty water runoff from cleared site areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Moderate (Negative)	Negligible (Negative)
Construction of infrastructures (pipelines, sumps).	Mixing of upstream clean water runoff with dirty water runoff from within infrastructure areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Moderate (Negative)	Minor (Negative)
Employment and Procurement for the construction and operation of the WRTRP.	Local employment and procurement of goods and services, as well as skills development, capacity building and economic development will	Socio-economic	Minor (Positive)	Moderate (Positive)

Activity	Potential Impact	Aspects Affected	Significance	Significance
	have a positive impact. All these impacts will result in a positive contribution to the GDP.			
Employment and procurement for the construction and operation of the WRTRP.	Disruption of movement and mobility for people and livestock.	Socio-economic	Moderate (Negative)	Minor (Negative)
Employment and procurement for the construction and operation of the WRTRP.	Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.	Socio-economic	Minor (Negative)	Minor (Negative)
Operational Phase				
Reclamation of the historical TSFs	Water and habitat quality modification	Aquatics	Moderate (Negative)	▪ Minor (Negative)
Existence, operation and maintenance of the pipeline through the pan wetland, under the N12.	The pipeline containing tailings slurry has the potential to impact the wetlands if an unplanned spill occurs. Disturbance of wetland habitat as the pipeline is an industrial negative impact to wetland integrity is anticipated	Wetlands	Minor (Negative)	Minor (Negative)
Employment and procurement during the operational phase of	Local employment and procurement of goods specific to	Socio-economic	Minor (Positive)	Moderate (Positive)

Activity	Potential Impact	Aspects Affected	Significance	Significance
the WRTRP	the operational phase of the WRTRP.			
Production of gold and uranium	Export of uranium and gold will contribute to South Africa's export earnings and allows the country to earn foreign exchange.	Socio-economic	Moderate (Positive)	N/A
Decommissioning Phase				
Removal of historical TSFs through hydraulic reclamation activities	Impact on groundwater contamination due to re-mining of historical TSFs	Groundwater	Moderate (Positive)	Moderate (Positive)
Removal of pipelines	The removal of the pipeline route will cause a loss of topsoil as a resource as a result of compaction and erosion.	Soil	Minor (Negative)	Negligible (Negative)
Reclamation of the historical TSFs	The removal of the tailings and the reclamation of the land use and land capability	Soil	Moderate (Negative)	Moderate (Positive)
Removal of infrastructure	Water and habitat quality modification	Aquatics	Moderate (Negative)	Negligible (Negative)
Removal of TSF material	Water and habitat quality modification	Aquatics	Moderate (Positive)	N/A
Rehabilitation of infrastructure footprint areas	Restoration of vegetation and habitat types.	Fauna and Flora	Low (Positive)	N/A

Activity	Potential Impact	Aspects Affected	Significance	Significance
Rehabilitation of infrastructure footprint areas	Rehabilitation of infrastructure footprint areas	Fauna and Flora	Moderate (Positive)	N/A
Decommissioning of the mined Cooke and Cooke 4 South TSF footprints.	This may have a positive impact on the surrounding wetlands if rehabilitation occurs as this is removing a current highly significant negative impact to the wetlands. If rehabilitation of the footprint is not done, a negative impact will be realised.	Wetlands	Moderate (Negative)	Moderate (Positive)
Decommissioning of the WRTRP operations	Retrenchments of mine employees will take place as operations close. The local economy will likely be dependent on the WRTRP to an extent which will be impacted once operations cease.	Socio-economic	Moderate (Positive)	Moderate (Positive)
Post-closure Phase				
Rehabilitation of footprint area	Improvement in catchment yield	Surface Water	Moderate (Positive)	Moderate (Positive)

Conclusion and Recommendation

The WRTRP will bring significant socio-economic contributions to the West Rand; the West Rand economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year, with the Westonaria LM unemployment was recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%. The capital investment and contributions to the GDP associated with the WRTRP, along with the potential multiplier effects, are significant over the life of the operation (50 years), which will provide a sustained contribution to the local and national economy. In addition, the reclamation of historical TSFs, which are located on sensitive dolomitic aquifers, will result in positive impacts as permanent pollution sources are removed from the environment. Furthermore, mine affected water being discharged into the environment will be reduced and this water will eventually be treated to potable standards and discharged, having a positive impact on the environment and downstream users.

The WRTRP will also result in negative impacts on the environment, most notably the construction of the proposed RTSF. The development and presence of the RTSF will result in a contamination plume that will impact on groundwater quality. The RTSF will be approximately 1 300 ha in size and, should no mitigation be implemented, the resultant contamination plume will impact an area of approximately 3 600 ha 100 years after closure. The implementation of a liner beneath the RTSF will prevent a contamination plume for sulfate and manganese after 50 years of operation, with the contamination plume 100 years after closure being restricted to the RTSF footprint.

However, the implementation of a liner is likely to result in the WRTRP being financially unfeasible and all of the positive impacts associated with the project will not be realised. SGL proposes to implement a blast curtain which will restrict the contamination plume to an area of approximately 1 600 ha which is 1 900 ha greater than the RTSF footprint. Although the liner is preferred from a groundwater perspective, the implementation of a blast curtain will ensure the project is feasible and the larger positive impacts associated with the WRTRP are realised.

Based on the potential positive impacts associated with the project, the implementation of a blast curtain is considered to be an acceptable mitigation measure should the requirement of a liner result in the project becoming financially unfeasible; the implementation of a blast curtain is more suitable than the project not being undertaken at all.

It must be noted that the Cooke Mining Right activities in isolation require authorisation in conjunction with the activities associated with the remaining Mining Right areas to incorporate the Ultimate WRTRP. Should one application or activity not be authorised, the entire WRTRP will not proceed and the significant positive impacts associated with the project will not be realised.

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Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Digby Wells Environmental (Digby Wells) was appointed by Sibanye Gold Limited (SGL) to conduct the Environmental Impact Assessment (EIA) process, which includes the compilation of an EIA and Scoping Report, for the West Rand Tailing Retreatment Project (WRTRP) in the Gauteng Province, South Africa, as shown in Plan 2.

1.1 Company Background

GFI Mining South Africa (Pty) Limited, Registration Number 2002/031431/07) was, prior to February 2013, a subsidiary within the Gold Fields Group. In early 2013 Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines in the Free State to create a separate entity in SGL and listed SGL as a fully independent company on both the JSE and the NYSE Stock Exchanges.

Subsequently, in October 2013, SGL purchased the interest held by Gold One International Limited (Gold One) in Rand Uranium Limited (Rand Uranium) and Ezulwini Mining Company Limited (Ezulwini). These interests were held through a 74% shareholding in Newshelf 1114 (Pty) Limited (Newshelf), which owns 100% of Rand Uranium and Ezulwini. The purchase consideration was 150 million SGL shares, amounting to a shareholding of about 17% being held by Gold One. The transaction was subject to various conditions, including the approval of the Competition Commission and the approval of the Minister of Mineral Resources. These approvals have been granted and the merger is now unconditional. The Gold One assets which have become part of Sibanye included the Cooke Operations (underground mining and surface reclamation operations) for gold and uranium production, and after completion of the transaction, SGL consolidated all of its and Gold One's operations for the reclamation of tailings to produce gold, uranium and sulphur on the West Rand.

1.2 Project History

The treatment of historical tailings in the West Rand area has a long history with Gold Fields, Rand Uranium, Harmony Gold Mining Company Limited (Harmony), Gold One and SGL completing a number of parallel, independent studies relating to the treatment of these historical tailings.

In late 2009 Gold Fields and Rand Uranium met to evaluate the potential synergy of an integrated flow sheet for the Cooke Uranium Project (Rand Uranium) and the West Wits Tailings Treatment Project (Gold Fields), both of which were nearing feasibility completion. A significant amount of re-engineering and confirmatory test work would have been required to achieve this and, given the momentum of the respective projects, it was agreed that the investment would not be justified at that point in time. After the completion of the respective projects they were put on hold because of economic circumstances at the time.

From 2010 through to 2012, Rand Uranium completed the Cooke Uranium Project (CUP) and the Cooke Optimisation Project (COP) for which various applications were made to the authorities with authorisation on certain aspects being received and others remain pending.

In 2012 Gold One acquired Rand Uranium and in the same year acquired the Ezulwini Mining Company (Pty) Ltd (Ezulwini) in an agreement with First Uranium Corporation. The company, during the same year, completed an application and relevant studies for the Geluksdal TSF Project Geluksdal.

In early 2013 Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines to create Sibanye Gold.

1.3 Project Description

The broader West Rand area[1] contains an estimated 1.3 billion tonnes of surface gold and uranium tailings, with approximately 170 million pounds of recoverable uranium and 11 million ounces of recoverable gold. SGL, as the current majority owner of these resources, plans to exploit them to develop a strong, long life and high yield surface mining business. Key to the successful execution of this development strategy is the WRTRP. The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The ultimate WRTRP or "Ultimate Project" involves the construction of a large-scale Central Processing Plant (CPP) for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases to treat up to eventually 4 Mt/month of tailings inclusive of current underground arisings. The resultant tailings will be deposited on a Tailings Storage Facility (TSF) with a modern engineering design called the Regional TSF (RTSF). The regional and local project settings are indicated on Plan 1and Plan 2.

The Ultimate Project will be implemented in a number phases. Of these phases, phase 1 or the "Initial Implementation", entails the reclamation of certain TSFs as well as the construction and operation of the first phase section of the RTSF, Gold Module 1 of the CPP and the first uranium roaster and acid plants. The Ultimate Project and Initial Implementation are explained in more detail below.

[1] The broader West Rand area includes Carletonville in the far west, Westonaria and Randfontein in the northeast.

Plan 1: Regional Setting

Plan 2: WRTRP Primary Infrastructure Layout

1.3.1 Ultimate Project

Simplistically, SGL's historical TSF holdings in the West Rand can be divided into four Mining Right areas; the Kloof, Driefontein, Cooke and the Ezulwini Mining Right areas, as shown in Plan 4a – Plan 4d. Each of these Mining Right areas (other than Ezulwini) contains a number of historical TSFs as detailed below:

- Kloof Mining Right area: Kloof 1 TSF, Kloof 2 TSF, Leeudoorn TSF, Libanon TSF, Venterspost North and Venterspost South TSFs. Venterspost North and South TSFs will be processed with the concurrent construction of Module 2 float and gold plants. The remainder of the TSFs will be processed once Module 3 of the CPP has been constructed;
- Driefontein Mining Right area: Driefontein 1, 2, 3, 4 and 5 TSF. Once the Driefontein 3 and 5 TSFs have been depleted the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 TSFs, will be processed through the CPP;
- Cooke Mining Right area: Cooke TSF and the Millsite Complex (38, 39 and 40/41 and Valley) TSFs. Millsite Complex will be processed with the concurrent construction of Module 2 float and gold plants; and
- Ezulwini Mining Right area: C4S TSF, which will be processed subsequent to Driefontein 3 and 5 TSFs and in parallel with the Cooke TSF.

Each of the Mining Right areas will be reclaimed in a phased approach (Plan 3). The Driefontein 3 TSF, concurrently with the Cooke TSF will be reclaimed first. Following reclamation of Driefontein 3 TSF, Driefontein 5 TSF and Cooke 4 Dam south (C4S) will be reclaimed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 million tonnes per month (1.5 Mt/m); 1 Mt/m from Driefontein 3 TSF, followed sequentially by Driefontein 5 and C4S TSFs and 0.5 Mt/m from Cooke TSF. Reclamation and processing capacity will ultimately ramp up to 4 Mt/m over an anticipated period of 8 years. At the 4 Mt/m tailings retreatment capacity, each of the Mining right Areas TSFs will be reclaimed and processed simultaneously as well as the underground arisings being accommodated.

The tailings material will be centrally treated in a CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulphuric acid which in turn will be re used in the uranium plant leach section.

To ensure the economic viability of the project the upfront capital required for the WRTRP will be minimised, only essential infrastructure will be developed during initial implementation. Use of existing and available infrastructure may be used to process gold and uranium until the volumetric increase in tonnage necessitates the need to expand the CPP.

The authorisation, construction and operation of a new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original Gold Fields WWP and the Rand Uranium CUP and Geluksdal TSF. The “deposition area” on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF if proved viable will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

SGL has various authorisations and approvals for elements of the WWP and CUP projects, with authorisations and approvals for certain aspects of the respective projects still outstanding. The WRTRP aims to combine the WWP and CUP projects, as per stakeholder concerns and suggestions based on the WWP and CUP projects. Should the WRTRP not proceed, SGL will continue with the CUP and WWP projects for activities that have been authorised, as well as proceeding with the application process for the outstanding authorisations.

Plan 3: Initial Implementation

Plan 4a: Kloof Mining Right Area

Plan 4b: Driefontein Mining Right Area

Plan 4c: Cooke Mining Right Area

Plan 4d: Ezulwini Mining Right Area

1.3.1.1 Water Sources

A number of mine impacted water sources have been identified and from which water can be supplied to the reclamation operations. SGL has recognised that water is a scarce and strategic commodity and hence currently impacted mine water will be used preferentially over Rand Water or other higher quality sources. Water will be supplied to the reclamation areas from the identified sources via pipelines and bulk water storage facilities (BWSF).

Once the impacted mine water, supplemented by recovered water from the various thickeners, has been used in the hydraulic reclamation process, it will find its way to the RTSF as carrier water for the retreated tailings. As process and rain water builds up on the RTSF it will be drained to the RWD and treated through the AWTF.

1.3.1.2 Reclamation of Tailings

The tailings reclamation process is essentially a water hydraulic mining operation, where the TSFs will be hydraulically reclaimed to the natural ground level in nominal 12 – 15 m benches and the foot print rehabilitated to a suitable end land use.

Water will be supplied to the various reclamation sites, from existing impacted mine water sources, and then pressurised through a high pressure pumping system before reporting to the monitoring guns at the top of the historical TSFs. Monitoring guns will be used at the reclamation site mining face to reclaim the tailings material.

The reclaimed material, in the form of slurry, will flow through open channels over screens to remove oversized debris from the slurry before it enters a tank. A series of pumps will then pump the slurry from the tanks via thickeners to the CPP for gold, uranium and sulfur extraction. The historical TSFs proposed for reclamation cover a total of approximately 1 660 ha, as shown in Table 1-1. The RTSF footprint will be approximately 1 350 ha, liberating a nett 310 ha of currently sterilised land.

Table 1-1: Total Area Covered by the TSFs that will be reclaimed over the life of the Ultimate Project

Block	Name	Area (ha)	Block	Name	Area (ha)
Northern Block	Venterspost N TSF	60.68	Western Block	Driefontein 1 TSF	87.15
	Venterspost S TSF	30.51		Driefontein 2 TSF	85.26
	Millsite Complex	315.47		Driefontein 3 TSF	72.76
	Cooke TSF	178.99		Driefontein 4 TSF	165.66
	Total	**585.65**		Driefontein 5 TSF	67.72
Southern Block	Kloof 2 TSF	72.76		Libanon TSF	93.64
	Kloof 1 TSF	86.99		**Total**	**572.19**
	Leeudoorn TSF	186.27			

Block	Name	Area (ha)	Block	Name	Area (ha)
	Ezulwini South	157.99	Potential future TSFs[2]	South shaft and Twin shaft TSFs	107.66
	Total	**504.01**			

1.3.1.3 Pipelines

The overland slurry and water piping required for the project will ultimately consist of approximately 120 km of pipeline (many of which will be parallel and in the same servitude). Existing mine servitudes will be utilised as far as possible for the overland piping. The following pipelines will be required:

- Water supply pipelines (from K10 shaft to the west BWSF, Cooke 1 and 2 water to the Cooke BWSF, Cooke 4 shaft to the south BWSF and from the respective BWSFs to the historical TSFs);
- Slurry pipelines (from the historical TSFs to the West Block Thickener (WBT), North block Thickener (NBT) and Cooke Thickener);
- Thickened slurry pipeline (from the WBT, SBT and Cooke Thickener to the CPP.);
- Uranium and sulfide rich slurry pipeline (from the CPP to Ezulwini);
- Tailings pipeline (from the CPP to the RTSF); and
- Treated water pipeline (from the AWTF to a discharge point on the Leeuspruit).

1.3.1.4 Thickeners

A WBT, NBT and Cooke Thickener will be constructed for the respective Mining Right areas. The thickeners will be used to thicken reclaimed tailings from the TSFs before it is pumped to the CPP for processing. The thickeners provide slurry of consistent density to the CPP, and are critical in the optimisation of the operating of the plant. The thickeners also aid in minimising pumping costs by optimising the amount of water pumped around the circuit.

1.3.1.5 The Central Processing Plant

The anticipated location for the CPP is mid-way between Kloof main and Kloof 4 shaft central to all the resources, water and power supply as well as existing and planned infrastructure (Plan 4a). The CPP will be developed in phases to treat eventually up to 4 Mt/month of historical tailings and current arisings. The CPP will eventually be comprised of:

- Gold Plant Modules (3);
- Float plants and associated infrastructure (one associated with the uranium plants);
- Roasters and associated infrastructure;

[2] The South Shaft and Twin Shaft TSFs will be part of a future application.

- Acid plants and associated infrastructure;
- Uranium processing plants (2);
- Bulk sulfuric acid storage facility;
- Loading facilities for uranium concentrate, bulk sulfuric acid and reagents;
- Bulk Water storage facilities; and
- Pollution control dams.

1.3.1.6 Regional Tailings Storage Facility

This RTSF has been positioned and sized as a facility that can cater for both the tailings generated by the WRTRP as well as other tailings located in the region approximating 1.3 billion tonnes.

During the pre-feasibility study (PFS) Gold Fields CTSF authorised by DEA/GDARD/NEMA and the Gold One Geluksdal TSF were considered for the WRTRP. Following an optimisation exercise requiring an ultimate deposition rate of 4 Mt/m, it was recognised that the CTSF and Geluksdal sites alone and collectively were insufficient to accommodate the desired tonnage profile for the project, both in deposition rates and in tonnage capacity for the proposed RTSF. The optimal location of the RTSF has been positioned between these two facilities, an area that has been extensively studied by the WWP and CUP but requires further investigation (Plan 7). It is likely that the construction of the RTSF will be phased to suit the envisaged tonnage build up. The RTSF will be sized, assessed and permitted on the basis of accommodating the long term requirements for the region and replaces the numerous TSFs scattered throughout the West Rand.

1.3.1.7 Return Water Dam

The design and management of the RTSF Return Water Dam (RWD) will need to be undertaken in line with the requirements of the GN 704 regulations. The RWD has therefore been sized to ensure that it is unlikely to spill into any clean water system more than once in 50 years, given a certain return water and/or water treatment rate.

The ultimate RWD arrangement, which will consist of a series of compartments due to the phased development of the RTSF, will require a total storage capacity of at least 3 million m^3 and is likely to have outer wall heights not exceeding 5m. To limit seepage of process water, the RWD will be lined with a geocomposite liner consisting of a 2mm HDPE geomembrane underlain by a 300 mm thick layer of clayey material won from site. A leakage detection system will also be provided to intercept and identify any leakage.

1.3.1.8 Advanced Water Treatment Facility

The design by Watercare Mining (WCM) consists of a multiple stage softening and membrane separation process. The method of softening uses a Crystalactor® process for softening which reduces the incoming water hardness by the precipitation of calcium pellets.

Through pH control and a feed crystal source of fine quartz sand, precipitation is controlled and creates fine pellets which are highly stable and easy to handle. This effectively combines the softening and clarifying stage in one process. This is followed by GAC (granular activated carbon) and Nano-filtration to remove all solids as well as organic compounds to protect the Reverse osmosis (RO) membranes from damage and fouling. The filtrate from the first stage membranes is below the prescribed quality and the brine is sent to a secondary Crystalactor® for softening again and follows the same processes as described by Stage 1. Three stages are used to create an overall water recovery of 93% with the solid waste discharged as stable pellets at an approximate water content of only 5%. Each stage of RO membrane recovery ranges from 65% to 50%, with each consecutive stage being lower recovery due to the saturation limit as well as the operating pressure being kept as low as possible to conserve energy.

The options for disposal of the pellets is either by creating a slurry that is pumped to the RTSF, or it needs to be collected on a drying bank and collected with a tipper and driven to the RTSF for disposal. The footprint of the proposed plant is approximate area of 3 600 ha and will cater for the scope of the Ultimate Project.

Plan 5: CPP Location

Plan 6: CPP Layout

Plan 7: RTSF Location

1.3.1.9 Mining Rights Concerned

1.3.1.9.1 Cooke Mining Right Area

Rand Uranium holds 2 mining rights (GP 7 MR and GP 173 MR) and two prospecting rights (GP 241 PR and GP 238 PR). These rights relate to the Cooke operations (1, 2 & 3) and Old Randfontein. This, after the prospecting rights have been converted into mining rights, will be referred to as the Cooke Mining Right Area.

1.3.1.9.2 Ezulwini Mining Right Area

Ezulwini holds Cooke 4 under GP 38 MR and a prospecting right (GP 307 PR). These will be known as the Ezulwini Mining Right Area.

1.3.1.9.3 Kloof Mining Right Area

Kloof holds in its own right, GP 66 MR (within which the CPP, RTSF and K10 water supply will from part), and adjacent to it are Venterspost TSFs (North and South) that will be incorporated into the right as part of this application.

1.3.1.9.4 Driefontein Mining Right Area

Driefontein holds mining right GP 51 MR. Currently the Driefontein No 4 TSF lies outside of the MR area and needs to be incorporated through an amendment process in terms of Section 102 of the MPRDA. This is the Driefontein Mining right Area.

Table 1-2: Scheduled Activities of the WRTRP – Ultimate Project provides a summary of the ultimate project and Figure 1-1 shows the geographical extent of the ultimate project.

Table 1-2: Scheduled Activities of the WRTRP – Ultimate Project

Proposed Construction Date*	2016	2018	2020
Operation Date	**2019**	**2021**	**2024**
Activities	▪ Treat Driefontein 3 and 5, C4S TSF (@1Mt/m) and Cooke TSFs at 0.5Mt/m totalling 1.5 Mt/m through Gold Module 1, uranium roaster and acid plants of the new Central Processing Plant (CPP) with deposition onto the Regional Tailings Storage Facility (RTSF). ▪ High grade uranium concentrate (50 kt/m) transported and treated at Ezulwini uranium plant.	▪ Kloof 1 and 2 TSFs and current arisings ▪ Reclaim Leeudoorn and associated Mine Dumps ▪ Potentially South Deep Mine Dumps (future) and current arisings tail will go through CPP (high Uranium) ▪ Reclaim Millsite TSF	▪ Continue to reclaim Millsite TSF (39, 40, 41 and Valley) ▪ Reclaim Venterspost North and South Mine Dumps
Existing infrastructure to be leveraged	▪ Ezulwini Uranium Plant (50 kt/m) to treat concentrate from the CPP		

New infrastructure required	▪ CPP Gold Module I (footprint of full capacity to be authorised now):
	  ▪ Gold Plant I
	  ▪ Sulphide and oxide Floatation Plant
	  ▪ Uranium Plant 1
	  ▪ Acid Plant
	  ▪ Roaster 1
	▪ RTSF (footprint of full capacity to be authorised)
	▪ West Block Thickener (WBT) and bulk water storage
	▪ Pipelines between D3, D5, C4S, Cooke TSF, WBT, CPP and RTSF
		▪ CPP Gold Module II:
		  ▪ Gold Plant II
		  ▪ Pipelines, roads and pumps
		  ▪ Thickener
			▪ CPP Gold Module III:
			  ▪ Gold Plant III
			  ▪ Uranium Plant II
			  ▪ Pipelines, roads and pumps
			  ▪ Thickener

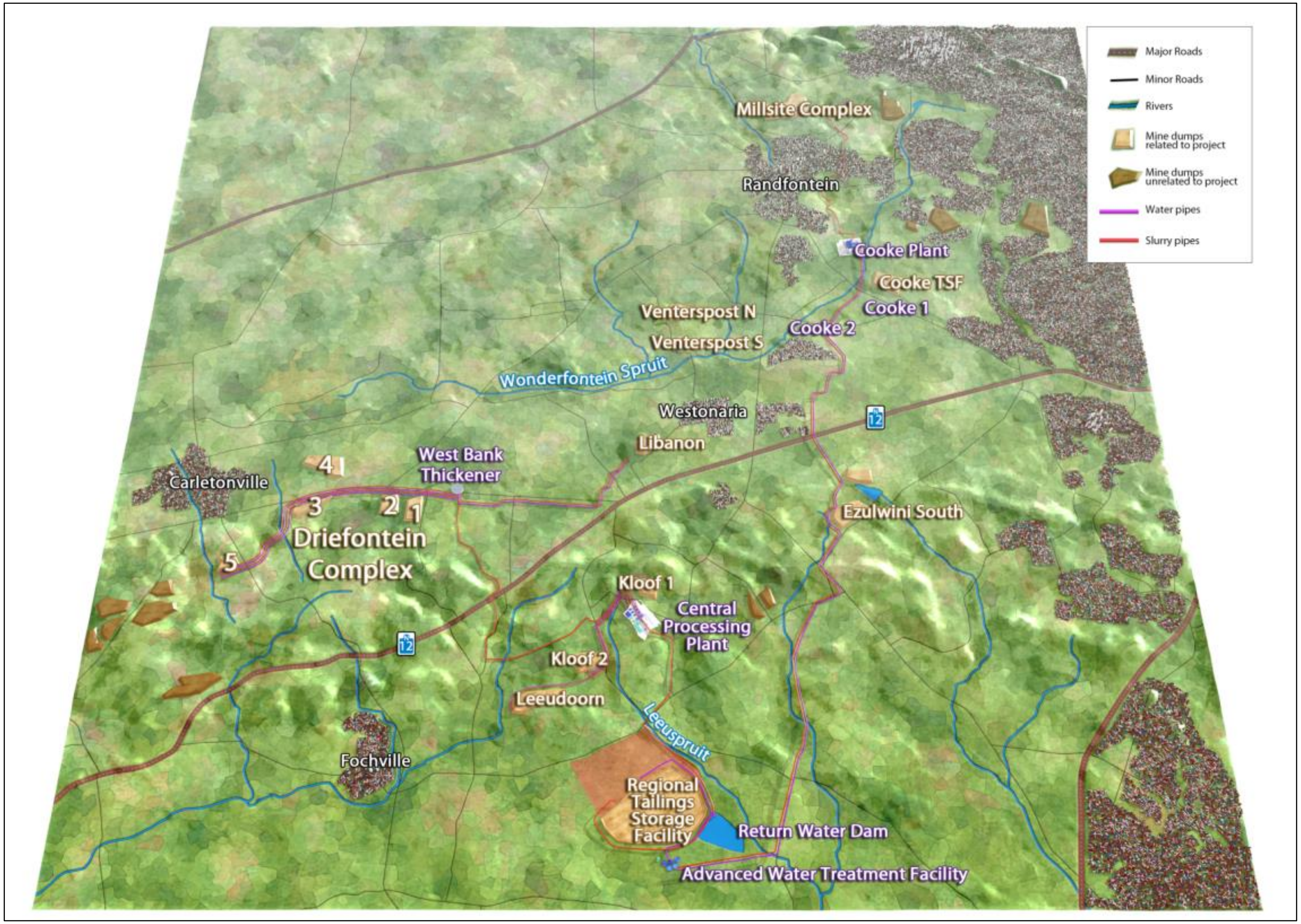

Figure 1-1: Geographical extent of the Ultimate Project - WRTRP

1.3.2 Initial Implementation

Due to commercial imperatives in developing a project of this magnitude, it needs to be implemented over time. The initial investment and development will be focused on those assets that will put the project in a position to partially fund the remaining development.

This entails the design and construction of the initial components of the CPP (gold module, floatation plant, uranium plant, acid plant and a roaster), to retreat up to 1.5 Mt/m concurrently from the Driefontein 3 and 5 TSFs, C4S TSF (1Mt/m) and the Cooke TSF (0.5Mt/m). Driefontein 3, 5 and C4S TSFs will be mined sequentially over 11 years, whilst the Cooke TSF will be mined concurrent to these for a period of 16 years. The resultant tailings will be deposited onto the first stage of the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50k tonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.

Figure 1-2 provides a high-level overview of the process to be undertaken Initial Implementation of the WRTRP whilst Plan 3 provides a visual overview of the project to be implemented in the various phases.

Figure 1-2: Initial Implementation Process Summary

The CPP and RTSF are likely to be the two components of the project with the most significant potential environmental impacts and will be developed as the project progresses. The CPP will be developed over a period of approximately eight years, however this application is for the entire CPP site i.e. Modules I, II and III, Uranium plants, roasters and acid plant. The decision to take this approach, as opposed to authorising it in stages over eight years, is to provide the regulators and the public with an impact assessment that takes the whole project into consideration. The same logic is applied to the RTSF. It will be developed in two phases over the life of the project, however, the entire footprint is assessed from an environmental impact perspective. Thus, the cumulative impacts associated with the Ultimate Project can be assessed, as opposed to activity specific impacts, as well as avoiding incremental decision making by the authorities.

The primary activities to take place during the Initial Implementation of the WRTRP are listed in Table 1-3.

Table 1-3: Primary Activities of the WRTRP Initial Implementation

Category	Activity
Kloof Mining Right area	
Infrastructure	Pipeline Routes (residual tailings).
	Central processing Plant (CPP) incorporating Module 1 float and gold plants and No1 uranium, roaster and acid plants) and Regional Tailings Storage Facility (RTSF).
	RTSF Return Water Dams (RWD) and the Advanced Water Treatment Facility (AWTF) complex.
Processes	Abstraction of water from K10 shaft
	Disposal of the residue from the AWTF.
	Gold, uranium and sulfur extraction at the CPP (tailings to RTSF)
	Water distribution at the AWTF for discharge or sale.
Pumping	Pumping of up to 1.5 Mt/m of tailings to the RTSF.
	Pumping water from the RTSF return water dams to the AWTF.
	Discharging treated water to the Leeuspruit.
	Pumping residue from the AWTF to the RTSF.
Electricity supply	Power supply from Kloof 1 substation to the CPP.
	Power supply from Kloof 4 substation to the RTSF and AWTF.
Driefontein Mining Right area	
Infrastructure	Pipeline Routes (water, slurry and thickened tailings).
	WBT and BWS complex.

Category	Activity
	Collection sumps and pump stations at the Driefontein 3 and 5 TSFs
Processes	Hydraulic reclamation of the TSFs at Dri3 and CD (which include temporary storage of the slurry in a sump).
Pumping	Pumping water from K10 to the BWSF located next to the WBT.
	Pumping water from the BWSF to the Driefontein TSFs that will be reclaimed.(Dri3 & 5 TSFs)
	Pumping slurry from the TSF sump to the WBT (for Driefontein 3 and 5 TSFs).
	Pumping the thickened slurry from the WBT to the CPP (2 pipeline route options).
Electricity supply	Power supply from West Driefontein 6 substation to Driefontein 3 TSF.
	Power supply from West Driefontein Gold substation to Driefontein 5 TSF.
	Power supply from East Driefontein Shaft substation to WBT and BWSF.
Cooke Mining Right area	
Infrastructure	Pipeline Routes (water, slurry and thickened tailings).
	Cooke and NBT thickener.
	Collection sumps and pump stations at the Cooke TSF.
Processes	Abstraction of water Cooke 1 and 2 and Cooke No. 4 shaft
	Hydraulic reclamation of the Cooke TSF (which include temporary storage of the slurry in a sump).
Pumping	Pumping 500 kt/m of tailings from the Cooke Dump to the Cooke thickener.
	Pumping from the Cooke thickener to the CPP via Ezulwini.
Electricity supply	Power supply from the Cooke substation to the Cooke thickener.
	Power supply from the Cooke Plant to the Cooke TSF
Ezulwini Mining Right area	
Infrastructure	Ezulwini floatation plant
Processes	Uranium extraction at Ezulwini (tailings to Ezulwini North Dump).
Pumping	Pumping water from the Pieter write dam to C4S TSF that will be reclaimed
	Pumping tailings from C4S TSF to the
	Pumping slurry from Ezulwini plant to Ezulwini North Dump
Electricity supply	Power supply from Ezulwini plant to the C4S TSF

Table 1-4: Pipeline Route Lengths

Name	Length (m)	Type
DRI3 to WBT	7 665	Slurry Pipeline -dilute
DRI5 to DRI3	6 646	Slurry Pipeline -dilute
WBT to CPP	17 473	Slurry Pipeline -thickened
Cooke TSF to Cooke Thickener	TBC	Slurry Pipeline-dilute
Cooke Thickener to CPP	TBC	Slurry Pipeline-thickened-existing approved route GDARD,NNR
Ezulwini South TSF to CPP	TBC	Slurry Pipeline-thickened
CPP to RTSF	17 908	Tailings Pipeline – thickened (alternate routes)
CPP to Ezulwini	18 502	Tailings Pipeline (Uranium Rich) - dilute
BWSF to DRI3	7 699	Water Pipeline
BWSF to DRI5	14 168	Water Pipeline
K10 to west BWSF	10 477	Water Pipeline
Cooke shafts to Cooke TSF	TBC	Water Pipeline – existing approved route GDARD , NNR
Cooke 4 shaft to C4S TSF	TBC	Water Pipeline
RWD to AWTF	1 960	Water Pipeline
WBT to CPP (Alternative Route)	13 284	Slurry Pipeline (Alternative Route)

Amendments to various MWPs and EMPs will be applied for in due course pending the inclusion of additional TSFs as the WRTRP expands to process 4 Mt/m. The RTSF and CPP will be assessed for the complete footprint to ensure suitability for all future deposition requirements and envisaged process plant requirements in the CPP area. This application, however, deals with the amendment of the Cooke Mining Right to include the Initial Implementation activities occurring within or associated with this right.

1.3.3 Amendment of the Cooke Mining Right

This application and Scoping Report relates to the required environmental authorisations for Initial Implementation relevant to the Cooke Mining Right Area which entails:

- The inclusion of Cooke 4 South (C4S) TSF into the Cooke Mining Right Area (Currently held under prospecting right GP 307 PR);
- The reclamation of Cooke and C4S TSFs; and

- The construction and operation of the Cooke Thickener and BWSF
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The activities associated with the Cooke application are listed in Table 1-5.

Table 1-5: Cooke Activities

Category	Activity
Cooke Mining Right area	
Infrastructure	Pipeline Routes (water, slurry and thickened tailings).
	Cooke thickener.
	Collection sumps and pump stations at the Cooke and C4S TSFs.
Processes	Abstraction of water from Cooke 1 and Cooke 4 shafts
	Hydraulic reclamation of the Cooke and C4S TSFs (which include temporary storage of the slurry in a sump).
Pumping	Pumping 500 kt/m of tailings from the Cooke Dump to the Cooke thickener.
	Pumping from the Cooke thickener to the CPP via Ezulwini.
Electricity supply	Power supply from the Cooke substation at the Cooke Plant to the Cooke thickener.

2 Item 3: Project applicant

SGL has appointed Digby Wells as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA and associated specialist studies for the WRTRP, as well as the required Public Participation Process (PPP).

2.1 Item 3(a)(i): Details of the EAP

Table 2-1 below provides the details of the Environmental Assessment Practitioner (EAP) working on the proposed Project.

Table 2-1: Contact details of the EAP

Name of Practitioner:	Mr Marcelle radyn
Telephone:	+27 11 789 9495
Fax:	+27 11 789 9498
Email:	Marcelle.radyn@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

2.2.1 The qualifications of the EAP

Marcelle completed his BSc at the University of the Witwatersrand. He then completed a BSc (Hons) through the University of South Africa. Refer to Appendix B for proof of these qualifications.

2.2.2 Summary of the EAP's past experience

Marcelle is a Senior Environmental Consultant at Digby Wells within the Environmental Management Services Department. Marcelle has been with Digby Wells since 2012 and has managed many projects within South Africa. During his employment at Digby Wells, Marcelle has been extensively involved in the management of the Environmental Impact Assessment (EIA) process as well as with the compilation of Environmental Management Programmes (EMPr). This includes the completion of the EIA/EMPs for mining related projects in accordance with the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). The projects involved managing the Public Participation Process (PPP), Project Meetings and resource allocation and management. He has also compiled numerous Prospecting Right Applications and Water Use License Applications (WULA). In addition he possesses experience in conducting due diligence investigations and EMP compliance auditing.

Refer to Appendix B for Marcelle's Curriculum Vitae (CV).

3 Item 3(b): Description of the property

The property details relating to the reclamation activities at the Cooke TSF as authorised in the existing mining right (GP 07 MR) are set out in Table 3-1 below where the properties and Surveyor General codes have been detailed too. The Cooke Mining Right area is to be extended to include the farm portions where new infrastructure is to be developed as detailed in Table Table 3-1 below.

Table 3-1: Property Details for Cooke TSF

Farm Name:	Luipaardsvlei 243 IQ, Portion 134.
Application Area (Ha):	273.789
Magisterial District:	City of Johannesburg district municipality – Cooke TSF and beginning of pipeline West Rand District Municipality - Cooke Thickener, and rest of pipeline Pipeline
Distance and direction from nearest town:	The Cooke TSF is located approximately 5 km south east of the town Mohlakeng, 7 km north east of the town Bekkersdal. In terms of the major towns, it is located10 km south east of the town Randfontein and 10 km north west of the town Soweto.
21 digit Surveyor General Code for each farm portion:	T0IQ00000000024300134

Table 3-2: Farms Associated with the Cooke Mining Right Extinction Area

Farm Name	Farm No	Registration Division	Farm Subdivision	SG Code
JACHTFONTEIN	344	IQ	Portion 41	T0IQ00000000034400041
MODDERFONTEIN	345	IQ	Portion 24	T0IQ00000000034500024
WATERPAN 292	292	IQ	Portion 4	T0IQ00000000029200004
WATERPAN 292	292	IQ	Portion 6	T0IQ00000000029200006
WATERPAN 292	292	IQ	Portion 13	T0IQ00000000029200013
RANDFONTEIN	247	IQ	Portion 1	T0IQ00000000024700001
RANDFONTEIN	247	IQ	Portion 1	T0IQ00000000024700001
RANDFONTEIN	247	IQ	Portion 14	T0IQ00000000024700014
RANDFONTEIN	247	IQ	Portion 45	T0IQ00000000024700045
RANDFONTEIN	247	IQ	Portion 185	T0IQ00000000024700185
RANDFONTEIN	247	IQ	Portion 192	T0IQ00000000024700192

Farm Name	Farm No	Registration Division	Farm Subdivision	SG Code
RANDFONTEIN	247	IQ	Portion RE	T0IQ00000000024700000
ELANDSVLEI	249	IQ	Portion 108	T0IQ00000000024900108
WATERVAL	174	IQ	Portion 1	T0IQ00000000017400001
WATERVAL	174	IQ	Portion 17	T0IQ00000000017400017
WATERVAL	174	IQ	Portion RE	T0IQ00000000017400000
WATERVAL	174	IQ	Portion 169	T0IQ00000000017400169
BRICKVALE	161	IQ	Portion RE	T0IQ00000000016100000
RIETFONTEIN	162	IQ	Portion RE	T0IQ00000000016200000
RIETFONTEIN	162	IQ	Portion 6	T0IQ00000000016200006
RIETFONTEIN	162	IQ	Portion 2	T0IQ00000000016200002
RIETFONTEIN	162	IQ	Portion 7	T0IQ00000000016200007

Plan 8: Land Tenure

4 Item 3(c) of Appendix 3: Locality map

The WRTRP ultimate scope is located across the West Rand District Municipality (WRDM) in Gauteng Province. The WRDM includes four local municipalities (LMs): Mogale City, Westonaria, Randfontein and Merafong City. Towns and larger settlements located in the broader project area include Randfontein, Toekomsrus, Fochville, Carletonville, Westonaria, Venterspost, Modderfontein, Rietvallei, Bekkersdal and Mohlakeng.

Although sections of the RTSF pipeline route traverse the Merafong City Local Municipality (LM), the Kloof Mining Right area falls predominantly within the Westonaria City Local Municipality. Land uses in the Westonaria LM can be categorised in three main divisions, i.e. agriculture, mining, and residential. Agriculture is the dominant land use in the LM, followed by mining and residential land uses, with the latter accounting for approximately 8% of the total land area of the LM. The municipality's human settlements are relatively scattered due to the mining activities taking place. The LM's residential development is generally dispersed with the dominant townships including:

- Westonaria;
- Bekkersdal;
- Hillshaven;
- Glenharvie;
- Venterspost;
- Simunye; and
- Mining towns such as Libanon and Waterpan.

The most significant land uses within the project area are mining, agriculture, residential and businesses. Of these, agriculture covers the largest portion of the area, followed by mining and residential uses. The area includes a large number of both historical and existing mining activities.

5 Item 3(d) of Appendix 3: Description of the Scope of the Proposed Overall Activity

The Ultimate Project is detailed in Section 1.3.1, with the required environmental authorisations for the Initial Implementation relevant to envisaged activities pertaining to the Cooke Mining Right Area including the following:

- The inclusion of Cooke 4 South (C4S) TSF into the Cooke Mining Right Area (Currently held under prospecting right GP 307 PR);
- The reclamation of Cooke and C4S TSFs; and
- The construction and operation of the Cooke Thickener and BWSF

- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The activities listed above are described in more detail in Section 0. The listed activities specific to the construction and operation of the CPP and RTSF are included as part of the Kloof Mining Right area application.

5.1 Item 3(d)(i): Listed and specified activities

5.1.1 Environmental Authorisation

The primary authorisation to consider will be an Environmental Authorisation to be granted in accordance with the Environmental Impact Assessment Regulations, 2014 (the EIA 2014 Regulations) promulgated in terms of the provisions of the National Environmental Management Act, 1998, as amended (NEMA). NEMA identifies two classes of activities requiring authorisation, those of a less significant nature requiring evaluation by what is described as a Basic Assessment process (BA), and those with substantial impact with require a more detailed scoping and environmental impact assessment (S&EIA) process. In addition to the EIA 2014 Regulations, the Minister of Environmental Affairs (DEA) has published two notices identifying activities that require a BA process (Listing Notice 1) and a full Environmental Impact Assessment process (Listing Notice 2). The proposed activities should be assessed against the activities listed in the two listing notices to determine what which of the Listed Activities will be triggered. As this project triggers activities under both Listing Notice 1 and 2, a Full EIA process will be undertaken.

The listed and specified activities are set out in Table 5-1 below.

Part 3 of Chapter 4 of the EIA 2014 Regulations sets out the timeframe for applying for and obtaining an Environmental Authorisation (EA). In brief, this requires:

- Compilation of a Scoping Report: within 44 days from date of submission of the application for the EA, a Scoping Report must be submitted to the competent authority;
- Consideration of the Scoping Report by the competent authority: the competent authority must reach a decision on the Scoping Report within 43 days and either accepts it and directs the applicant to proceed with the EIA, or refuse it under defined circumstances;
- Preparation of the EIA: the applicant must prepare a detailed EIA and an Environmental Management Programme (EMPr)in accordance with the Scoping Report and submit it to the competent authority within 106 days after being directed to do so; and
- Decision on the application: the competent authority must reach a decision on the EIA and the EMPr and either grant authorisation or refuse it.

5.1.2 Waste Management

The Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 were published on Friday 24 July 2015 in GN R632 in GG 39020. These Regulations provide the framework for the management of TSFs in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA), in place of the Regulations previously in place in terms of the MPRDA. Although the DMR will remain the competent authority, residue stockpiles and residue deposits will now be governed by the new NEM:WA Regulations.

The implications in brief are as follows:

- The identification and assessment of environmental impacts arising from residue stockpiles and residue deposits must be done as part of the environmental impact assessment;
- The management of residue stockpiles and residue deposits must be in accordance with any conditions and management measures in the EMP and waste management licence;
- A risk analysis based on the identified characteristics and the classification must be used to determine the appropriate mitigation and management measures;
- Residue stockpile and residue deposit must be characterised to identify any potential risk to health, safety and environmental impacts that may be associated with the residue when stockpiled or deposited, in terms of its physical characteristics, chemical characteristics and mineral content; and
- The required pollution control barrier system shall be defined by the National Norms and Standards for the Assessment of Waste for Landfill Disposal and the National Norms and Standards for Disposal of Waste to Landfill.

As far as the design of TSFs is concerned, the Regulations provide that the design must be undertaken by a professional civil or mining engineer, an assessment of the typical soil profile on the site is required for all residue stockpile and residue deposit must be made and the design of a residue stockpile and residue deposit must take into account all phases of the life cycle of the residue stockpile and residue deposit, from construction through to post closure

The List of waste management activities that have, or are likely to have, a detrimental effect on the environment published in GN 921 in GG 37083 of 29 November 2013 have been amended in terms of GN R633 in GG 39020 of 24 July 2015 to include residue deposits and residue stockpiles.

Further details pertinent to the policy and legislative context of this project are set out in Section 6 of this report.

Table 5-1: Project Activities

Listed Activity		Description of Activity	Aerial extent of the Activity
Listing notice GNR 983 (Basic Assessment) (NEMA)			
Activity 9	The development of infrastructure exceeding 1 000 m in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more.	Water is to be pumped from the Cooke 4 Shaft to the C4S TSF to be used for the reclamation process. The pipeline is proposed to be 1.22 km in length with an internal diameter of at least 0.36 m.	3 ha
Activity 11	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	The development of facilities or infrastructure for the transmission and distribution of electricity.	300 ha
Activity 24	The development of – (ii) a road with a reserve wider than 13.5 meters, or where no reserve exists where the road is wider than 8 meters	The development and use of haul roads and access roads. It should be noted however that existing roads will be used as far as possible.	To be investigated as part of the EIA phase
Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	Clearance of land for the construction of the Cooke thickener, C4S thickener and pipelines	3 ha

Listed Activity		Description of Activity	Aerial extent of the Activity
Listing notice GNR 984 (Full Scoping and EIA) (NEMA)			
Activity 21	Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.	Cooke and C4S thickeners will be constructed to thicken the tailings reclaimed from the TSF. This is done to optimise the pumping process	5 ha
Activity 6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions , pollution or effluent	The Cooke TSF and the C4S TSF will be reclaimed as part of the Cooke Mining Right. Cooke and Cooke 4 Thickeners will be constructed together with the BWSF for the completion of the reclamation activities.	179 ha
Activity 17	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	The reclamation activities proposed to occur at the Cooke TSF and the C4S TSF.	184 ha

Listed Activity		Description of Activity	Aerial extent of the Activity
General Activities			
Not Listed	N/A	Reclaimed Tailings will be pumped via a pipeline to the Cooke thickener located west of the Cooke TSF and then pumped to the CPP. Additionally, reclaimed tailings from the C4S TSF will be pumped to the C4S thickener before they are transported to the CPP for processing.	3 ha

5.2 Item 3(d)(ii): Description of the activities to be undertaken

This section describes in detail the envisaged activities to be undertaken and includes (Plan 7):

- The inclusion of Cooke 4 South (C4S) TSF into the Cooke Mining Right Area (Currently held under prospecting right GP 307 PR);
- The reclamation of Cooke and C4S TSFs;
- The construction and operation of the Cooke Thickener and BWSF, and
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

During the construction phase of the project the environmental aspects of land transformation, job creation and spending may need to be investigated further. Land transformation was seen to have an influence on the heritage landscape, land use and biophysical (wetlands and fauna and flora) of the project areas. This applies to all the areas of surface disturbance; pipelines, Cooke Thickener, BWSF and support infrastructure.

The creation of jobs was seen to link to the characterisation of the social environment of the study area and this would need to be studied to identify possible impacts; positive and negative. The capital expenditure as well as the operational costs for the project are linked to the economic analysis of the project.

The activities associated with the construction phase are summarised in Figure 5-1.

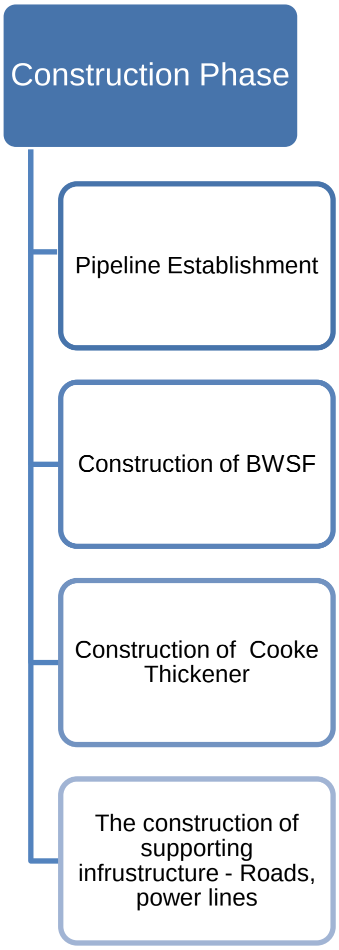

Figure 5-1: Summary of Construction Activities - Cooke

It is during the operational phase that a number of activities, with associated environmental aspects and impacts, will take place. These can be linked to the main project activities as summarised in Figure 5-2.

Note: The extraction of gold at the CPP and deposition of tailings at the RTSF is part of the Kloof Mining Right and EMP and is not included as part of this application.

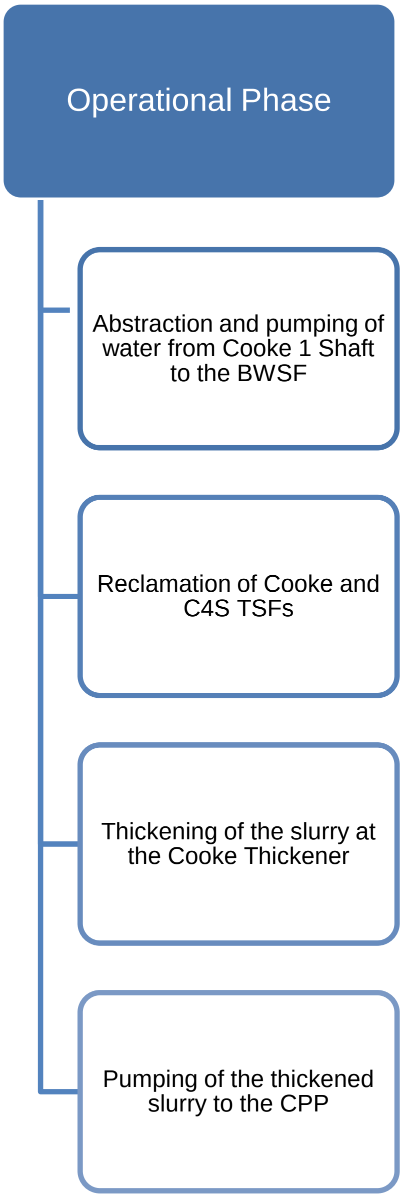

Figure 5-2: Main Activities Associated with the Operational Phase of the Project – Cooke

The project spans several Mining Right areas with pipelines often required to traverse areas where no Mining Right is held. To ensure the liability of project infrastructure is attributed to SGL's Mining Right areas, the following principles were adopted:

- The Mining Right area within which infrastructure is situated will be liable for said infrastructure;
- Where pipelines traverse non-mining areas, the Mining Right area whose activities necessitate the pipeline, will accept liability; and
- The Kloof Mining Right area will be extended to include RTSF complex footprint.

Plan 2 shows the infrastructure and the mining right area liable for it.

5.2.1 Tailings Reclamation

The reclamation of the Cooke TSF will occur over a period of 16 years concurrently with the reclamation of the Driefontein 3, 5, and C4S TSFs. The tailings reclamation process entails a water hydraulic mining operation where the TSF in question will be hydraulically reclaimed to the natural ground level in nominal 12 – 15 m benches. The TSF footprint is to be rehabilitated to a suitable end land use once the reclamation activities have seized.

Water from the existing Cooke 1 shaft will be pumped to the Cooke TSF to be used during the reclamation activities. As part of the process, the water from the Cooke 1 Shaft will be pressurised through a high pressure pumping system before reporting to the monitoring guns at the top of the Cooke TSF. The monitoring guns will be used at the reclamation site to slurry the tailings material. A total of 500 000 t/m of tailings will be reclaimed from the Cooke TSF. The reclaimed material will be in the form of slurry which will flow through open channels to remove oversized debris from the slurry before it enters a tank. The tailings will be transported from the tank via the tailings pipeline to the Cooke Thickener and then once thickened, to the CPP for processing. The discards from this process will be disposed of at the new RTSF.

The C4S TSF will be reclaimed using water from Cooke 4 shaft in the same manner as for the Cooke TSF. Abstracting water from the Cooke 4 shaft will not be included as part of the Cooke Mining Right. However, this will be applied for as part of the Ezulwini application.

5.2.2 Pipeline Route

The pipeline used to transport reclaimed tailings from the Cooke TSF to the CPP will be constructed. Authorisation has already been granted by the Gauteng Department of Agriculture and Rural Development (GDARD) and the National Nuclear Regulator (NNR) approving the route from the Cooke thickener to the CPP. In addition to this, the pipeline construction from the Cooke 2 Shaft to the Cooke TSF has also been authorised by GDARD and the NNR. The route from the Cooke TSF to the thickener however, requires authorisation.

Another pipeline is proposed to be constructed from the Cooke 4 shaft to the C4S TSF to transport water abstracted from the shaft for use during the reclamation activities. This pipeline is proposed to be 1.22 km long. This pipeline requires authorisation which is to be applied for as part of this application.

The various pipeline lengths are provided in Table 1-4 above.

5.2.3 Thickener

A thickener is proposed to be constructed adjacent to the Cooke TSF along the pipeline route. It will be used to thicken the reclaimed tailings from the Cooke TSF before they are transported through to the CPP for processing. Another thickener is proposed to be constructed north of the C4S TSF to thicken the reclaimed slurry before it is pumped to the CPP for processing. This thickener will be located north of the C4S TSF along the C4S TSF to the CPP pipeline route. The thickeners within the SGL Complex will be used to provide the slurry with a consistent density before it reaches the CPP. This is a critical step in ensuring the optimisation of the operation of the plant. The thickener also aids in minimising the pumping costs by optimising the amount of water pumped around the circuit.

5.2.4 Storage

Storage tanks will be used to collect the reclaimed tailings (in the form of slurry) and store them temporarily before they are pumped to the Cooke Thickener. This has already been authorised as part of the Geluksdal project.

5.2.5 Power Supply

It is proposed that power supply will be required for the operation of the Cooke Plant and the pumping of tailings from the Cooke TSF to the Cooke thickener, and from the thickener to the CPP. Power will be generated using the Cooke substation situated at the Cooke Plant.

5.2.6 Water Supply

Water will be collected from the Cooke 2 Shaft and pumped to the Cooke TSF to be used during the reclamation activities. A pump station will be used to pump this water from the Cooke 2 Shaft to the Cooke TSF for the hydraulic mining activities as described. Water used for the reclamation activities at the C4S TSF will be abstracted from the Cooke 4 shaft and transported to the C4S TSF via the 1.22 km pipeline as described above. The abstraction from the Cooke 4 shaft however will not be included as part of this application. A pump station, which is the main C4S reclamation pump station, will be constructed south of the proposed C4S thickener.

The WRTRP has recognised that water is a scarce and strategic commodity and hence mine impacted water will be used preferentially over Rand Water or other higher quality sources. Water will be supplied to the Cooke reclamation area from the Cooke 2 Shaft via water storage facilities.

Once the impacted mine water has been used in the hydraulic reclamation process, it will find its way to the RTSF. As water builds up in the RTSF it will be drained to the Return Water Dam (RWD) and the option to treat it through an advanced water treatment facility will be investigated. The water can then either be treated to potable or discharge standards, depending on the final use. It should be noted however that this will not be included as part of this application.

A plan illustrating the proposed infrastructure and pipelines at the Cooke Mining Right Area is provided as Plan 4c above

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6 Item 3(e): Policy and legislative context

This section aims to provide a description of the policy and legislative context within which the project is being proposed. This section has been divided into national and provincial legislation and policies, plans, guidelines and development planning frameworks and tools.

Table 6-1: Relevant National Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied
The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) Under Section 24 of the Constitution of the Republic of South Africa, it is clearly stated that: *Everyone has the right to (a) an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -* *(i) Prevent pollution and ecological degradation;* *(ii) Promote conservation; and* *(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	An EIA process has been undertaken to determine the impacts associated with the project. As part of the EIA process, mitigation measures and monitoring plans have been recommended (as detailed in this document) to ensure that any potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA) and EIA Regulations (December 2014) The National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution of the Republic of South Africa. 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 Environmental Impact Assessment (EIA) Regulations, Government Notice Regulation (GN) R982 were published on 04 December 2014 and promulgated	The EIA process was undertaken in accordance with the principles of Section 2 of NEMA as well as with the EIA Regulations, promulgated in terms of NEMA. These Listed Notices have been reviewed against the project activities to determine the likely triggers. The listed activities which are potentially triggered under the Listing Notices are provided in Table 5-1. Based on the activities listed, it was identified that a full EIA process is required for the project. An application for the listed activities as detailed in Table 5-1 above has been submitted to the DMR who is the relevant Competent Authority in terms of this application for Environmental Authorisation.

Applicable legislation and guidelines used to compile the report	Reference where applied
on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended.	
GN R. 982 National Environmental Management Act, 1998 (Act No. 107 of 1998): Environmental Impact Assessment Regulations, 2014 These three listing notices set out a list of identified activities which may not commence without an Environmental Authorisation from the relevant Competent Authority through one of the following processes: ▪ Regulation GN R. 983 - Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and which must follow a basic assessment process. ▪ Regulation GN R. 984 – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation and which must follow an environmental impact assessment process. ▪ Regulation GN R. 985 – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies which if undertaken within the stipulated provincial boundaries will require environmental authorisation. The basic assessment process will need to be followed.	Please refer to Table 5-1 above for the listed activities which could potentially be triggered by the proposed project.
National Water Act, 1998 (Act No. 36 of 1998) (NWA) The National Water Act (Act No. 36 of 1998) (NWA) provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.	The IWULA and IWWMP will be compiled and submitted to the Department of Water and Sanitation (DWS) as the decision making authority. The water uses which may be triggered under Section 21 of the NWA in relation to the proposed project are listed below: ▪ S21(c) – Impeding or diverting the flow of water in a watercourse; and ▪ S21(i) – Altering the bed, banks, course or characteristics of a

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>GN R704 National Water Act, 1998 (Act No. 36 of 1998)</u> Regulations 4 and 5 of the regulation on use of water for mining and related activities aimed at the protection of water resources, Government Notice Regulation 704 (GN R No. 704) published in June 1999, states the following: ▪ Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution ▪ Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution. ▪ Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, while Regulation 7 details the requirements necessary for the protection of water resources.	watercourse.
<u>Mineral and Petroleum Resource Development Act, 2002 (Act No. 28 of 2002) (MPRDA)</u> A Mining Right Application submitted to the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Act, 2002 (Act No.28 of 2002) (MPRDA) must be succeeded by various documents including a Scoping Report, EIA Report and an EMP. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.	An EIA process has been undertaken as per the proposed project scope of work to meet the MPRDA requirements. Furthermore, in support of the MRA, a SLP and MWP has been submitted to the DMR with the MRA.
<u>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)</u> The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive	As part of this project, a flora, fauna, wetlands and aquatic assessment have been undertaken to determine the current status of the environment and to determine any potential ecological sensitivities to be avoided and/or mitigated. There are currently no applications submitted in terms of NEM:BA for the

Applicable legislation and guidelines used to compile the report	Reference where applied
species. This Act works in accordance to the framework set under NEMA. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: ▪ Alien and Invasive Species Lists, 2014 published (GN R599 in GG 37886 of 1 August 2014) ; ▪ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; ▪ National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN 1002, 9 December 2011).	project. This will be confirmed during the detailed specialist investigations.
<u>National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA)</u> According to the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) the Department of Environmental Affairs (DEA), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS) (GN R 1210 of 2009). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured.	An Air Quality Assessment has been undertaken to determine the baseline conditions of the air prior to the implementation of the proposed activities at the project site. The project activities will be set out to abide by the NEM: AQA and standards set out in the National Ambient Air Quality Standards. The required measures have been included in this EMPr.
<u>National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)</u> The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Limpopo Provincial Heritage Resources Authority (LIHRA), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	A Notice of Intent to Develop (NID) was submitted, as part of the scoping report, to the Gauteng Provincial Heritage Resources Authority (PHRA-G) and the South African Heritage Resources. Furthermore, a Heritage Impact Assessment (HIA) was undertaken.

Applicable legislation and guidelines used to compile the report	Reference where applied
Environmental Conservation Act, 1989 (ECA), (Act No. 73 of 1989) - National Noise Control Regulations, GN R.154 (10 January 1992) These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. The National Environmental Management: Air Quality Act, 2004 (Act No 39 of 2004) also provides for noise control.	A Noise Impact Assessment was undertaken as part of the EIA process to understand the impacts that the proposed activities to be undertaken at the project site have on the ambient noise environment.

Table 6-2: Relevant Provincial Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied
The Provincial Heritage Resources Authority Gauteng (PHRA-G) The Provincial Heritage Resources Authority Gauteng (PHRA-G) is responsible for the identification, conservation and management of heritage resources throughout the province. The Agency was established in terms of the NHRA.	An HIA was undertaken in respect of these regulations to determine whether a permit will be required as a result of the proposed activities.

7 Item 3(f): Need and desirability of the proposed activities

The objectives of the WRTRP is to reprocess historical TSFs to economically recover gold, uranium and sulfur, while implementing concurrent rehabilitation of their footprints for long term sustainability. By removing the existing historical TSF liabilities located on ecologically sensitive dolomitic structures, sulfur and uranium constituents will reduce significantly and will consequently reduce any future pollution potential and acid mine drainage, as well as eliminate residual cyanide trapped in the historical TSFs. In addition, the reclamation of up to 13 historical and current TSFs throughout the project area and the deposition of the residual tailings on the RTSF will reduce the footprint of mining on the landscape, freeing in excess of 300 ha of land. The following benefits are envisioned as a result of the implementation of the WRTRP:

- During construction, capital investment into the WRTRP will generate a total of R26.48 billion of new business sales that will translate into R9.89 billion in GDP-R, at

2015 prices, as well as creating a total of 54 049 full time equivalent (FTE) man-years. Of these, approximately three quarters will be created through production and consumption induced impacts. Households will earn R4.25 billion (2015 prices) in income over the Initial Implementation construction period (Appendix C);

- The operational phase will span the period between 2018 and 2034, during which the historical TSFs will be reclaimed. This will generate sales to the value in excess of R40 billion at 2015 prices. Through the direct and multiplier effects, the mine will stimulate the creation of new business sales to the value of approximately R72 billion that will translate into R36.8 billion of value added in 2015 prices. On average, R6.5 billion of production output, and associated R4.6 billion of GDP-R will be created on an annual basis (Appendix C). This will in turn create and sustain 53 820 employment opportunities throughout the country, of which 7 683 jobs will be sustained at the mine itself (Appendix C). The total income earned by all households benefiting from the WRTRP operation, directly or through multiplier effects, will be approximately R7 billion in 2015 prices. In addition, operations of the mine will increase export earnings for South Africa and boost government revenue to the value of R5 billion (2015 prices) (Appendix C);
- Protection of sensitive dolomitic aquifers and water resources through:
  - The removal of the historical TSFs, currently located on the dolomites.
  - The deposition of the reclaimed and reprocessed tailings onto the RTSF, which is to be constructed on impermeable bedrock, away from sensitive dolomitic areas.
- Removal of impacts associated with existing historical gold tailings facilities by reducing sulfur and uranium concentrations. The reduction in sulfur concentrations will in turn lower the risk of Acid Mine Drainage (AMD);
- Reduction of health risk to surrounding communities by addressing persistent dust fallout from TSF's spread over a vast area, into a single well-managed best practice designed RTSF;
- Release of valuable land under the historical TSFs for residential, commercial, and agricultural needs. The final land uses of the TSF footprints will be determined based on a Closure Plan for the respective Mining Right areas;
- Treatment of currently impacted water with the proposed AWTF, which could potentially provide potable water for domestic and agricultural users, mitigating existing shortages.

The baseline environment for the project area indicates impacted and modified environments due to the land uses within the landscape, namely mining, agriculture and residential. These land uses have impacted and will continue to impact on the surrounding environment. The respective specialist studies have assessed the continued impacts of the existing land uses on the baseline environment, or the no-go option. The continued impacts on the aquatic habitats and wetlands due to the current land uses are considered to be medium-high to high. Although construction and operational impacts are likely to occur as a result of the WRTRP, there will be long term positive impacts as pollution sources will be removed, impacted wetlands from the CPP and RTSF will be offset, and treated water will be discharged into the Leeuspruit, diluting the poor water quality. The discharge of 15 Mℓ/day of treated water into the Leeuspruit have positive impacts for downstream water uses in terms of both water quality and water quantity.

7.1 Cooke Specific Components

7.1.1 Cooke and C4S Thickeners, the Cooke 2, 3 and 4 Shafts

The Cooke and C4S Thickeners ensure that the tailings reclaimed from the Cooke and C4S TSFs respectively are thickened before they reach the CPP for processing. Thickeners provide a slurry of consistent density to the CPP which in turn is critical in the optimisation of the operating of the plant. The thickeners also aid in minimising pumping costs for SGL by way of optimising the amount of water pumped around the circuit.

The Cooke 2 and 3 shafts will be used to abstract water which is to be used during the proposed reclamation activities at the Cooke TSF. Approximately 4 – 5 ML/day of mine infected water will be abstracted from these shafts and pumped to the Water Storage Facility (WST) located west of the Cooke TSF. Making use of mine infected water prevents SGL from having to utilise Rand Water or any other high quality water sources.

The water abstracted from the Cooke 4 shaft will be used for the reclamation activities proposed to occur at the C4S TSF. Cooke 4 shaft is an existing shaft through which underground mining operations were accessed in the past. Thus, using the mine affected water found in the shaft will prevent SGL from having to utilise Rand Water or any other high quality water sources.

In addition to this, the seeing as the Cooke 4 shaft is located north of the C4S TSF, it is positioned in such a way that the pipeline required to be constructed from the shaft to the C4S TSF would run within the mine infrastructure complex thus reducing the environmental footprint. The water pipeline proposed to transport water from the Cooke 4 Shaft runs adjacent to the tailings pipeline.

The Cooke Thickener, WSF, and Cooke Dump reclamation pump station are all located within proximity of one another. This optimises the construction footprint and also the operational layout.

7.1.2 Reclamation of the Cooke and C4S TSFs

The reclamation of historical TSFs is a fundamental component of the Ultimate Project and Initial Implementation and it is important for the overall success of the WRTRP. The Ultimate Project contains in excess of 170 million pounds of uranium and 11 million ounces of gold that is extractable from the TSFs located throughout the Mining Right areas. The quantities of gold and uranium contained in the TSFs ensure that the reclamation and processing of the TSFs is economically viable.

The Cooke TSF occupies an area of approximately 5 ha and the C4S TSF an area of approximately 157.99 ha. The presence of the TSFs is a pollution source to the receiving environment and surrounding receptors. The generation of dust emissions from the TSFs impacts on the ambient air quality, affecting the receptors within the surrounding communities. In addition, the TSFs are located on sensitive dolomitic aquifers where seepage and contamination plumes from the TSFs are impacting on groundwater resources. Although impacts on the surrounding environment and receptors may increase during the reclamation activities, the complete removal of the TSFs will have a long term positive impact for the region. Once the TSFs have been reclaimed to their entirety, the TSF footprints will be rehabilitated to a suitable end land use.

Plan 2 shows the infrastructure and the mining right area liable for it.

8 Item 3(g): Motivation for the preferred development footprint within the approved site including a full description of the process followed to reach the proposed development footprint within the approved site

8.1 Item 3(g)(i): Details of the development footprint alternatives considered

This section provides the details of the alternatives considered as part of this project. the alternatives considered are with regards to the site layout, the type of activity undertaken, the property on which the activity will occur, the technology to be used in the activity, the operational aspects of the activity and the option of not implementing the activity at all. The site plan can be found in Appendix A of this report.

8.1.1 The property on which or location where it is proposed to undertake the activity

The property on which the reclamation activities for the Cooke TSF are proposed to occur is limited to the Cooke Mining Right area. The activities associated with the reclamation activities including the temporary storage and subsequently the thickening of the reclaimed tailings is restricted to the proximity of the Cooke Mining Right area.

The proposed pipeline servitudes for the Cooke TSF activities and the storage facilities have already been authorised, and thus SGL is expected to utilise the existing servitudes.

8.1.2 The type of activity to be undertaken

The focus of the WRTRP is to reclaim historical TSFs for economic benefits. As part of this process and particularly this application, the Cooke and the C4S TSFs will be reclaimed, therefore no alternative activities have been considered.

8.1.3 The design or layout of the activity

The design and layout of the proposed reclamation activities at the proposed project area are driven by economic and environmental factors.

8.1.3.1 Pipeline Routes

As previously mentioned, the pipeline routes leading from the Cooke Thickener to the CPP and from the Cooke 2 Shaft to the Cooke TSF have been authorised. The pipeline route leading from the Cooke Thickener stretches in a southern direction, across the N12, past the Ezulwini North Dump, around the eastern boundary of the Cooke 4 South TSF, stretch in a south westerly direction, over the R28, across a river and to the CPP. No alternatives for this have been considered however since the proposed routes have already been approved.

The proposed route from the Cooke TSF to the Cooke Thickener has not been authorised. The pipeline is proposed to run from the western boundary of the Cooke TSF to the existing pipeline route adjacent to the thickener. An alternative to this would entail the pipeline extending from the eastern boundary of the Cooke TSF, around the northern boundary of the Cooke TSF and connecting to the existing pipeline route west of the Cooke TSF. This alternative however proves to be longer and less economically viable as opposed to the first alternative.

A pipeline is proposed to be constructed from the Cooke 4 shaft to the C4S TSF located approximately 900 m south of the Cooke 4 shaft. The pipeline route meanders in a southern direction towards the C4S TSF and totals a length of 1.22 km.

8.1.3.2 Cooke and Cooke 4 South Thickener

Considering the fact that the pipeline route stretching from the Cooke Thickener to the CPP has already been approved by the GDARD, it is economically viable to construct the Cooke thickener along the existing pipeline route. This is to prevent having to submit another application for environmental authorisation for the construction of a pipeline at a different route assuming the Cooke Thickener was constructed away from the existing pipeline servitude.

The C4S thickener is proposed to be constructed north of the C4S TSF which is in proximity to the entire reclamation related infrastructure such as the C4S main reclamation pump station and the pipelines. This in turn concentrates the impacts into one area and reduces the environmental footprint. No alternatives were considered for this.

8.1.4 The operational aspects of the activity

There is no alternative operational aspect of this activity. The Cooke TSF and the C4S TSF can only be reclaimed via hydraulic mining activities.

8.1.5 The option of not implementing the activity

The option of not implementing the proposed activity, also known as the "No-go option" refers to the Cooke and C4S TSFs not being reclaimed through hydraulic mining activities. If these TSFs were to not be reclaimed as part of the WRTRP, the potential contamination from the historical TSFs restricts the possibility of viable alternative land uses. The TSFs would remain in their present locations and leachates emanating from them could potentially seep into the adjacent watercourses (Mooriverloop, west of the Cooke TSF) thus compromising the water quality. Subsequently, the downstream water users would also be affected by this. None of the envisioned benefits (described in Section 7) will come to fruition, such as. environmental clean-up, job opportunities, investment into the local and regional economy, treatment of currently impacted water and a reduction in the health impacts posed by the historical TSFs. The potential for Acid Mine Drainage within the area would also increase as a result of the activity not being implemented.

8.2 Item 3(g)(ii): Details of the public participation process followed

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent. This section provides an overview of the PPP undertaken and full details thereof are included in the Public Participation (PP) Report under Appendix D.

8.2.1 Stakeholder Identification

To ensure a proper representation of all stakeholders, the following identification methods were utilised to develop a comprehensive stakeholder database:

- Conduct Windeed searches for farm portions in and around the project site to verify land ownership and obtain contact details;
- Use of existing stakeholder databases available from SGL, Digby Wells and Gold Fields;
- Desktop and online research; and
- Stakeholder networking and discussions to source additional stakeholder details.

Stakeholders identified who are effected by or interested in the proposed project were grouped into the following broad categories:

- **Government:** National, Provincial, District and Local Authorities;

- **Parastatals:** Various semi-Government entities;
- **Landowners:** Directly or indirectly affected and adjacent;
- **Land occupiers:** Directly or indirectly affected and adjacent;
- **Communities:** Directly affected and adjacent communities;
- **Agriculture:** Farmers associations;
- **Non-Governmental Organisations (NGOs):** Environmental organisations, community-based organisations; and
- **Business and industry:** small to medium enterprises, mines, industrial and large business organisations.

A detailed description of the various stakeholder categories are provided in further detail in the Public Participation Report and a full list of stakeholders is categorised and included in the stakeholder database.

8.2.1.1 Directly Affected Landowners

The following directly affected landowners have been identified, as per Table 8-1.

Table 8-1: Landowners and Properties Directly Affected

Farm	Portion	Registered Landowner
GEMSBOKFONTEIN 290 IQ	5	Rand Uranium (Sibanye Gold)
GEMSBOKFONTEIN 290 IQ	6	Rand Uranium (Sibanye Gold)
GOEDGEDACHT 27 (or Panvalkte 291) IQ	RE	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	2	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	3	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	5	Mr Sylvester Tshilwane - Department of Public Works
LUIDPAARDSVLEI 243 IQ	8	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	31	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	33	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	34	Provincial Government of Gauteng

Farm	Portion	Registered Landowner
LUIDPAARDSVLEI 243 IQ	46	Hermanus Antonie Conradie
LUIDPAARDSVLEI 243 IQ	58	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	59	Arch Import & ExportX CC
LUIDPAARDSVLEI 243 IQ	64	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	126	Rand Uranium (Sibanye Gold)
LUIDPAARDSVLEI 243 IQ	127	Zacharias Johannes Van Greuning
LUIDPAARDSVLEI 243 IQ	134	Randfontein Estates Gold Mining Co Witwatersrand Ltd
LUIDPAARDSVLEI 243 IQ	RE	Du Toit Ebenhaezer-Administrators/Rand Uranium
WATERPAN 292 IQ	9	Mr Sylvester Tshilwane - Department of Public Works

The Cooke Mining Right area will be extended to include the C4S TSF. The directly affected farms and their landowners are detailed in the Table below.

Table 8-2: Directly Affected Landowners and Properties of the Extended Cooke Mining Right area

Farm	Portion	Registered Landowner
Jachtfontein 344 IQ	2	LI Tongming
Jachtfontein 344 IQ	41	Rand Uranium (Sibanye Gold)
Modderfontein 345 IQ	24	Rand Uranium (Sibanye Gold)
Waterpan 292 IQ	4	Rand Uranium (Sibanye Gold)
Waterpan 292 IQ	6	Rand Uranium (Sibanye Gold)
Waterpan 292 IQ	13	Rand Uranium (Sibanye Gold)
Waterpan 292 IQ	24	Rand Uranium (Sibanye Gold)

8.2.1.2 Adjacent Landowners

The various adjacent landowners for the project are reflected in Table 8-3 below.

Table 8-3: Landowners and Properties Indirectly Affected

Farm	Portion	Registered Landowner
Luipaardsvlei 243-IQ	RE	Du Toit Ebenhaezer-Administrator/Rand Uranium
Luipaardsvlei 243-IQ	8	Rand Uranium (Sibanye Gold)
Luipaardsvlei 243-IQ	39	Charles Katz
Luipaardsvlei 243-IQ	40	MV Ngcobela Family Trust
Luipaardsvlei 243-IQ	41	Rand Uranium (Sibanye Gold)
Luipaardsvlei 243-IQ	42	Rand Uranium (Sibanye Gold)
Luipaardsvlei 243-IQ	43	Rand Uranium (Sibanye Gold)
Luipaardsvlei 243-IQ	45	Rand Uranium (Sibanye Gold)
Zuurbult 240-IQ	RE	Republic of South Africa
Luipaardsvlei 243-IQ	88	Rand Uranium (Sibanye Gold)
Luipaardsvlei 243-IQ	90	Nicolas Johannes Erasmus Coetzee
Luipaardsvlei 243-IQ	121	Jan Harm Du Plessis
Luipaardsvlei 243-IQ	133	Jan Harm Du Plessis
Luipaardsvlei 243-IQ	44	Portion 4 of the Farm Luipaardsvlei CC

8.2.1.3 Authorities

As indicated in Table 8-4, various authorities are listed who have been engaged during the pre-application phase.

Table 8-4: Authorities Engaged

Authority	Representative
Department of Water Affairs and Sanitation (DWS)	Marius Keet Acting Provincial Head
	Bashan Govender Water Quality Manager
Department of Mineral Resources (DMR)	Dimakatso Ledwaba Acting Regional Manager
	Jimmy Sekgale Assistant Director
	Rudzani Mabogo Assistant Director
	Moleseng Tlaila Assistant Director
Gauteng Department of Agriculture and Rural Development (GDARD)	Jacob Legadima Director - Air Quality Management
	Dan Motaung Deputy Director: EIA
National Department of Environmental Affairs (DEA)	Lucas Mahlangu Deputy Director: Licensing Systems Management
National Nuclear Regulator (NNR)	Patle Mohajane Manager: Naturally Occurring Radioactive Material(NORM)
West Rand District Municipality	Musa Zwane Environment and Green Manager
	Suzan Stoffberg Environmental Specialist

8.2.2 Land Claimants

A formal enquiry, which contained all the directly and indirectly affected land portions, was submitted via letter to Ms Rachel Masango of the Gauteng Department of Rural Development and Land Reform, Land Claims Commission, on Friday, 13 February 2015. Feedback was received by means of letter on Friday, 13 March 2015 which indicated that no existing land claims reside over the direct affected and adjacent land portions.

8.2.3 Pre-Consultation with interested and Affected Parties

A summary of consultation activities is provided in Table 8-5 and provides an overview of the various consultation methods already undertaken as part of the pre-application phase. Consultation with stakeholders was focussed toward one-on-one meetings and focus group meetings with authorities, landowners and NGOs.

Consultation prior to the application submission was aimed at providing stakeholders with an overview of the WRTRP. This was driven by SGL, with support from Digby Wells. One-on-one and focus group meetings were held along with telephonic discussions with invited stakeholders that could not attend. Engagement with the authorities also aimed to obtain an understanding of the regulatory requirements in lieu of the changes promulgated in December 2014. Table 8-5 details activities that formed part of the pre-application phase.

Stakeholders were provided with project information as part of the engagement process which were distributed via email, post and hand delivery or presented at stakeholder meetings. An overview of each are detailed below.

- Positioning document;
- Various notification letters;
- Information pack comprising of a project description document and Invitation letter with registration and comment form and agenda;
- Illustrative Maps;
- Animation showing the reclamation process; and
- Various PowerPoint presentations.

Table 8-5: Summary of PP Activities during the Pre-Application Phase

Activity	Details	Reference in PP Report
	Pre-Application Phase	
Identification of stakeholders	Stakeholders, with associated details, were identified by means of Windeed searches, available existing information, stakeholder networking, site visits, and research for the compilation of a database.	**Appendix D** Stakeholder database.
Identification of land claims	A request to identify potential land claims over affected land portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Feedback indicated there are land claims on the following properties associated with the Kloof Mining Right area: Gemspost 288 Ptn 19, Doornfontein 522 Ptn 15 and Kalbasfontein 365 Ptn 4. A response on some of the properties is still outstanding.	**Appendix D** Land claims letters.
Development of information materials	Various material pieces were developed to be used as part of stakeholder meetings and for ad-hoc requests to provide project details.	**Appendix D** Pre-application information materials.

Activity	Details	Reference in PP Report

Stakeholder meetings	Meetings with stakeholders were arranged as one-on-one meetings and focus group meetings. These are listed below:
	▪ One-on-one Authorities Meetings:
	  ▪ Department of Water and Sanitation – 2 and 11 December 2014;
	  ▪ National Nuclear Regulator – 2 December 2014;
	  ▪ Department of Environmental Affairs – 2 December 2014;
	  ▪ Gauteng Department of Agriculture and Rural Development – 3 and 11 December 2014 ;
	  ▪ West Rand District Municipality – 3 December 2014;
	  ▪ Department of Mineral Resources – 10 December 2014; and
	  ▪ Section 80 Committee, West Rand District Municipality (Environmental Portfolio) – 3 February 2015 & 15 April 2015
	▪ Focus Group Meeting with Authorities – 16 April 2015;
	▪ Focus Group Meeting with Landowners – 16 April 2015; and
	▪ Focus Group Meeting with Environmental NGOs – 21 April 2015 .
	A high level overview of the full project was mainly discussed and stakeholder inputs captured. All stakeholder comments have been responded to in the CRR.
		Appendix D
		Comment and Response Report.

8.2.4 Consultation during the Scoping Phase

The aim of consultation during the Scoping Phase was centred on the formal EIA process, proposed specialist impact studies and addressing stakeholder comments already submitted. The Scoping Report was made available for review for a period of 30 days and a combination of Focus Group and Open House meetings were prominent methods to facilitate stakeholder dialogue between the project team and landowners, authorities, NGOs and communities.

The updated Scoping Reports were made available to stakeholders on the Digby Wells website and in public places for a 21 day comment period and notification was distributed to inform stakeholders of its availability. Stakeholders had the opportunity to verify that their comments were captured and also to review responses provided by the project team.

The various PP materials used during the Scoping phase have been included as appendices.

- Background Information Document;
- Newspaper advertisements;
- Site notices;
- Letter with Registration and Comment Form; and
- PowerPoint presentation and poster set.

Table 8-6 details PP activities that will be undertaken as part of the Scoping Phase have been detailed.

Table 8-6: Summary of PP Activities during the Scoping Phase

Activity	Details	Reference in PP Report
Scoping Phase		
Update of stakeholder information	The stakeholder database has been updated with new I&APs who formally register, attend stakeholder meetings or submit comments.	**Appendix D** Stakeholder database.
Distribution announcement materials	A BID, announcement letter with registration and comment form was email and posted to stakeholders on *Tuesday, 1 September 2015*. *An SMS to announce the project was sent to the full database on Tuesday, 1 September 2015.* The Background Information Document was also available on (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/) *Tuesday, 1 September 2015.* The announcement letter also included information of the stakeholder meetings that will be held, where the Scoping Reports will be available for comment and the allowed public comment period.	**Appendix D** BID, letter with registration and comment form.
Placing of advertisements	Advertisements were placed in the following newspapers: ▪ Randfontein Herald (Local Newspaper), Friday 11 September 2015; ▪ Carletonville Herald (Local Newspaper), Thursday, 3 September 2015; and ▪ Roodepoort Record (Local Newspaper), Friday, 4 September 2015.	**Appendix D** Advertisement.
Placing of site notices	Site notices were put up at various places within proposed project site, local libraries and publically accessible venues within close proximity of the project area on *Tuesday, 1 September 2015 – Thursday, 3 September 2015.* These places are: ▪ City of Johannesburg Metropolitan Library;	**Appendix D** Site notice map and placement report.

Activity	Details	Reference in PP Report
Scoping Phase		
	▪ Randfontein Public Library; ▪ Westonaria Public Library; ▪ Toekomsrus Public Library; ▪ Fochville Public Library; ▪ Carletonville Public Library; and ▪ Bekkersdal Public Library. A site notice placement report and map has been developed, indicating the exact locations where site notices were placed, with photos and GPS coordinates.	
Identification of land claims	A request to identify potential land claims over affected land portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Feedback indicated there are land claims on the following properties associated with the Kloof Mining Right area: Gemspost 288 Ptn 19, Doornfontein 522 Ptn 15 and Kalbasfontein 365 Ptn 4. A response on some of the properties is still outstanding.	**Appendix D** Land claims letters.
Announcement of the Scoping Reports	The announcement letter was emailed and posted to the full database on *1 September 2015* to: ▪ Announce availability of the Scoping Reports; ▪ Share information of the Open House meetings; ▪ Where the Scoping Reports will be available for comment; and ▪ Public comment period. The public comment was extended and announcement was done by means of a letter emailed and posted to stakeholders on 15 October 2015. *SMSs to notify stakeholders that the Scoping Reports are available for comment and about the public comment period extension was sent to the full*	**Appendix D** Letter to announce availability of Scoping Report

Activity	Details	Reference in PP Report
Scoping Phase		
	database. The Scoping Reports was available on the Digby Wells website: (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/). *(Public comment period: 15 September to 15 October 2015, extended to 6 November 2015)*	
Placement of Scoping Reports	The Scoping Reports have been made available to stakeholders at the following public places: ▪ City of Johannesburg Metropolitan Library ▪ Randfontein Public Library ▪ Westonaria Public Library ▪ Toekomsrus Public Library ▪ Fochville Public Library ▪ Carletonville Public Library ▪ Bekkersdal Public Library The Scoping Reports were available on the Digby Wells website (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/) and was available at the various stakeholder meetings. *(Public comment period: 15 September to 15 October 2015, extended to 6 November 2015)*	**Appendix D** Placement map.
Focus Group Meetings	The following Focus Group meetings were held during October and November 2015: ▪ Authorities' site visit to key areas of the project was held on Tuesday, 6 October 2015 from 09:00 – 11:00. All the officials met at Lido Sand	**Appendix D** Comment and Response Report. **Appendix D**

Activity	Details	Reference in PP Report
Scoping Phase		
	Works Conference venue and were accompanied from there by SGL and Digby Wells. A route and infrastructure map was also provided. The following authorities attended: DMR, DWS, NNR, WRDM and WLM); ▪ The site visit was followed by the formal Focus Group Meeting from 12:00 – 14:00 at the same venue; ▪ A Focus Group Meeting was held with landowners (occupiers and private) on Tuesday, 6 October from 16:00 – 19:00 at Lido Sand Works Conference venue; ▪ A Focus Group Meeting was held with NGOs and some very technical stakeholders on Tuesday, 13 October 2015 from 10:00 – 12:00 at Oaklands Inn, Randburg; and ▪ A smaller Focus Group with specific landowners (as per their request) close to the Doornpoort farm on 4 November 2015. This meeting was accompanied by SGL, Digby Wells and SLR (consulting engineers).	PowerPoint Presentation.
Open House Meetings	Two Open House meetings were held with communities and all stakeholders scheduled between 15:00 – 19:00 on the following dates and venues: ▪ Wednesday, 7 October 2015: Westonaria Banquet Hall; and ▪ Thursday, 8 October 2015: Carletonville Community Hall.	**Appendix D** Comment and Response Report.
Announcement of the updated Scoping Reports	Announcement letter of availability of the updated Scoping Reports was emailed and posted to the full database on Tuesday 17 November 2015. *An SMS to notify stakeholders that the updated Scoping Reports are available for comment was sent to the full database on Tuesday, 17 November 2015.* These reports were available on (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/).	**Appendix D** Announcement Letter.

Activity	Details	Reference in PP Report
Scoping Phase		
	(Public comment period: 17 November to 15 December 2015)	
Placement of updated Scoping Reports	The updated Scoping Reports include the amended CRR, which contains new stakeholder comments and responses, and the inclusion of new PP activities undertaken as part of the Scoping phase. The updated Scoping Reports were available on the Digby Wells website (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment -project).	N/A
Focus Group Meetings	It is anticipated that various Focus Group Meetings will be held. Stakeholders will be informed of the various meetings via email and telephonic discussions. Additional methods of informing stakeholders of the meetings will be considered and implemented.	**Appendix D** Comment and Response Report
Open House Meetings	Two Open House Meetings will be held with all stakeholders, and specifically so communities, scheduled between 15:00 – 18:00 as follow: ▪ Wednesday, 17 February 2016: Westonaria Banquet Hall; and ▪ Thursday, 18 February 2016: Carletonville Community Hall.	**Appendix D** Comment and Response Report
Obtaining comments from stakeholders	Comments, issues and suggestions received from stakeholders will be captured into the Comment and Response Report.	**Appendix D** Comment and Response Report

8.2.5 Consultation during the Impact Assessment Phase

It is anticipated that the PP process to be implemented for the Impact Assessment phase will be similar to the process commenced for the Scoping phase. The premise of activities is to ensure that the various legislative requirements for PP are met and that a single, integrated process is followed. This will limit stakeholder fatigue and ensure that stakeholders are presented with a single view of the full project and EIA information.

8.3 Item 3(g)(iii): Summary of issues raised by I&APs

This section provides a summary of the I&AP comments that have arisen from the PPP thus far. The CRR summary is provided in Table 8-7 to Table 8-9.

Table 8-7: Interested and Affected Parties

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Landowners, Lawful occupier/s of the land, Landowners or lawful occupiers on adjacent properties					
Nicci Simpson *Landowner*	Yes	25 March 2015, 17 April 2015	It is requested that more effort be made to inform landowners for the attendance of stakeholder meetings, specifically previously disadvantaged farmers. The Public Participation process must also be managed in a more transparent manner.	A fair amount of landowners have already been identified either interested in or affected by the proposed project, and since the formal EIA process is only aimed to start in September 2015, we are continuing our efforts to identify more landowners by means of various channels. Also, adverts will be placed as part of the formal EIA process. Please feel free to provide details of specific landowners you would want us to include as part of the process.	Not yet finalised and under investigation
Peet Bornman, Jaco Taute *Landowners*	Yes	16 April 2015	When the west wind blows the whole area is white with dust and trucks do not always water for dust suppression. Breathing in the dust causes health issues.	With dedicated mitigation measure in place, dust emission will be reduced drastically, hence lowering exposure to repairable fractions that result in health problems-this material is likely sourced from the historical dams which are planned to be removed. The newly planned RTSF will be concurrently rehabilitated.	Not yet finalised and under investigation
Piet Rheeder, Armand de Villiers *Landowners*	Yes	16 April 2015	Pollution of groundwater and surface sources, specifically the Leeuspruit, is a concern. This will also disturb the water balance of our water.	Any water discharged into the Leeuspruit, will be treated to SANS 241 drinking standards and will enhance the quality therein. These guidelines are very stringent, so therefore, any water discharged will be of a benefit as it will serve to promote dilution, of the current water quality of the Leeuspruit.	Not yet finalised and under investigation
Peet Bornman, Piet Rheeder *Landowners*	Yes	16 April 2015	The Regional Tailings Storage Facility (RTSF) will have a negative impact on surrounding area, specifically from a visual point of view.	A Visual Impact Assessment was undertaken and assesses the significance of the visual impacts to the surrounding landscape. Mitigation measures have been provided in the EMP to mitigate such visual impacts. Please refer to the photomontages in Section 9.4 of the Topography and Visual Impact Assessment Report for an illustration of the potential future views of the RTSF and other project infrastructure.	Not yet finalised and under investigation
Dre Schalekamp, Nicci Simpson *Landowners*	Yes	16 April 2015	Why pollute new agricultural land? Other Tailings Storage Facilities (TSFs) can be used. Sibanye need to do what is good for the community.	This project is attempting to combine the proposed Geluksdal and West Wits project TSFs into a single deposition site based on request made by the community and the DMR. The historic dumps are not designed to today's best practice standards. Their size	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				limits the deposition rates and tonnage storage required to retreat these dumps economically. They do not have adequate pollution prevention measures in place and are a source of pollution to the groundwater aquifers of the dolomites.	
Armand de Villiers *Landowner*	Yes	16 April 2015	Will mined areas be rehabilitated and if so, what are the timelines?	The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years. The final end-land use of these re-mined areas will be dependent on several factors and engagement with all stakeholders is imperative to assist in determining the end-land use and also site specific conditions. The timeframe associated with the rehabilitation of these areas is dependent on several factors, such as the rate of reclamation and current market demands.	Not yet finalised and under investigation
Coetsee Badenhorst, Alf Rudman *Landowners*	Yes	16 April 2015	How will compensation be managed for the project, since no agreements have been put in place yet?	The specialist studies are not directly involved in decisions around the actual buy-out of farms which have to be considered at the appropriate timelines as the project unfolds and meets social, commercial and environmental imperatives.	Not yet finalised and under investigation
Barry van Wyk, Peet Bornman *Landowners*	Yes	16 April 2015	Cattle's meat will be contaminated as a result of the project and people have been very ill as a result of drinking contaminated water.	The impact assessment phase has evaluated the current groundwater quality at various farm boreholes. Representative boreholes were collected for water quality evaluation and the laboratory result is available for anyone interested. The potential impact during and after the mine operation have also been predicted. Please refer to the groundwater EIA report for details.	Not yet finalised and under investigation
Sarel Cilliers, Barry van Wyk *Landowners*	Yes	16 April 2015	We are not in support of the proposed project and object to it strongly. Promises are being made and nothing is delivered. Our environment and lives are destroyed because of the mines.	Thank you for the comment. The legislative process will allow all stakeholders to raise their grievances.	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Hermann Heunis *Landowner*	Yes	4 September 2015	The National Water Act stipulates that water pollution should be avoided by all possible reasonable humane methods. Assessments done in the past show that this principle cannot be guaranteed.	All developments impact water to some degree however the EIA regulations read with the National Water Act provide for the assessment of those impacts and necessary mitigations and then the regulator can make a balanced and informed decision about the project.	
Dre Schalekamp *Landowner* Thabang Frans Ramogodi *Senwes LTD*	Yes	15 October 2015, 6 November 2015	The affected land is being used to produce maize and this land will be next to the TSF.	The SIA and Economic Impact Assessment (EIA) addresses the impact on land uses from the perspective of (a) increased access to land following the retreatment of tailings, and (b) alternative end-land uses post mine closure (see also Section 11.6 and Section 11.10 of the SIA, as well as the EIA specialist study	
Jacobus van Wyk *Landowner* Mr & Mrs Rudman *Landowners*	Yes	6 October 2015, 12 October 2015	My farm's water will be contaminated. There will also be air pollution due to the dust and we will inhale the dust. There will also be an visual impact and our property prices will drop.	The Groundwater Impact Assessment has modelled the potential contamination plume and draw down impacts associated with the RTSF and blast curtain. In addition, an Air Quality Impact Assessment modelled potential dust fallout, PM2.5 and PM10 emissions. Please refer to Sections 8.3 and 9.2 of the Topography and Visual Impact Assessment Report. The viewshed areas of the CPP and RTSF were split into categories expected to experience different levels of visual exposure. These categories are as follows. CPP: 0 - 1.5 km Potential High Visual Exposure, 1.5 - 3 km Potential Moderate Visual Exposure and 3 - 4 km Potential Low Visual Exposure. RTSF: 0 -5 km Potentially High Visual Exposure, 5 - 9 km Potentially Moderate Visual Exposure and 9 - 12 km Potentially Low Visual Exposure. Plans 13, 15 and 16 of the Topography and Visual Impact Assessment Report indicate the practical viewshed models of the CPP, RTSF and Kloof MRA. The above impacts have also been detailed in the EIA report, with the mitigation measures provided.	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Kriszanne Lehman *Landowner* F.R.J de Bruyn *Landowner* Jean Coetzer & Maria Coetzer *Landowner*	Yes	28 September 2015, November 2015	The pollution will affect my and my family's health negatively.	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Alida Potgieter *Landowner* Sarel Cilliers *Landowner* Andre Burger *Landowner* Dorothy de Bruyn *Landowner*	Yes	6 October 2015, 1 & 6 November 2015	As land value is impacted by surrounding mine dams, land should be bought out entirely at a competitive rate to ensure owner can replace farm somewhere else without financial loss.	The purchasing of properties is dependent on various aspects, one of which is SGL receiving a licence to operate. Should the project proceed, the acquisition of properties will take place on case-by-case basis if applicable.	
Paul da Cruz *Landowner*	Yes	13 October 2015	The proposed pipeline will also negatively affect the current and future value of my property thereby having a financial impact on the investment I have made in the property and improving it.	The impact of the infrastructure proposed on individual land value will have to be assessed once the necessary environmental and company approvals for the project are obtained.	
Dr J.A Olivier *Landowner*	Yes	4 November 2015	There needs to be a balance between the economics and impact an environment for this project; there needs to be a compromise between the stakeholders involved.	SGL concurs.	
Nicci Simpson *Landowner* Dr J.A Olivier *Landowner* Alf Rudman *Landowner*	Yes	6 October 2015, 4 November 2015	Why can't the RTSF be built more north of the Doornpoort TSF?	The West Wits project EIA provided a site selection process and Gold Fields also submitted an application for another TSF. DMR said what a single TSF must be developed for the area. The proposed TSF will need to accommodate 4 million tonnes of tailings per month. The proposed Gold Fields TSF could only accommodate 2,75 million tonnes of tailings per month and West Wits 0,75 million tonnes of tailings per month - this was established through the 2 EIA studies undertaken. If was identified that the preferred area for the RTSF falls between the West Wits area and Gold	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				Fields area, but unfortunately 2 separate sites can't be used for the RTSF.	
H.N Thorold, Adriaan and Lanet and Susan and Jaco Taute, Victor Siqongana, Pulane Malebo, Shanique Marais, Patricia August *Landowners / Occupiers*	Yes	5 November 2015	Do not build the dump and the plant.	Under the constitution a developer has the right to put forward any project proposal for regulatory approval and which meet legislative requirements.	
H.N Thorold, Adriaan and Lanet and Susan and Jaco Taute, Victor Siqongana, Pulane Malebo, Shanique Marais, Patricia August *Landowners / Occupiers*	Yes	5 November 2015	The impacts can be managed by keeping existing plant at Waterpan or Westonaria.	This is the most suitable area for the RTSF in terms of greatest final capacity and the rate of deposition required. Two independent site selection processes looked at a 50 km radius of the district and both homed into this area.	
Kimberly Gietzmann *Landowner*	Yes	6 November 2015	Increase of theft because mines do not control access to their properties and do not give advanced notice.	Your comment is noted. Safety and security concerns are endemic to the region and the country, and needs a collective and collaborative approach to root out.	
Pierre Ludick on behalf of Dr J.A Olivier *Landowner*	Yes	15 December 2015	My communication refers: As I am in contention to the proposed dump of Sibanye to be placed in Kalbasfontein, I am therefore insisting on the services of an independent specialist to be despatched to assist the community, and where I am instructing that the services of this specialist environmentalist to be paid for by Sibanye, as it is Sibanye who is wanting to place the dump in our area that we do not want. It is unacceptable to me that the community should be expected to be paying for such services and where it is insisted upon that all studies be reinitiated, with nothing being carried over from the Geluksdal project, but to begin afresh. Your immediate and urgent response is required.	With regard to your request that we consider the appointment an independent consultant at our own expense, we point out that if payment is made to such a consultant, he could not be regarded as any more independent than our existing consultants who are currently lending us advice. Regrettably, therefore, we are unable to accede to your request.	
Municipal councillor					

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Clr Vincent Mfazi *West Rand District Municipality, Section 80 Committee*	Yes	3 February 2015	The reclamation process uses water, but Acid Mine Drainage (AMD) is a concern and will be used as part of the process.	Government funds with regard to AMD are largely targeted at legacy or abandoned areas. The WRTRP will use impacted water from current operations No inter connected mine activities exist between the western and far western basins.	Not yet finalised and under investigation
Clr Roy Harris *West Rand District Municipality, Section 80 Committee*	Yes	3 February 2015	Is this similar to what is done by Mintails? Radioactivity is a concern because it remains well after reclamation and rehabilitation took place. The rehabilitated land might not be suitable for agriculture because it remains radioactive.	Similar to what is done at DRD Gold. Final rehabilitation of the reclaimed TSF footprint has to achieve standards set by the NNR for end land use Working with specialists to cut into surface and take out radioactive material to understand feasibility at this stage.	
Clr Vincent Mfazi *West Rand District Municipality, Section 80 Committee*	Yes	3 December 2014, 15 April 2015	The clay structure will collapse during the reclamation process and new chemical structures will be formed which can be harmful to people and the environment. How will the particulates be prevented from floating into the air once the clay structure is destroyed?	The reclamation is a waterborne process. The slurry will be processed through a number of chemical processes before going to the RTSF. The resultant tailings will undergo a very specific geochemical analysis as part of the specialist impact studies to ensure that the chemical components of the process is understood in detail once the elements in the tailings are exposed to the various processes. The specialists addressing the geochemical analysis and doing the design of the RTSF are highly specialized. Collection of samples from a composite and individual sample of the TSFs to be treated and analysis thereof after metallurgical test work has been done over the last six months in order to understand all the elements including the clay structures. Air quality modelling will be used and integrated with the geochemical findings in order to prescribe mitigation measures to be included in the EMP.	Not yet finalised and under investigation
Municipality					
Susan Stoffberg *West Rand District Municipality,*	Yes	3 December 2014	What are the potential land uses that can be considered? This will assist the West Rand District Municipality for future development and associated planning.	The post closure land uses of the TSFs that will be mined will be based on inputs from various sectors of local society - ongoing interaction with the relevant Section 80 committees will assist in integrating planning.	Not yet finalised and under investigation
Olivia Calderia	Yes	15 April 2015	There are a lot of health issues because of the amount	Dust and PM_{10} monitoring is in place already to assess	Not yet finalised and

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
West Rand District Municipality, Section 80 Committee			of dust and this is an issue/concern. A lot of watering will need to be done.	current scenario and future impacts associated with those pollutants. A dispersion model will be run during the EIA phase, after which mitigation measures will be recommended to curtail potential impacts. Mitigation measures will be put in place to curtail dust i.e. concurrent covering and vegetation of tailings slopes, application of dust suppressants on mine dirt road – water, dust-a-side etc. Suitable quality water will be available.	under investigation
Tokky Mosolo *Westonaria Local Municipality*	Yes	16 April 2015	Ad hoc projects for community development originating from other mining houses in the area are underway and a consolidated Social and Labour Plan (SLP) for the area and the project should be developed (incorporating other mining houses in the area).	The SLPs must be tied to a mining right issued by the DMR.SGL is attempting to consolidate these as the legislation requires them to be separate.	Not yet finalised and under investigation
Joyce Kethwa *Westonaria Municipality*	Yes	2 October 2015	There will be a lot of dust and people will contract diseases like cholera and TB. Also we will have a lot of earth tremors where maybe houses will be affected e.g. cracks and broken windows.	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Charles Stevens *West Rand District Municipality*	Yes	6 October 2015	What are the closure objectives and what will be the land use be used for? This must be determined at the planning phase. Also, what is the future use of the RTSF considering post-closure?	The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years.	
Organisations of state (Responsible for Infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.)					
Will be consulted during the Scoping and EIA phases.					
Communities					
Lucas Misapitso *Interested Community Member*	Yes	21 April 2015	Some of the communities are irresponsible and uses AMD water to irrigate crops and are also using sludge to manufacture bricks. It is a huge problem and a	The DMR Regional Strategy was considered during the compilation of the rehabilitation report and the plan compiled is aligned with these objectives. This will	Not yet finalised and under investigation

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
			health risk. Communities need to be educated and mitigation measures put in place.	ensure that all the proposed mitigation measures are implemented accurately to minimize any residual impacts. The reclamation process will ensure controlled exposure of the material to air and water and contained within the existing foot print of the TSF.	
Lucas Misapitso *Interested Community Member*	Yes	21 April 2015	Which mitigation strategies will Sibanye use to reduce the radiation levels? The Westrand already has high level of radiation.	The remaining footprint after reclamation is the biggest challenge, but the needed closure and rehabilitation plans will be developed in collaboration with the relevant competent authorities. This will also include end land use which will be considered as part of the social studies to be undertaken. One of the reasons the project is being undertaken is to remove the latent radiation found in these tailings facilities. This will reduce the risk and exposure for communities. NNR approvals for the project require assessments to be done for workers and public in and around the TSFs to be reclaimed.	Not yet finalised and under investigation
Ezekiel Khunou *Bekkersdal Care for the Aged* Tefo Hlasa *Batho Pele Community Development Centre* Sylvia Maguma *Sizabantu HBC*	Yes	25 September 2015, 7 October 2015	The project might impact me in terms of health. The dust can have negative impact to the community especially our elderly whom their immune system is vulnerable to many for opportunistic diseases.	Thank you for your comment. One of the key objectives of the ultimate project is to re-mine and thus physically remove the tailings dams as sources of potential dust pollution. Any potential impacts resulting from the hydraulic re-mining and construction processes, will be investigated during the EIA process, and if needed, appropriate mitigation measures will be put in place to mitigate these impacts.	
Bongani Jonas *MACU*	Yes	28 September 2015	During such reclamation processes at dams near informal dwellers, they are automatically affected or infected from the acid mining drainage e.g. cattle drink water from a polluted dam.	Surface and groundwater specialist studies have been undertaken to determine environmental impacts and the results thereof, together with mitigation measures, are available to the public and stakeholders.	
Siphiwe Radebe *SANCO*	Yes	7 October 2015	When demolishing the old TSFs, dust will be a concern for nearby communities, because there will be chemicals used. Are any mitigation measure put in place for that?	The reclamation of TSFs uses only water and dust doesn't get created as part of the process. No chemicals are included.	
Moatlhodi Molefe *Wira Coordinator*	Yes	7 October 2015	There is exclusion and not sufficient communication which leads to the community not being informed properly.	The Public Participation process provides opportunity to communities to partake in the process in order to gain a better understanding of the project and EIA	

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
				process. No stakeholders are excluded from the process and can partake freely.	
Thabsile Vilakazi *Batho Pele Community Development Centre* Sibusiso Khumalo *SANCO* Makhotso Lekopa *Ward Committee secretary ward 18*	Yes	7 & 8 October 2015	What is the benefit for the community?	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	
Ebrahim Dithagiso *Hillshaven Homeowners Association* Sibongile Doreen Kati *Twelve Star Co-operative* Siphiwe Radebe *SANCO*	Yes	27 September 2015, 6 & 7 October-2015	First it will affect us because the project will change the nature of this place the dust will affect the community which will cause people to be ill and easily affected by TB.	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Tebogo Makolwane *SANCO* Londi Tembe *Poortjie Community*	Yes	7 & 8 October 2015	It will impact me positive if I would be a beneficiary from the project, even though it might also leave after effects in terms on health and environmental due to air pollution, which might affect my community.	Thank you for your comment. The SIA makes recommendations to maximise project benefits for affected communities. The SLP will also commit to implement community projects based on the priorities of the municipality. See also Section 11.5 and 11.8 of the SIA.	
Norman Ngqaqu *Merafong Disability Forum* Clement Mokoma *Ward 18 Ward Committee BEE*	Yes	8 October 2015	Why are the Councilors not here?	The various Councilors were invited, but it is understood that they are on recess and not able to attend.	
Clement Mokoma *Ward 18 Ward Committee BEE*	Yes	8 October 2015	How/what will the communities benefit out of this proposed project in terms of jobs?	Approximately 2000 jobs opportunities will be available during the construction phase and approximately 500	

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
Annah Tshoagong *Aganang Centre* Tebogo Makolwane *SANCO*				permanent positions thereafter.	
Mosimanegape Mathiba *Matre-Faith Trading and Projects*	Yes	18 November 2015	The polluted air and water affects people, animals, farmers and plants.	Model predictions show that impacts are minimal and within compliance. Please refer to the relevant specialist' studies and sections in the draft EIA Report.	
Busisiwa Ronose *Westonaria Concerned Residents*	Yes	14 December 2015	The tailings dam must concentrate accordingly in order to avoid the contaminants that have been disposed in the tailings dam from affecting the environment.	Mitigation measures have been provided in the EIA report for the operation of the RTSF to mitigate and prevent potential impacts to the surrounding environment. Water runoff, seepage and contamination plumes and erosion of tailings material through wind have all been identified as potential to result in environmental impacts. The mitigation measures are provided in the EIA report.	
Traditional Leaders					
No traditional leaders are involved in the project.					
Department of Land Affairs					
Nomvuzo Mjadu *Department of Agriculture, Forestry and Fisheries*	Yes	15 December 2015	The pipeline routes traverse watercourses and there will be 25 watercourses crossing:- • Are there no any other routes away from the 25 rivers, to mitigate the chances of spillage or pipeline bursts and leakages into the watercourses?		
Department of Environmental Affairs					
Lucas Mahlangu *Department of Environmental Affairs*	Yes	2 December 2014	For listed activities it needs to be ensured that the correct department or level is consulted.	Noted - however we understand that at the present these interactions will be channelled through the DMR.	Not yet finalised and under investigation
Majalele Pholudi *Department of Environmental Affairs*	Yes	16 April 2015	Environmental liability is important; who will be held responsible?	A closure costing estimate was undertaken as part of the EIA process and will be approved by the DMR and it will be Sibanye Gold's responsibility to provide sufficient funds to undertake rehabilitation prior to approval of the project.	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Other Competent Authorities Affected					
Victor Nkuna, Portia Chawane, Bashan Govender *Department of Water and Sanitation*	Yes	2, 11 December 2014, 4 June 2015	How will water use be managed or treated and where will water be sourced from used for reclamation?	The removal of historic dumps on dolomite as part of the tailings reclamation is expected to improve the water quality by removing the sources of contamination. The geochemistry of the proposed RTSF has been conducted and the seepage rate has been calculated. Appropriate monitoring and management plans will be implemented at each site that is being reclaimed.	Not yet finalised and under investigation
Patle Mahonjane *National Nuclear Regulator*	Yes	2 December 2014	A radiation protection function needs to be integrated as part of the EIA and associated processes.	The EIA process as well as a public and worker assessment is required to be carried out for approval of the NNR which will require monitoring and reporting. Sibanye have a dedicated radiation protection team that will work on the WRTRP.	Not yet finalised and under investigation
Mwinsa Mpundu *National Nuclear Regulator* Rina Taviv, Christopher Rakuambo *Gauteng Department of Agriculture and Rural Development*	Yes	2, 3 December 2014	Are there other options for the project? For example decentralised plants, rather expanding the existing ones e.g. Geluksdal Central Tailings Storage Facility (CTSF)?	The technical viability of the processes to be employed for gold, uranium and sulphur are the result of extensive metallurgical test work, based on this outcome the position of all the components of the necessary infrastructure are then subjected to alternatives in terms of location and are presented for scrutiny as part of the EIA process.	Not yet finalised and under investigation
Moleseng Tlaka *Department of Mineral Resources*	Yes	10 December 2014	Will the RTSF be able to accommodate all the tailings facilities in the area and will it be jointly owned by Sibanye Gold and Gold Fields?	The RTSF will be able to accommodate SGL and other TSFs in the area to a total of 1.3 billion tonnes.	Not yet finalised and under investigation
Bashan Govender *Department of Water and Sanitation*	Yes	11 December 2014	The Department of Water and Sanitation look to address issues coming from underground/surface water AMD experienced currently.	The water management will be integrated with the technology and recovery will be the focus for the area. Water migrating to groundwater resources will be reduced and it is aimed to close shafts and mines where required. For the WRTRP the use of Rand Water will be replaced with treatment of existing water resources to be used as part of the reclamation process. It is also envisaged that municipality(s) will be assisted with the management of their water.	Not yet finalised and under investigation
Dan Motaung *Gauteng Department of*	Yes	11 December 2014, 4 June 2015	Concern is that the new area is in a rural setting used for farming and this will be removing agricultural land in	The historical TSF sites will be removed, making previously unusable land available. The potential	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Agriculture and Rural Development Marius Keet *Department of Water and Sanitation*			Gauteng.	impact of the RTSF on the surface and groundwater has been evaluated and mitigations methods have been proposed. With the implementation of the proposed mitigations techniques, the impact can be reduced to minimum. Please refer to the Surface and Groundwater reports for details.	
Bashan Govender *Department of Water and Sanitation* Rudzani Mabogo *Department of Mineral Resources*	Yes	11 December 2014, 16 April 2015	Close consideration must be given to the liner option or rather how to go about securing that water does not leak into the underground water resources e.g. High Density Polyethylene (HDPE) liner	It is likely that lining a facility of this size will make the project economically unfeasible however a number of options are being explored.	Not yet finalised and under investigation
Eric Mulibana, *Gauteng Department of Agriculture and Rural Development* Portia Chawane, Victor Nkuna *Department of Water and Sanitation*	Yes	2 December 2014,16 April 2015	Where will the water to be used for reclamation be sourced from? It is proposed that existing mine water for the reclamation process.	The water will be sourced from existing impacted water from underground operations at the Kloof, and Cooke shafts. Currently 35 Mℓ/day is discharged from the Kloof 10 shaft, into the Wonderfonteinspruit, and 20 Ml/d from Cooke under licence. The first phase (1.5Mt/m) of this project will take 30 Ml/d of that for hydraulic reclamation and once it has gone through the process, it will be treated through an advanced water treatment facility (AWTF) at the toe of the RTSF. The treated water will either be discharged to the Leeuwspruit or can be supplied to nearby communities. It is not likely that there will be a significant impact on downstream users where water is being discharged into the Wonderfonteinspruit.	Not yet finalised and under investigation
Wilcot Speelman *National Nuclear Regulator*	Yes	16 April 2015	Clarity on the full project needs to be provided, not just phase one. The WRTRP must be well thought through considering that it will be a 25 year project sot that potential negative impacts do not become a reality in the future and is irreparable.	The project will be presented as a whole to demonstrate long term viability with authorisation being sought for initial implementation.	Not yet finalised and under investigation
Dan Motaung *Gauteng Department of Agriculture and Rural Development*	Yes	16 April 2015	How will rehabilitation for the project and RTSF be managed?	Consideration of alternate are a requirement for all sites proposed in the WRTRP. The specific rehabilitation measures for the RTSF and historic facilities will be addressed within the rehabilitation plan that will compiled including appropriate re-vegetation	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				techniques and post rehabilitation monitoring.	
Marius Keet *Department of Water and Sanitation*	Yes	4 June 2015	Sibanye can potentially assist in supplying water to people in the broader region.	Sibanye is more than willing to engage with the Department on these matters.	Not yet finalised and under investigation
Rudzani Mabogo *Department of Mineral Resources*	Yes	6 October 2015	It is important to ensure that the RTSF will be accessible to all companies in the area, large or small, busy with reclamation to deposit tailings.	Other miming companies in the area will have access for deposition and the necessary arrangements will have to be negotiated and put into place.	
Bashan Govender *Department of Water and Sanitation*	Yes	6 October 2015	Will the RTSF be lined?	Various options are being investigated currently.	
Bashan Govender *Department of Water and Sanitation*	Yes	6 October 2015	Does SGL have the needed allocated and dedicated funds should a pipe burst? Also, are the required emergency processes in place for such an event?	Yes, SGL does have the required funds allocated and associated health & safety plans in place in order to address pipeline emergencies.	
Elmond Lekota *National Nuclear Regulator*	Yes	6 October 2015	The pipeline infrastructure results in a lot of stream and wetland crossings; you must have alternatives and it must be environmentally viable and cost effective.	Thank you for your comment, all the necessary pipe routes have been assessed in relation to viable alternatives and thus minimising potential risks to the wetlands -these will be assessed during the EIA phase and appropriate mitigation measures recommended.	
Amukezani Shibambo *Department of Water and Sanitation*	Yes	6 October 2015	Has SGL done an analysis, and associated costs, of treatment and discharge of water into the Leeuspruit? It needs to be determined if the treated water can be used for human consumption and not just to discharge into the river.	Yes part of the proposal is to install a AWTF (advanced water treatment facility) to treat the water to the SANS 241 potable water standard, prior to discharge.	
Rudzani Mabogo *Department of Mineral Resources*	Yes	7 October 2015	What other social development benefits will this project be brining to the area?	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	

Table 8-8: Other Affected Parties

Other Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
Xolani Hlanganyana *Empowering Emotionally Abused Women and Children*	Yes	28 September 2015	Safety precautions need be followed and the community should be alerted in terms of safety.	Risk assessments are conducted for all sections of the proposed plant and suitable mitigations provided especially for safety issues.	
William Mathe *Letsema Agriculture Development Unit*	Yes	28 September 2015	The heritage site is only Donaldson Dam, the stream that supply Donaldson Dam is used by churches to baptise people of various religions.	Please refer to the Water Quality Assessment for further details on the risks associated with continued use of the Donaldson Dam. From a heritage perspective, the loss of ritualistic use of the dam will manifest in the degradation of the intrinsic intangible heritage value. Where continued use is maintained, no impact to the intangible heritage value of the resource is envisaged.	
Thabang Wesi *Great Westonaria Concerned Residents Association P.R.O*	Yes	7 October 2015	Regulators are always backing up the mines. Diseases will occur and people's lives could be in danger if the DMR do not consider who they issue licences to.	All mines need to comply with regulations, which sets out requirements pertaining to health impacts. Should this project proceed, SGL will adhere to these legislative requirements.	
Philip Mofokeng *ANC Treasure Ward 15* Charles Marekwa *Remmogo* Johnson Mdlolo *SANCO*	Yes	7 October 2015	There will be more revenue impact because of job creation and economic upliftment.	Thank you for the comment.	
Heinrich von Wielligh *Corobrik*	Yes	8 October 2015	Will all the required funds be available for rehabilitation?	The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation	

Other Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
				is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years.	

Table 8-9: Interested Parties

Interested Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	What type of water treatment will be used and how many megalitres will be treated a day?	Chrystalactic/Reverse osmosis process is proposed for the water treatment. Between 10 and 15 megalitres will be treated per day and options for the use thereof is being investigated.	Not yet finalised and under investigation
Emily Taylor *Endangered Wildlife Trust (EWT)*	Yes	21 April 2015	The EWT would like to be involved and assist with information relating to the identification of species, where possible.	Thank you for your comment, the wet and dry season field work studies have been completed and the full species list (both fauna and flora) is in the F&F report heading no.7. EWT did not accompany the team during the dry season site visit due to short time frames. However the report will also be made available to EWT for review.	Not yet finalised and under investigation
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	The DMR's regional mine closure strategies needs to be closely considered and the required closure funds needs to be available. While the FSE is in support of the re-mining of historical tailings storage facilities and reclamation, a precautionary approach needs to be adopted and consideration should be given to risks when determining re-mining, rehabilitation, closure and financial provisions for rehabilitation and closure. The primary objective of regional TSFs and regional mine closure must be to prevent or minimize adverse	The DMR's closure guideline document and Dr Phil Tanner's Report and guideline will be considered in the compilation of rehabilitation plan report. This will ensure that all the proposed mitigation measures are implemented accurately to minimize any residual impacts. The reclamation process will ensure controlled exposure of the material to air and water and contained within the existing foot print of the TSF. The closure provision fund will be put in place and managed according to legal requirements which provides for assessing these aspects.	Not yet finalised and under investigation

Interested Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
			long term environmental and socio-economic impacts, and to leave the environment in a state where sustainable development can take place.		
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	Radiometric surveys over previously reprocessed mine residue deposit footprints have, in some cases, shown elevated levels of residual radioactivity in soils.	This is a valuable comment and will definitely be taken into account. It is understood that the land use can only be determined once the historical TSFs are removed. The radioactive material and impact on the underlying soils will vary for each footprint; therefore the end land use potentials will be different.	Not yet finalised and under investigation
Mariette Liefferink *Federation for a Sustainable Environment* Judith Taylor *Earthlife Africa* Bashan Govender *Department of Water and Sanitation*	Yes	21 April 2015, 4 June 2015	Social and economic benefits are very important and communities need to benefit, and not just in terms of jobs, but benefits must be applicable to communities over the long term. They need to be involved to ensure short to long term benefits that are sustainable.	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	Not yet finalised and under investigation
Elise Tempelhoff *Media24*	Yes	6 October 2015	How will SGL ensure that dust won't affect the area negatively?	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Thabang Wesi *Great Westonaria Concerned Residents Association P.R.O*	Yes	7 October 2015	Have SGL worked with the communities in terms of grooming them for potential employment opportunities?	SGL is in the process to identify the various requirements for employment and will incorporate the SIA specialist study findings and recommendations.	
Mariette Liefferink *Federation for a Sustainable*	Yes	13 October 2015	The impact assessment ratings and associated definitions utilised for the EIA studies needs to be	Sibanye Gold trusts that Digby Wells, as the independent and competent EAP, will apply the latest	

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
Environment			reconsidered, since this will influence the mitigation measures to be developed and implemented.	definitions and ratings to the impact assessments.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	13 October 2015	As part of the Geluksdal project it was proposed that alternative sites need to be identified. One of the very strong suggestions was to deposit on Gold Fields' site which is land already mined. May I ask why that was not perused? My understanding is that Gold Fields are comfortable to investigate this option whereby liabilities and responsibilities can be co-owned.	The Gold Fields site has not been considered, due to the total deposition tonnages required.	
Judith Taylor *Earthlife Africa*	Yes	13 October 2015	Impacts from dust are significant and so does the effect thereof on people - they are getting very sick in areas such as Welkom and Riverlea.	The hydraulic mining is not a dust generating process. However, the proposed hydraulic reclamation of the historical TSFs will result in the permanent removal of these sources, resulting in an environment that is within compliance.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	22 October 2015	Demonstrate that the end or post-mining (sequential) land use with associated use of other resources connected with such sequential land use, for example water use, is viable and will result in a self-sustaining ecosystem and communities.	Sustainable closure plans with adequate funding are a requirement of the EIA process with final closure to be assessed and refined in conjunction with relevant stakeholders at the time of closure.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	22 October 2015	Plough some of the value from the reprocessing operations back into the rehabilitation of the entire mining area. It must be accepted that the reprocessing of some mining residues will never be economically viable and that these will need to be transported to the RTSF, if this is not too costly or rehabilitated in situ.	Adequate financial provision (which is reviewed annually by the competent authority) is made for the entire mining impacted area.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	4 November 2015	The FSE recommends that the risks pertaining to radon, stay on or in close proximity to contaminated land and/or unauthorised entry to mine sites be investigated and mitigation measures proposed.	This is an important aspect to consider with respect to land use. Appropriate mitigation measures will be provided within the soils report and the rehabilitation plan, as the level of contamination will determine the potential land use and what remedial action is required.	
Jaco Taute and Carl van Heerden *Landowners, NFMD*	Yes	14 December 2015	We as the NFMD (No for Mega Dump) Forum representing the Community (farmers, business owners and residential area). Attached find signed petition forms (29 forms and 793 signatories_ and a letter from	Your petition is noted and will be submitted to the DMR along with the final EIA.	

Interested Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
			Tom McGhee our Consulting Geologist.		
Tom McGhee *Independent Consultant*	Yes	14 December 2015	With this project having a lifespan of over 30 years, it is apparent that both the area of the existing dumps and the area of the proposed RTSF as well as a large area on either side of the proposed pipelines will be under threat during this period with no benefits to existing communities. I seriously urge you to reconsider your proposal.	The project will be undertaken in stages and the benefits of removing the dumps from the landscape will materialise as soon as the reclamation starts. Please refer to our mitigation measures in the EIA and let us know if there are any gaps that you can identify.	

9 Item 3(g)(iv): The environmental attributes associated with the development footprint alternatives

This section describes the baseline environmental conditions prior to the proposed project commencing. Furthermore, this section also contains a description of the current land uses and specific environmental features relevant to the project area.

9.1 Baseline environment

9.1.1 Air Quality

9.1.1.1 Climate

Ambient air quality in this region of South Africa is strongly influenced by regional atmospheric movements, together with local climatic and meteorological conditions. The most important of these atmospheric movement routes are the direct transport towards the Indian Ocean and the recirculation over the sub-continents.

The country experiences distinct weather patterns in summer and winter that affect the dispersal of pollutants in the atmosphere. In summer, unstable atmospheric conditions result in mixing of the atmosphere and rapid dispersion of pollutants. Summer rainfall also aids in removing pollutants through wet deposition. In contrast, winter is characterised by atmospheric stability caused by a persistent high pressure system over South Africa. This dominant high pressure system results in subsidence, causing clear skies and a pronounced temperature inversion over the Highveld. This inversion layer traps the pollutants in the lower atmosphere, which results in reduced dispersion and a poorer ambient air quality. Preston-Whyte and Tyson (1988) describe the atmospheric conditions in the winter months as highly unfavourable for the dispersion of atmospheric pollutants.

Site specific MM5 modelled meteorological data set for full three calendar years (2012 – 2014) was obtained from the Lakes Environmental Consultants in Canada to determine local prevailing weather conditions. This dataset consists of surface data, as well as upper air meteorological data that is required to run the dispersion model.

Modelled meteorological data for the period January 2012 to December 2014 was obtained for a point in the proposed project area near Westonaria (26.317775°S, 27.650683° E).

9.1.1.2 Wind

Dispersion of atmospheric pollutants is a function of the prevailing wind characteristics at any site. The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

The amount of particulate matter generated by wind is highly dependent upon the wind speed. Below the wind speed threshold for a specific particle type, no particulate matter is liberated, while above the threshold, particulate matter liberation tends to increase with the wind speed. The amount of particulate matter generated by wind is also dependent on the material's surface properties. This includes whether the material is crusted, the amount of non-erodible particles and the particle size distribution of the material.

The spatial and annual variability in the wind field for the proposed project area calculated from the modelled data is clearly evident in Figure 9-1. The predominant winds are coming from north northeast and north with an average wind speed of 3.86 m/s. Wind class frequency distribution per sector (wind direction) is given in Figure 9-2 and Table 9-1.

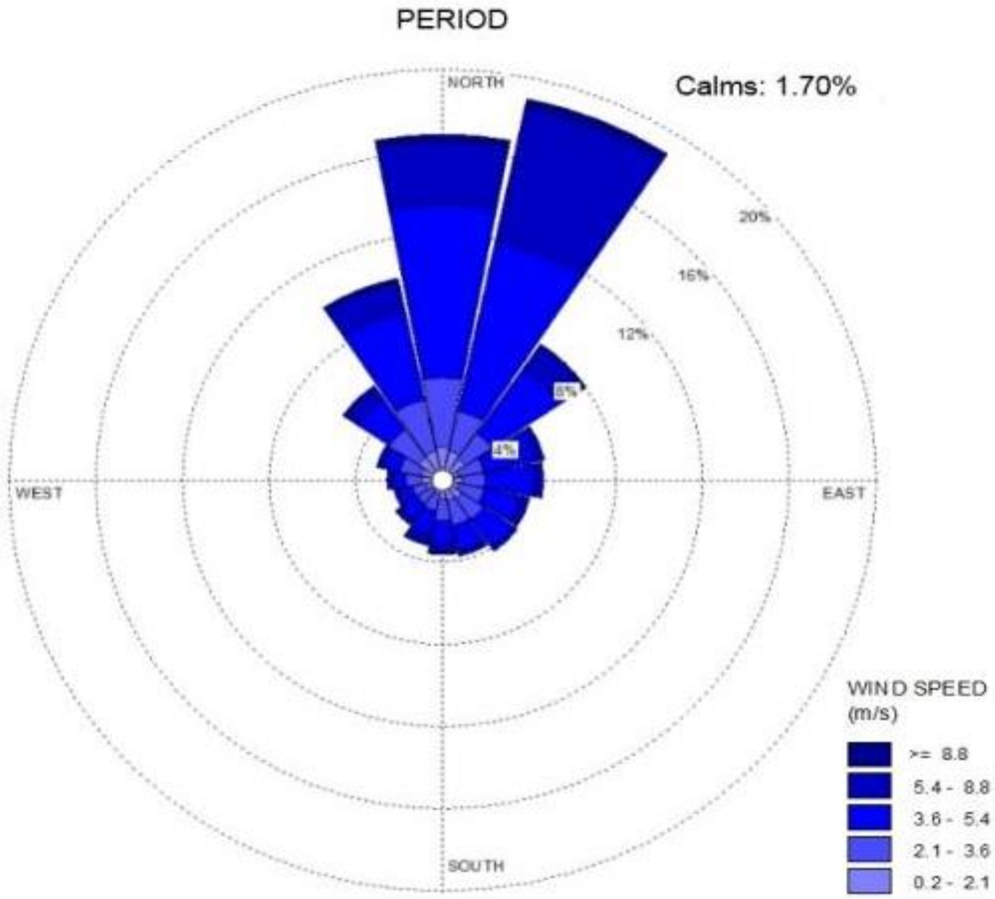


Figure 9-1: Surface wind Rose for Sibanye Project Area

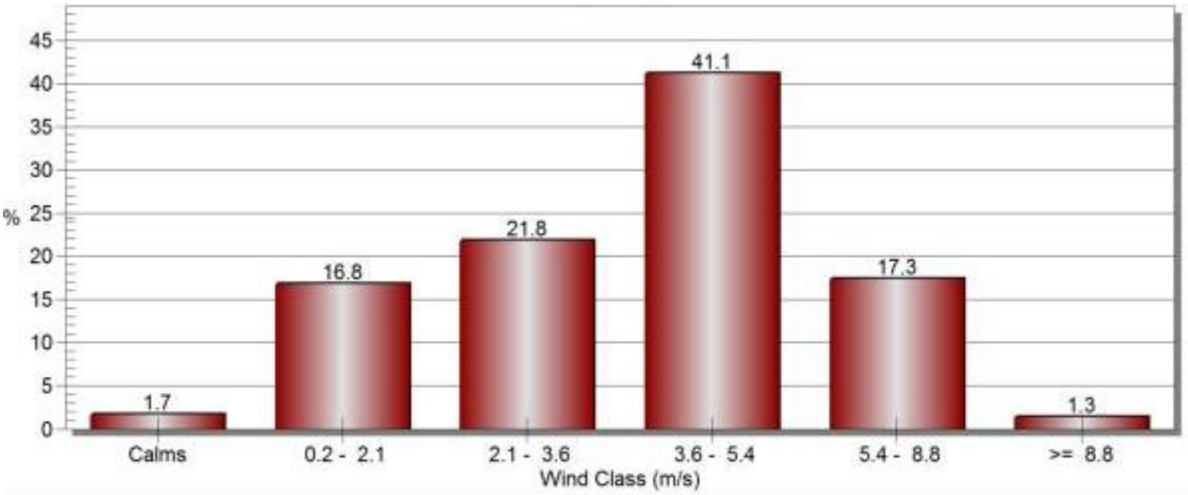


Figure 9-2: Wind Class Frequency Distribution

Table 9-1: Wind Class Frequency Distribution per Direction

No.	Directions	0.2 -2.1	2.1 -3.6	3.6 -5.4	5.4 -8.8	>= 8.8	Total (%)
1	N	1.6	3.4	8.4	3.1	0.4	16.8
2	NNE	1.5	2.0	8.4	6.6	0.4	18.9
3	NE	1.3	1.5	3.8	1.4	0.1	8.0
4	ENE	0.8	1.2	2.4	0.4	0.0	4.8
5	E	0.9	1.0	2.2	0.5	0.0	4.7
6	ESE	0.8	1.2	1.7	0.4	0.0	4.1
7	SE	1.1	1.2	1.6	0.3	0.0	4.2
8	SSE	1.0	1.2	1.2	0.3	0.0	3.8
9	S	0.9	1.0	1.1	0.5	0.1	3.6
10	SSW	0.7	0.8	1.2	0.5	0.0	3.2
11	SW	0.6	0.8	0.8	0.4	0.0	2.6
12	WSW	0.8	0.7	0.6	0.2	0.0	2.3
13	W	1.0	0.7	0.6	0.2	0.0	2.6
14	WNW	1.0	1.0	0.8	0.3	0.0	3.1
15	NW	1.3	1.6	1.8	0.7	0.1	5.6
16	NNW	1.5	2.5	4.4	1.5	0.2	10.0
Sub-Total		**16.8**	**21.8**	**41.1**	**17.3**	**1.3**	**98.3**
	Calms						1.7
	Missing/Incomplete						0
Total							**100**

9.1.1.3 Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers.

The monthly temperature maximum and average for the project area are given in Table 9-2. The monthly maximum temperatures range from 8.8°C in July to 18.2°C in January, with monthly average ranging from 2.4°C in July to 13.2°C in January. Annual maximum and mean temperatures for the area is given as 15.23°C and 8.1°C respectively.

Table 9-2: Monthly Average Temperature Values

Temp(°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	18.2	18.2	17.9	14.9	13.5	11.4	8.8	14.1	15.3	16.0	17.2	17.3	15.2
Monthly Mean	13.2	12.8	11.6	6.9	4.8	3.2	2.4	4.0	7.4	9.1	9.5	12.4	8.1

9.1.1.4 Relative Humidity

The data in Table 9-3 is representative of the relative humidity for the proposed WRTRP area. The annual maximum, minimum and average relative humidity is given as 66.4%, 61.6% and 63.8%, respectively. The daily maximum relative humidity remains above 60 % for most of the year, and range from 57.9 % in November to 74.2 % in March. The daily minimum relative humidity on the other hand is above 56 % for the whole year, with the highest minimum (67.2 %) observed in June and the lowest (55.6 %) occurring in November.

Table 9-3: Monthly Average Relative Humidity Values

Relative Humidity (%)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	67.1	65.6	74.2	63.3	64.0	72.2	69.9	67.7	67.7	64.0	57.9	63.8	66.4
Monthly Min.	62.1	60.9	60.6	62.5	61.5	67.2	63.0	63.6	61.8	60.8	55.6	59.1	61.6
Monthly Ave.	64.5	63.1	66.5	62.8	62.6	69.1	66.7	65.2	64.1	62.0	56.5	62.2	63.8

9.1.1.5 Precipitation

As shown in Table 9-4, for the three years data considered, the total monthly rainfall (max) and average total monthly rainfall are reported. The annual totals, maximum and average of 1 065 mm and 591 mm are reported.

Table 9-4: Total Monthly and Average Precipitation Values

Precipitation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Total Monthly Rainfall (Max).	204.2	115.1	70.9	46.2	6.9	4.1	0.5	8.6	53.1	178.3	148.6	228.1	1065
Average Total Monthly Rainfall	122.0	64.1	35.8	25.1	2.6	1.4	0.3	5.8	19.2	72.9	99.1	142.5	591

9.1.1.6 Evaporation

As shown in Table 9-5, the maximum, minimum and mean monthly evaporation rates as measured in the Westonaria area for the period 1957-1987 are 263 mm, 113 mm and 178 mm, respectively. The highest monthly maximum evaporation (322 mm) occurred in October and the lowest of 68 mm in April. The monthly minimum evaporation ranges between 68 mm (April) and 180 mm in October.

Table 9-5: Monthly Evaporation Rates for Westonaria

Evaporation (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Monthly Max.	289	262	224	190	223	244	257	261	288	322	277	320	263
Monthly Min.	88	120	93	68	79	70	85	111	155	180	178	128	113
Monthly Mean	206	177	171	141	124	109	126	170	224	253	224	212	178

9.1.1.7 Boundary Layer Properties and Atmospheric Stability

The region of the atmosphere governing transport and dispersion of the majority of the pollutants is the planetary boundary layer. This layer is defined as the layer where the wind structure is influenced by the surface of the Earth (Preston-Whyte and Tyson (1988)).

The height of the planetary boundary layer varies with the atmospheric stability and this is important for the concentrations of pollutants in the air because the majority of the pollutant mass typically is confined within this layer. During night-time when conditions in most cases are stable, the planetary boundary layer is shallow, down to 20-50 metres and the surface concentration of pollutants can therefore be quite high, especially close to emission sources that are active during the night. Under unstable conditions the planetary boundary layer can be as high as 2 kilometres and pollutants are in this case distributed in the air column mainly by convective turbulence.

The atmospheric conditions may be divided into three broad classes in terms of stability: neutral, stable and unstable conditions. These major three categories are characterised by the following:

- *Neutral* conditions where the temperature is homogeneous throughout the boundary layer. This situation typically occurs in the transition from day to night and is characterised by strong winds and clouds and large amounts of mechanical turbulence.
- *Stable* conditions where the temperature is lowest close to the surface and increases towards the top of the boundary layer. This situation typically occurs during night-time or in winter situations and is characterised by little turbulence and a strong stratification of the planetary boundary layer which is quite shallow. This class can be further divided into stable and very stable classes.
- *Unstable* conditions where the temperature of the air closest to the surface is higher than the temperature of the air above it. This situation typically occurs during daytime at summer when the sun is shining and it is characterised by large amounts of

convective turbulence usually resulting in the formation of cumulus clouds during the day. This class can be further divided into very unstable, moderately unstable and unstable classes.

The refined classes of atmospheric stability classes are further defined in the Table 9-6 and Table 9-7.

Table 9-6: Atmospheric Stability Classes

Designation	Stability Class	Atmospheric Condition
A	Very unstable	Calm wind, clear skies, hot daytime conditions
B	Moderately unstable	Clear skies, daytime conditions
C	Unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

Table 9-7: Meteorological Conditions that define the Pasquill Stability Classes

Surface wind speed	Daytime incoming solar radiation			Night time cloud cover	
m/s	Strong	Moderate	Slight	> 50%	< 50%
< 2	A	A – B	B	E	F
2 – 3	A – B	B	C	E	F
3 – 5	B	B – C	C	D	E
5 – 6	C	C – D	D	D	D
> 6	C	D	D	D	D

*Note: Class D applies to heavily overcast skies, at any wind speed day or night.

9.1.1.8 Dust Fallout Baseline

Dust deposition data is crucial as it shows monthly, seasonal, and inter-annual variability in dust fallout rates – pre and during the operational phase of an activity. The amount of dust collected at any given time is a function of the rate of deposition, which may vary widely depending on the meteorological factors described previously, such as wind speed intensity, direction and variations in the background dust concentrations. The dust fallout sampling, analyses, and interpretation is conducted according to the recommended SANS 1929:2011 (adapted from ASTM1739-98) expressed in the units of $mg/m^2/day$ averaged over a 30-day period.

SGL has provided dust deposition data for the WRTRP area dating back to 2006 for analysis and interpretation. Several networks are currently operational at the Kloof, Driefontein, Cooke, Ezulwini Mining Right Area. The different monitoring networks currently in operation and their relative position to each other are depicted in Plan 9.

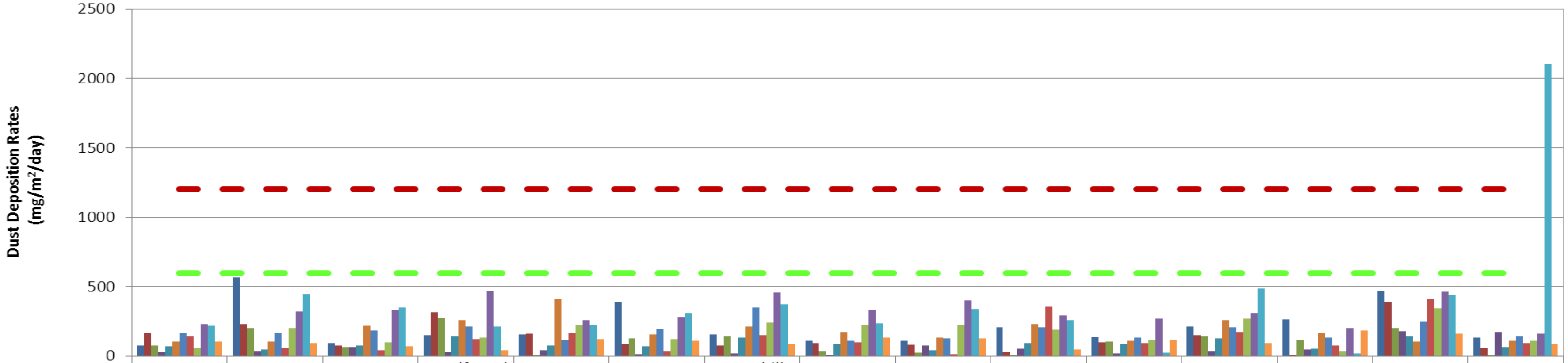
In terms of dust deposition standards for this study, the NDCR 2013 standard which classified two areas: residential and non-residential was applicable in the assessment phase. With regards to the graphs, the green line represents the limit which the dust fallout levels are permissible for residential areas, and the red line represents the limit which the dust fallout levels are permissible for non-residential areas. For residential and non-residential limits, the current margin of tolerance is two exceedances within a year, and no two sequential months (NDCR, 2013).

Plan 9: Air Quality Monitoring Points at the Different MRAs

9.1.1.9 PM_{10} Baseline

Data from Rand Uranium dust monitoring network are represented with dust fall rates measured in 2013 and 2014 (Figure 9-3 and Figure 9-4). In 2013 all sites were within the 600 mg/m^2/day recommended for residential areas, with the exception of December at sites Uncle Harry with deposition rate of 2 102 mg/m^2/day.

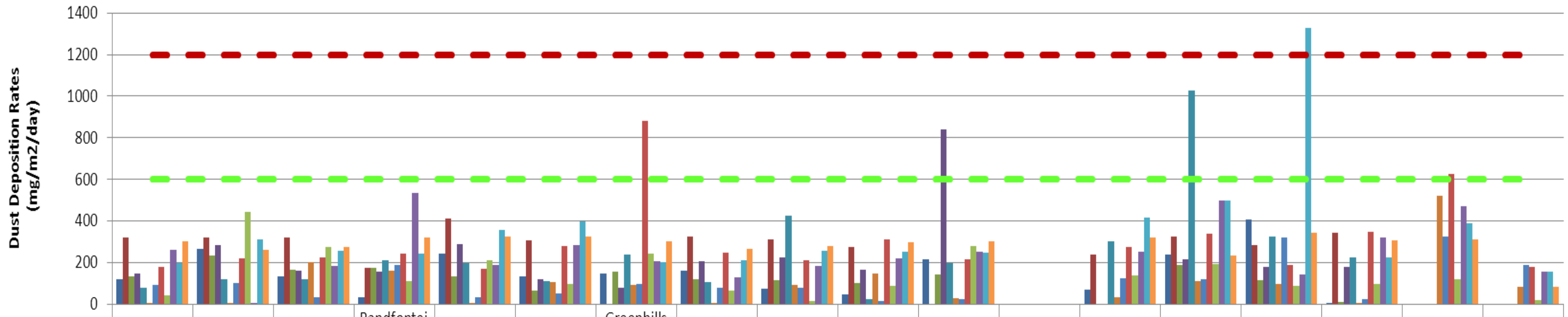
Exceedances observed in 2014 were observed predominantly in July, with different sites exceeding the standard for residential areas - 600 mg/m^2/day (NDCR 2013). There was no violation of the permissible frequency of exceedance. The current margin of tolerance is two exceedances within a year, no two sequential months (NDCR, 2013).



	Jameson lodge	Laerskool Raportryer	Randfontein Primary	Randfontein Office Park	Betsie Verwoerd	Robin Park	Greenhills Sewage Plant	Technical College	Game Reserve	Horse Riding Club	Cooke Security	Simunye	Cooke 2 w/shop	G1 Stores	Uncle Harry's
Jan-13	76	567	91	150	157	391	154	108	113	205	136	213	266	472	132
Feb-13	166	228	74	314	162	86	74	91	82	33	99	149	5	392	59
Mar-13	77	202	66	275	9	129	146	37	22	4	106	142	116	200	8
Apr-13	28	36	63	31	41	16	21	5	75	54	17	35	47	180	170
May-13	70	46	78	145	79	68	131	89	43	95	86	130	51	146	67
Jun-13	107	103	219	259	410	157	212	175	135	231	109	258	167	106	110
Jul-13	169	164	182	212	113	195	351	112	126	209	134	209	132	245	142
Aug-13	147	58	39	119	166	35	151	99	13	353	92	173	78	414	93
Sep-13	60	203	100	130	227	120	242	223	226	187	117	273	34	342	112
Oct-13	232	321	332	471	259	279	460	332	400	291	270	309	200	461	160
Nov-13	220	449	348	212	227	310	372	237	338	258	25	485	21	440	2102
Dec-13	106	91	68	44	124	110	90	135	127	45	114	92	184	161	88
Residential	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Non residential	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200

Jan-13 Feb-13 Mar-13 Apr-13 May-13 Jun-13 Jul-13
Aug-13 Sep-13 Oct-13 Nov-13 Dec-13 Residential Non residential

Figure 9-3: Dust Deposition Record for RU Monitoring Network (2013)



	Jameson lodge	Laerskool Raportryer	Randfontei n Primary	Randfontei n Office Park	Betsie Verwoerd	Robin Park	Greenhills Sewage Plant	Technical College	Game Reserve	Horse Riding Club	Cooke Security	Waterpan	Simunye	Cooke 2 w/shop	G1 Stores	Uncle Harry's	D20/PS (pump stn)	D20 Res complex
Jan-14	118	267	134	33	241	133	146	159	75	45	217	0	69	239	406	2		
Feb-14	319	319	320	174	411	305	0	325	311	273	0	0	237	324	285	341		
Mar-14	131	234	166	172	135	67	156	121	114	100	141			186	116	9		
Apr-14	145	286	162	155	287	121	78	206	223	166	838			217	177	178		
May-14	78	119	118	213	196	112	237	107	424	22	198		300	1025	325	225		
Jun-14	2	4	200	160	2	108	90	2	94	145	29		35	112	98	2	523	85
Jul-14	92	102	33	187	33	50	98	80	77	16	25		125	121	320	26	325	189
Aug-14	179	222	225	241	169	277	881	245	210	310	216		276	337	186	347	626	177
Sep-14	41	442	273	110	211	95	243	67	15	87	277		140	193	86	98	118	18
Oct-14	259	7	183	534	188	284	205	129	183	221	252		252	496	144	321	472	157
Nov-14	198	310	255	241	358	397	201	209	258	253	247		416	496	1329	226	389	154
Dec-14	300	262	276	318	324	325	303	267	278	299	301		322	235	342	305	312	84
Residential	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Non residential	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200

Figure 9-4: Dust Deposition record for RU Monitoring Network (2014)

9.1.2 Geology

9.1.2.1 Regional Geology

The geology map of the area indicates that the site is covered with Quaternary age sediment. However, the quaternary sediment was only found partially on site while shale and diabase outcrop are common.

The regional geology of the area is illustrated on the 1:250 000 Geology Map 2626 West Rand series, published by the Council for Geoscience. The surface geology comprises of Pretoria Group lithologies of the Transvaal Supergroup of the Vaalian Erathem. The Pretoria Group sediments comprise of shale, slate, quartzite, siltstone and conglomerate of approximately 2 200 million years of age. The Pretoria Group lithologies form prominent east-west trending ridges in the vicinity of the study area. Diabase sills of a younger geological age (Monkolian 1 000 to 2 050 million years) are intruded into the Pretoria Group sediments.

The area is underlain by a gentle sloping stratum, generally dipping to the south at 10 to 20º.

The oldest rocks of the Central Rand, Klipriviersberg and Chuniespoort Groups (3 100-2 200 My) crop out to the north of study area with progressively younger rocks outcropping in the south.

Extensive diabase sill intrusions, as characterised by its highly positive magnetic signature in the aeromagnetic survey, is evident as intrusions in the Silverton shale and Timeball Hill siltstone-shale sequences.

9.1.3 Groundwater

The groundwater baseline information was taken from the EIA for the proposed uranium plant and Cooke Dump re-processing infrastructure written by Golder and Associates (2010). This information was taken in order to better illustrate the groundwater baseline environment around the Cooke Mining Right area.

According to the information gathered by Golder and Associates (2010), borehole depths varied between 15 metres below ground level (mbgl) and 100 mbgl, with an average depth of 38 mbgl. The Cooke TSF was noted to be located on dolomite. Groundwater in dolomite occurs in voids opened up by weathering, solution and fracturing. Dolomite areas are subdivided into compartments characterised by relatively impermeable features such as faults and dykes. The Cooke TSF was noted to be located in the Zuurbekom-East groundwater compartment which is further subdivided into smaller compartments by a number of smaller dykes (Golder and Associates, 2010).

9.1.3.1 Groundwater Quality

No boreholes are available to monitor groundwater levels and quality at the proposed Uranium plant site. However, up to 20 boreholes are monitored in the vicinity of the Cooke Dump and indicated groundwater levels are between 12 m and 20 m below ground level at the uranium plant and acid plant site and Cooke Dump. Groundwater is generally expected to follow the topography and will therefore flow towards the Wonderfonteinspruit (Golder and Associates, 2010).

9.1.4 Noise

9.1.4.1 Current Ambient Environment

The current noise soundscape of the study area has been characterised by means of baseline noise measurements near the major noise emitting components from the WRTRP namely Driefontein TSFs3 and 5, the proposed CPP, RTSF and AWTF. These measurements were taken in 2015. The measurements were carried out in accordance with the Gauteng Noise Control Regulations. The measured baseline will be compared to the guidelines of the SANS 10103:2008 which compares environmental noise with respect to annoyance and speech communication (refer to Table 9-8).

Table 9-8: Acceptable Rating Levels for Noise in Districts (SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON-RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50
NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.						
NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7.						

Type of District	Equivalent continuous rating level ($L_{Reg,T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
NOTE 3 In districts where outdoor $L_{R,dn}$ exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor $L_{Req,T}$ values in line with those given in table 1.						
NOTE 4 For industrial districts, the $L_{R,dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, LReq,d = LReq,n =70 dBA can be considered as typical and normal.						
NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.						
NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum Weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.						
a The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.						
b The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.						

The criteria used to site the measurement locations are (refer to Plan 10):

- The locations nearest noise sensitive receptors to the Driefontein TSF 5 and Driefontein TSF 3, as well as nearest to the proposed CPP and RTSF; and
- The locations served as suitable reference points for the measurement of ambient sound levels surrounding the proposed project area. The noise measurement locations cover rural as well as suburban and urban areas that represent a comprehensive soundscape of the area.

The list of noise measurement locations can be seen in Table 9-9.

Table 9-9: Noise Measurement Locations

Site ID	Farm/location	Category of Receiver	GPS Coordinates
N1	Leslie Williams Private Hospital	Urban/industrial	26° 24.077'S & 27° 25.322'E
N2	Wildebeestkuil 360 IQ portion 6	Rural	26° 28.459'S & 27° 36.615'E
N3	Letsatsing Village	Suburban	26°15'17.95"S & 28°29'22.04"E
N4	Rietfontein 349 IQ portion 42	Rural	26° 25.346'S & 27° 37.832'E

The results from the noise meter recordings for all the sampled points as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 9-10.

Table 9-10: Results of the Baseline Noise Measurements

Sample ID	SANS 10103:2008 Rating Limit					
	Type of district	**Period**	**Acceptable rating level dBA**	**$L_{Areq,T}$ dBA**	**Maximum/Minimum dBA**	**Date**
N1	Urban	Daytime	60	52	80/ 39	23/02/2015
		Night time	50	52	68 / 41	23/02/2015
N2	Rural	Daytime	45	51	87 / 29	26/02/2015
		Night time	35	43	67 / 28	26/02/2015
N3	Suburban	Daytime	50	44	77 / 38	02/03/2015
		Night time	40	40	66 / 37	02/03/2015
N4	Rural	Daytime	45	45	72 / 29	05/03/2015
		Night time	35	48	70 / 37	05/03/2015
	Indicates current $L_{Aeq,T}$ levels above either the daytime rating limit or the night time rating limit					

9.1.4.2 Historical Baseline Environment

Historical baseline measurements were taken by J. H. Consulting in 2009 and covered project areas of Cooke TSF, RTSF and AWTF and C4S TSF.

Table 9-11: Noise levels at N1 (Hassall, J.R. 2009)

Date	Time	T°C	RH %	Wind m/s	$L_{Areq,I}$	L_{90}
Mon 19/10/09	15:10-15:20	25	24		42.1	37
Mon 19/10/09	15:22-15:32	25	24		42.9	39
Wed 22/04/09	15:19-15:29	19.5	44	<4.5	50.1	42
Wed 22/04/09	15:30-15:40	19.5	44	<4.5	44.1	40
Mon 19/10/09	16:09-16:19	24.5	24		49.9	40

Date	Time	T°C	RH %	Wind m/s	$L_{Areq,I}$	L_{90}
Mon 19/10/09	16:23-16:33	24.5	24		42.9	40
Thu 28/04/09	16:28-16:38	24.5	13	<3.1	44.8	41
Thu 28/04/09	16:40-16:50	24.5	13	<3.1	44.1	40
Mon 19/10/09	17:10-17:20	24.5	24		44.9	40

These values are typical of a rural area with the continuously operating industrial plant dominating the noise climate and $L_{Aeq,I}$ value. The L_{90} (the sound level exceeded for 90% of the time, and usually taken as the background noise without intruding events such as vehicles and aircraft) also dominates the background noise and indicates the very consistent plant noise bounded between 40 and 42 dB(A) during the day (Hassall, J.R. 2009).

Table 9-12: Noise levels at N2 (Hassall, J.R.2009)

Date	Time	T°C	RH %	Wind m/s	$L_{Areq,I}$	L_{90}
Wed 22/04/09	15:52-16:02	19.5	44	<3.8	49.6	49
Wed 22/04/09	16:04-16:14	19.5	44	<3.8	49.2	49
Thu 28/04/09	15:06-15:16	24.5	13	<2.7	49.7	49
Thu 28/04/09	15:18-15:28	24.5	13	<2.7	49.3	48

These values are typical of a rural area with the continuously operating industrial plant dominating the $L_{Aeq,I}$ and L_{90} values. The plant noise is consistently 48/49 dB(A) at this position and represents well the current impact of the Cooke Gold Plant (Hassall, J.R.2009).

Table 9-13: Noise levels at N3 (Hassall, J.R.2009)

Date	Time	T°C	RH %	Wind m/s	$L_{Areq,I}$	L_{90}
Mon 19/10/09	14:40-14:50	25	24	0.8	49.2	39
Mon 19/10/09	14:52-15:02	25	24	0.8	47.5	41
Mon 19/10/09	15:38-15:48	25	24	1.3	49.9	41
Mon 19/10/09	15:50-16:00	25	24	1.5	51.9	48
Mon 19/10/09	16:40-16:50	24.5	24	<1.1	49.7	44
Mon 19/10/09	16:52-17:02	24.5	24	<1.1	51.6	45

These values are typical of a rural area with the heavily trafficked R559 dominating the noise climate, $L_{Aeq,I}$ and the L_{90} (the sound level exceeded for 90% of the time, and usually taken as the background noise without intruding events such as vehicles and aircraft). It should be noted that this measurement position is in the area suggested for future residential development (Hassall, J.R.2009).

The daytime and night time measurement results taken from GijimaAST are presented in Table 9-14 and Table 9-15 respectively.

Table 9-14: Daytime noise levels (Cornelius, J.2009)

Location	Measured typical noise rating ($L_{req,T}$) range dBA	Measured noise rating level dBA ($L_{req,T}$)	Maximum/Acceptable rating level dBA
N4	41.6 – 97.4	71.8	45
N5	41.6 – 48	42	45
N6	41.6 – 63.8	48.8	45
N7	39.1 – 73.9	55.1	45

Table 9-15: Night time noise levels (Cornelius, J.2009)

Location	Measured typical noise rating ($L_{req,T}$) range dBA	Measured noise rating level dBA ($L_{req,T}$)	Maximum/Acceptable rating level dBA
N4	33.6 – 92.5	70.4	35
N5	33.5 – 44.5	34.8	35
N6	41.2 – 57.8	45.9	35
N7	34.5 – 54.9	45.6	35

Additional measurements were taken in 2012 and have been detailed in Table 9-16 below.

Table 9-16: Noise Measurement Levels

Sample ID	SANS rating limit					
	Type of district	Period	Acceptable rating level dBA	$L_{Areq,T}$ dBA	Maximum/ Minimum dBA	Date
N8	Rural	Daytime	45	49	93 / 18	07/05/2012
		Night time	35	39	67 / 18	07/05/2012

Sample ID	**SANS rating limit**					
	Type of district	**Period**	**Acceptable rating level dBA**	**$L_{Areq,T}$ dBA**	**Maximum/ Minimum dBA**	**Date**
N9	Suburban	Daytime	50	55	85 / 34	15/05/2012
		Night time	40	45	68 / 31	15/05/2012
N10	Suburban	Daytime	50	50	70 / 36	14/03/2012
		Night time	40	47	66 / 30	14/03/2012
	Indicates current LAeq,T levels above either the daytime rating limit or the night time rating limit					

The overall baseline results from the additional measurements taken at N8, N9 and N10 in 2012 indicate that ambient noise levels are slightly higher than the SANS limit for rural districts because of the vehicular activity on the main roads passing through the rural areas. The ambient noise levels at the suburban areas are at levels expected for these districts.

Plan 10: Noise Monitoring Points

9.1.5 Soils

The land type data gathered during the scoping phase suggested the following dominant soils:

- Red well-drained soils on foot slopes of Land Type Ab.
- Shallow rocky soils on the steep escarpment of Land Type Fb.
- Red soils and rocky soils on crests of Land Type Ba and,
- Various hydromorphic and shallow soils on rock in midslopes and foot slopes of Land Type Bb.

9.1.5.1 Land Type Data

The soils found in the project area are represented by four possible land types as summarised in Table 9-17 and shown in Plan 13. The land uses and land capabilities are shown in Plan 14 and Plan 15 respectively.

Table 9-17: Dominant Soil Types and Slopes occurring within the Project Area

Dominant Land Type	Description	Dominant soil types	Dominant Land Capability	Potential occurrence % per land type
Ab	Land Type Ab is dominated by the foot slope landscape position (82%). Red well drained soils are common in this landscape position.	Red well drained soils for example Hutton soils.	II	90
Fb	Land Type FB is dominated by midslope (33%) and footslope (42%) positions but also contains scarp (5%) landscape positions due to the presence of rocky outcrops.	Shallow stony soils and rocks are common in this Land Type.	VI	59
Ba	Land Type Ba is dominated by crest (30%) and midslope (55%) landscape positions. The crest positions are dominated by red soils but also contain a fair amount of rock outcrops.	Deep red and shallow stony soils for example Hutton and Mispah soils respectively.	III	47
Bb	Land Type Bb is dominated by midslope (38%) and footslope positions (42%).	This Land Type is characterised by mixed soils such as shallow Mispah soils, wet soil such as Longlands and Wasbank soils as well as heavy clay soils such as Valsrivier and Sterkspruit soils.	III	59

Plan 11: Land Types

Plan 12: Land Use

Plan 13: Land Capability

9.1.5.1.1 Cooke Tailings Storage Facility

The Cooke TSF site falls within the Ab7 land type. The Ab land type is dominated by freely draining deep red soils, most likely to be the Hutton soil form. This was confirmed by the report conducted by Golder Associates Africa Pty (Ltd), 2010.

9.1.5.1.2 Cooke 4 South Tailings Storage Facility

The Cooke 4 South TSF is situated in the Fb5 land type (Shallow rocky Soils, Mispah).

9.1.5.1.3 Pipeline

The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Fb5 land type (Shallow rocky Soils, Mispah) to the Ab7 land type (deep well drained red soils, Hutton).

9.1.5.2 Land Capability

Land capability is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long term use of land under rain-fed conditions.

9.1.5.2.1 Cooke Tailings Storage Facility

The Cooke TSF site falls within the Class II land capability (intensive cultivation/arable).

9.1.5.2.2 Cooke 4 South Tailings Storage Facility

The Cooke 4 South TSF is situated in the Class VI land capability (moderate grazing).

9.1.5.2.3 Pipeline

The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Class VI land capability (moderate grazing) to the Class II land capability (intensive cultivation).

9.1.6 Surface Water

South Africa is divided into 19 Water Management Areas (WMA), managed by its respective water boards. Each of the WMAs are made up of quaternary catchments, which relate to the drainage regions of South Africa. Each of the quaternary catchments have associated hydrological parameters including area, Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) , and Mean Annual Runoff (MAR).

9.1.6.1 Regional Hydrology

The WRTRP is situated in the Upper Vaal Water Management Area (WMA) 8 within the quaternary catchments C23E, C23J, C23D, C22J and A21D (Plan 14).

The surface water attributes of the affected catchments namely the MAR in million cubic meters (Mm^3), MAP (mm) and MAE (mm) are summarised in Table 9-18 (WRC, 2005).

Table 9-18: Summary of the Surface Water Attributes for Quaternary Catchments

Quaternary Catchment	Total Area (km^2)	MAP (mm)	MAR (Mm^3)	MAE (mm)
C22H	454	639	8.38	1650
C22J	669	633	11.81	1650
C23D	510	664	9.12	1650
C23E	850	631	13.41	1675
C23J	890	620	18.49	1670

The C22H quaternary catchment area is 454 km^2 and has an MAR of 8.38 Mm^3. Runoff emanating from this quaternary catchment drains into a south westerly direction into the Klein Wes Rietspruit which in turn flows into the larger Rietspruit.

The C23D quaternary catchment area is 510 km^2 and has an MAR of 9.12 Mm^3. Runoff emanating from this quaternary catchment drains in a south westerly direction into the Wonderfonteinspruit which is the largest river in the quaternary catchment. The C23D quaternary catchment is a contributing catchment to C23E, therefore all runoff from C23D eventually drains to the catchment outlet of C23E.

The C23E quaternary catchment area is 850 km^2 and has an MAR of 13.41 Mm^3. Runoff emanating from this quaternary catchment drains in a south westerly direction via the Mooirivierloop. The C23E quaternary catchment includes urban areas which are greater than 5 km^2.

The C23J quaternary catchment area is 890 km^2 and has an MAR of 18.49 Mm^3. Runoff emanating from this quaternary catchment drains in a south westerly direction via the Loopspruit. The Loopspruit is the largest river within the quaternary catchment.

The C22J quaternary catchment area is 669 km^2 and has an MAR of 11.81 Mm^3. Runoff emanating from this quaternary catchment drains in a southerly direction via the Leeuspruit. The Leeuspruit is the largest river within the quaternary catchment.

Plan 14: Catchment Area

9.1.6.2 Water Quality

Thirteen (13) surface water quality samples were collected by Digby Wells from the rivers and Dams within and around the project area. The sampled rivers include the Leeuspruit, Loopspruit and other unnamed rivers around the project area.

The water quality for the Wonderfonteinspruit and the Klein Wes Rietspruit was not investigated through sampling during this study as sufficient data was provided by the applicant. The first round of sampling was undertaken on the 25th of March 2015 and the second round was conducted on the 10th of July 2015. Amongst the identified sampling points within and around the project area, some of the rivers/drainages were found to be dry and sampling was not possible.

Samples were submitted to Aquatico Laboratory (Pty) Ltd, a SANAS accredited laboratory in Pretoria for analysis of their physical and chemical quality status. Table 9-19 indicates the surface water monitoring locations for samples taken by Digby Wells and the applicant.

Table 9-19: Surface Water Monitoring Locations

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
LP002	-26.4313	27.5522	Kloof Mining Right
LP004	-26.444	27.5494	Kloof Mining Right
LP005	-26.4574	27.5491	Kloof/Driefontein Mining Rights
LP006	-26.4665	27.5484	Kloof/Driefontein Mining Rights
LU014	-26.4733	27.6151	Kloof Mining Right
DSW9	-26.348808	27.431807	Driefontein Mining Right
DSW42	-26.341755	27.4282	Driefontein Mining Right
L1	-26.3665	27.70366	Cooke 4 South/Ezulwini mining rights
L2	-26.3961	27.69999	Cooke 4 South/Ezulwini mining rights
L3	-26.4227	27.68142	Cooke 4 South/Ezulwini mining rights
Klein Wes Rietspruit	-26.401889	27.770547	Ezulwini Mining Right
W12	-26.233	27.73676	Kloof/Cooke Mining Rights
W13	-26.2417	27.73358	Kloof/Cooke Mining Rights
W15	-26.2657	27.69887	Kloof/Cooke Mining Rights
DP006	-26.4237	27.6397	Kloof Mining Right
DP003	-26.4162	27.6346	Kloof Mining Right
LU009	-26.4291	27.6005	Kloof Mining Right
C2H080	-26.326400	27.410600	Kloof Mining Right

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
GOL2376-SW1	-26.3970	27.645561	Kloof Mining Right
GOL2376-SW2	-26.4549	27.637475	Kloof Mining Right
GOL2376-SW3	-26.5255	27.675763	Kloof Mining Right
GOL2376-SW4	-26.472418	27.616659	Kloof Mining Right
GOL2376-SW5	-26.428294	27.601109	Kloof Mining Right
GOL2376-SW6	-26.479373	27.538946	Kloof/Driefontein Mining Rights
GOL2376-SW7	-26.42150	27.552755	Kloof Mining Right
GOL2376-SW8	-26.41115	27.405821	Driefontein Mining Right
GOL2376-SW9	-26.39815	27.402759	Driefontein Mining Right
GOL2376-SW13	-26.43393	27.552212	Kloof Mining Right
GOL2376-SW21	-26.375072	27.5922517060001	Kloof Mining Right
GOL2376-SW23	-26.418215	27.6020881740001	Kloof Mining Right
GOL2376-SW26	-26.453431	27.603918664	Kloof Mining Right

**All coordinates are in decimal degrees using the Geographic (latitude and longitude) WGS 1984 coordinate system*

Additional water quality data (January 2013 to March 2015) was provided to Digby Wells by the applicant and was used to describe the current water quality status throughout the project area.

Non-parametric statistics was used to calculate the variability of available data, which is a measure of how water quality differs over time; this was undertaken using Microsoft Excel. This allows the calculation of the parentage of time for which a specific value/ concentration was not exceeded. The 95th percentile value thus refers to a value that was not exceeded for 95% of the data points while 50th percentile represent the median or average value that was not exceeded for 50% of the data points. For this data set, the current water quality was based on the calculation of the median, 50th percentile and the 95th percentile.

Water quality results have been benchmarked against the South African National Standards (SANS) 241: 2015, drinking water standards. This part of SANS 241 specifies the quality of acceptable drinking water, defined in terms of microbiological, physical, aesthetic and chemical determinants, at the point of delivery. Water that complies with this part of SANS 241 is deemed to present an acceptable health risk for lifetime consumption (this implies an average consumption of 2 litre of water per day for 70 years by a person that weighs 60 kg).

The results were also benchmarked against the In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment as the project area lies within the Vaal Dam drainage region/catchment.

The predominant water use around the project area was agriculture (irrigation and livestock watering). For that reason, the results were also benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996).

The water quality guidelines describe the fitness for use of a water resource, while the Water Quality Objectives defines what management action is required for a water resource. The fitness for use of water defines how suitable the quality of water is for its intended use. The following fitness for use categories are linked to the SAWQGs:

- **Ideal –** the use of water is not affected in any way; 100% fit for use by all users at all times; desirable water quality (TWQR);
- **Acceptable –** slight to moderate problems encountered on a few occasions or for short periods of time;
- **Tolerable –** moderate to severe problems are encountered; usually for a limited period only; and
- **Unacceptable –** water cannot be used for its intended use under normal circumstances at any time (DWAF, 2006c).

The water quality results are set out in Table 9-20 (benchmark against drinking standards) and Table 9-21 (benchmark for in-stream quality).

Table 9-20: Water Quality Results Benchmarked against the SANS 241:2015 Drinking Water Quality Standards (Draft)

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
SANS241:2015	Standard limits)		5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<11	<1.5	<0.3	<0.3	<0.1	<1.5
		Date	pH	EC mS/m	TDS mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_3-N mg/L	F mg/L	Al mg/L	Fe mg/L	Mn mg/L	Ammonia mg/L
LP002		03/03/2015	6.9	8	34	7	5	5	0	5	7	0	0.2	0.1	0.0	0.0	0.00
LP004		03/03/2015	7.2	92	688	95	31	75	0	31	95	1	0.4	0.0	0.0	0.0	0.00
LP005		03/03/2015	7.5	93	708	96	31	75	0	31	96	1	0.4	0.0	0.0	0.0	0.00
LP006		03/03/2015	8.0	101	754	106	36	78	0	36	106	1	0.4	0.0	0.0	0.0	0.00
LU014		02/03/2015	7.5	113	970	124	50	65	0	50	124	0	0.4	0.0	0.0	0.0	0.00
DSW9	50th percentile	2013 to 2015	8.3	90	662	183	212	52	0	42	278	1	0.3	0.1	0.0	0.0	0.0
	95th percentile		8.8	101	1009	224	225	61	0	49	304	2	0.6	0.1	0.1	0.1	0.1
DSW42	50th percentile	2013 to 2015	8.3	74	520	158	192	26	0	35	143	1	0.1	0.1	0.0	0.0	0.0
	95th percentile		8.5	80	579	175	207	29	0	38	149	1	0.2	0.1	0.1	0.0	0.1
L1	50th percentile	Jan 2013-March 2015	7.7	90	743	96	41	32	0	19	428	2	0.5	0.0	0.0	0.1	2.9
	95th percentile		8.2	100	933	125	55	53	0	29	502	5	0.7	0.1	0.0	0.4	6.1
L2	50th percentile	Jan 2013-March 2015	7.5	88	696	84	48	37	0	17	387	1	0.6	0.0	0.0	0.1	0.2
	95th percentile		8.0	94	889	155	62	44	0	24	410	1	1.1	0.0	0.0	0.3	0.4
L3	50th percentile	Jan 2013-March 2015	7.6	114	877.0	119	38	76	0	70	415	2	0.4	0.0	0.0	1.2	2.1
	95th percentile		8.0	173	1480.0	186	54	144	0	97	719	5	0.7	0.1	0.0	9.7	4.6
W12	50th percentile	Jan 2013-March	7.8	75	460.0	59	18	57	0	36	415	75	0.4	0.0	0.1	1.4	4.0

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
SANS241:2015	**Standard limits)**		5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<11	<1.5	<0.3	<0.3	<0.1	<1.5
		Date	**pH**	**EC mS/m**	**TDS mg/L**	**Ca mg/L**	**Mg mg/L**	**Na mg/L**	**K mg/L**	**Cl mg/L**	**SO_4 mg/L**	**NO_3-N mg/L**	**F mg/L**	**Al mg/L**	**Fe mg/L**	**Mn mg/L**	**Ammonia mg/L**
	95th percentile	**2015**	8.1	82	538.2	116	22	85	0	50	719	215	0.7	0.1	0.1	3.7	18.4
W13	**50th percentile**	**Jan 2013-March 2015**	7.8	75	474.0	55	19	57	0	40	82	8	0.4	0.0	0.0	1.3	4.8
	95th percentile		8.1	82	606.0	119	25	92	0	52	236	14	0.5	0.1	0.0	3.0	19.8
W15	**50th percentile**	**Jan 2013-March 2015**	8.0	94	692.0	86	28	73	0	50	267	5	0.3	0.0	0.1	0.0	3.6
	95th percentile		8.3	107	853.6	128	48	105	0	64	310	9	0.6	0.0	0.2	0.6	6.7
Klein Wes Rietspruit			7.7	85	690	93	41	32		19	379	0.9	0.4	0.0	0.0	0.0	2.4
C2H080			7.6	103	747	98	39	80		53	322	3	0.3	0.0	0.3	0.0	1.0
DP006		**02/03/2015**	7.7	11	82	11	6.6	6	0	4	6	0	0.0	0.004	0.0	0.2	0.2
DP003		**02/03/2015**	7.0	36	306	33	23.1	14	0	65	14	0	0.0	0.021	0.0	0.2	0.2
LU009		**02/03/2015**	7.6	114	896	133	55	63	0	112	386	1	0.0	0.001	0.019	0.0	0.1
GOL2376-SW1		**25/03/2015**	7.0	5	32	3	3	3	1	5	1	0	0.3	-0.003	0.115	-0.001	0.1
GOL2376-SW2		**25/03/2015**	7.7	57	358	49	28	36	5	42	78	0	0.3	-0.003	-0.003	0.003	0.2
GOL2376-SW3		**25/03/2015**	7.9	120	764	149	50	72	11	98	417	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW4		**25/03/2015**	8.3	119	826	156	50	67	10	90	454	2	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW5		**25/03/2015**	7.8	123	862	157	46	70	13	83	494	3	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW6		**25/03/2015**	8.1	101	654	102	41	81	8	90	315	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW7		**25/03/2015**	7.6	7	48	4	4	3	1	6	1	0	0.2	-0.003	-0.003	-0.001	0.1
GOL2376-SW8		**10/07/2015**	8.4	110	777	107	43	81	5	88	362	1	0.3	-0.002	-0.004	-0.002	0.1
GOL2376-SW9		**10/07/2015**	8.3	111	790	109	44	84	6	90	372	1	0.3	-0.002	-0.004	0.196	0.1
GOL2376-SW13		**10/07/2015**	8.2	91	616	82	28	77	6	70	283	4	0.5	-0.002	-0.004	-0.002	0.1
GOL2376-SW21		**10/07/2015**	8.8	89	628	70	42	66	2	55	343	2	0.6	-0.002	-0.004	-0.002	0.0
GOL2376-SW23		**10/07/2015**	7.8	131	985	142	58	77	6	95	490	10	0.4	-0.002	-0.004	0.060	0.0
GOL2376-SW26		**10/07/2015**	8.3	117	810	126	48	73	7	109	358	1	0.4	-0.002	-0.004	-0.002	0.0

Monitoring points L3, W12, W13 and W15 have shown elevated concentrations of Manganese and Ammonia that exceed the SANS drinking water standard of 0.5 mg/L and 2 mg/L respectively. Iron was exceeded at monitoring point LU009.

Monitoring points L1, L3 and W12 indicated Sulfate concentrations of 502 mg/L, 719 mg/L and 719 mg/L respectively, which exceed the SANS drinking water standard for Sulfate (250 mg/L).

Monitoring points W12 and W13 indicated Nitrate concentrations of 215 mg/L and 14 mg/L respectively, that were higher that the SANS drinking water standard of 11 mg/L.

The Klein Wes Rietspruit monitoring point, shows elevated Sulfate concentrations (379 mg/L) and Ammonia (2.4 mg/L), which exceed the SANS drinking water standards for the mentioned parameters.

The monitoring location of the Wonderfonteinspruit directly downstream of the 1 m pipeline is represented by monitoring point C2H080. From the results the SANS drinking water standards for Sulfate had been exceeded, with the measured Sulfate quality being 322 mg/L.

Table 9-21: Water quality results benchmarked against the in-stream water quality guidelines for the Vaal Dam Catchment

Sample ID			Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F	Phosphate as PO_4	Aluminium as Al	Iron as Fe	Manganese as Mn	Magnesium as Mg
In-stream Water Quality Guidelines for the Vaal Barrage sub-catchment		**Ideal**	**<0.5**	**<5**		**<20**	**<18**	**6.5-8.5**	**<0.2**	**--**	**--**				**<8**
		Acceptable	**0.3-3**	**5-50**		**20-100**	**18-30**	**-**	**0.2-0.5**	**<0.5**	**<0.03**	**<0.3**	**<0.5**	**<0.15**	**8-30**
		Tolerable	**3-6**	**50-75**		**100-200**	**30-70**	**-**	**0.5-1.0**	**0.5-1**	**0.03-0.05**	**0.3-0.5**	**0.5-1.0**	**0.15-0.20**	**30-70**
		Unacceptable	**>6**	**>75**		**>200**	**>70**	**<6.5;>8.5**	**>1**	**>1**	**>0.05**	**>0.5**	**>1.0**	**>0.2**	**>70**
		Dates													
LP002		**03/03/2015**	18.0	4.9	0	7.2	8.3	6.9	0.0	20.0	0.2	0.1	0.0	0.0	5
LP004		**03/03/2015**	237.0	31.0	0	94.8	91.7	7.2	0.0	127.1	0.4	0.0	0.0	0.0	31
LP005		**03/03/2015**	240.0	30.8	0	96.0	93.3	7.5	0.0	126.3	0.4	0.0	0.0	0.0	31
LP006		**03/03/2015**	265.0	35.8	0	106.0	101.0	8.0	0.0	147.8	0.4	0.0	0.0	0.0	36
LU014		**02/03/2015**	310.0	49.8	0	124.0	113.0	7.5	0.0	204.2	0.4	0.0	0.0	0.0	50
DSW9	**50th percentile**	**2013 to 2015**	1.5	42.5	0	278.0	89.8	8.3	0.0	0.3	0.1	0.1	0.0	0.0	212
	95th percentile		2.0	49.1	0	303.8	100.9	8.8	0.1	0.6	0.1	0.1	0.1	0.1	225
DSW42	**50th percentile**	**2013 to 2015**	1.2	35.0	0	143.0	74.1	8.3	0.0	0.1	0.3	0.1	0.0	0.0	192
	95th percentile		1.3	38.3	0	148.8	80.2	8.5	0.1	0.2	0.3	0.1	0.1	0.0	207
L1	**50th percentile**	**Jan 2013-March 2015**	2.3	19		428	90	7.7	2.9	0.45		0.0	0.0	0.1	41
	95th percentile		5.3	29.2		502	99.8	8.24	6.1	0.74		0.1	0.0	0.4	55
L2	**50th percentile**	**Jan 2013-March 2015**	0.6	16.5		387	87.5	7.5	0.2	0.6		0.0	0.0	0.1	48
	95th percentile		0.775	24		410	93.75	7.975	0.37	1.05		0.0	0.0	0.3	62
L3	**50th percentile**	**Jan 2013-March 2015**	1.9	70		415	114	7.6	2.1	0.43		0.0	0.0	1.2	38
	95th percentile		5.45	97.4		718.8	172.8	8.04	4.6	0.745		0.1	0.0	9.7	54
W12	**50th percentile**	**Jan 2013-March 2015**	74.5	36		415	75	7.8	4	0.4		0.0	0.1	1.4	18

Sample ID			Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F	Phosphate as PO_4	Aluminium as Al	Iron as Fe	Manganese as Mn	Magnesium as Mg
	95th percentile		215.25	50.2		718.8	82.4	8.1	18.4	0.725		0.1	0.1	3.7	22
W13	**50th percentile**	**Jan 2013-March 2015**	7.8	40		82	75	7.8	4.8	0.4		0.0	0.0	1.3	19
	95th percentile		14.2	52.2		235.8	82.2	8.12	19.8	0.525		0.1	0.0	3.0	25
W15	**50th percentile**	**Jan 2013-March 2015**	5.2	50		267	94	8	3.6	0.3		0.0	0.1	0.0	28
	95th percentile		8.74	64		310	107	8.3	6.74	0.56		0.0	0.2	0.6	48
Klein Wes Rietspruit			0.9	19		379	85	7.7	2.4	0.4	0.2	0.0	0.0	0.0	41
C2H080			2.6	53		322	103	7.6	1.0	0.3	3.0	0.0	0.3	0.0	39
DP006		**02/03/2015**	0.3	3.56		5.72	10.8	7.67	0.15	0		0.004	0.0	0.2	6.6
DP003		**02/03/2015**	0.3	64.7		13.5	36	7.02	0.22	0		0.021	0.0	0.2	23.1
LU009		**02/03/2015**	1.4	112		386	114	7.63	0.08	0		0.001	0.019	0.0	55
GOL2376-SW1		**25/03/2015**	0.24	5.48	19.2	0.53	5.25	6.97	0.11	0.25	0.08	-0.003	0.115	-0.001	3
GOL2376-SW2		**25/03/2015**	0.21	41.5	205	78	56.5	7.72	0.22	0.34	0.06	-0.003	-0.003	0.003	28
GOL2376-SW3		**25/03/2015**	0.84	97.7	149	417	120	7.89	0.22	0.39	0.06	-0.003	-0.003	-0.001	50
GOL2376-SW4		**25/03/2015**	1.52	89.9	139	454	119	8.28	0.13	0.32	0.06	-0.003	-0.003	-0.001	50
GOL2376-SW5		**25/03/2015**	2.53	82.8	133	494	123	7.76	0.1	0.3	0.08	-0.003	-0.003	-0.001	46
GOL2376-SW6		**25/03/2015**	1.16	90.1	131	315	101	8.14	0.15	0.41	0.44	-0.003	-0.003	-0.001	41
GOL2376-SW7		**25/03/2015**	0.17	5.83	24.5	0.9	6.5	7.55	0.11	0.22	0.07	-0.003	-0.003	-0.001	4
GOL2376-SW8		**10/07/2015**	0.833	88.2		362	110	8.35	0.079	0.319	0.017	-0.002	-0.004	-0.002	43
GOL2376-SW9		**10/07/2015**	0.554	90.1		372	111	8.29	0.083	0.337	-0.002	-0.002	-0.004	0.196	44
GOL2376-SW13		**10/07/2015**	4	70		283	91	8.17	0.068	0.457	0.509	-0.002	-0.004	-0.002	28
GOL2376-SW21		**10/07/2015**	1.55	54.6		343	89.4	8.8	0.006	0.633	-0.002	-0.002	-0.004	-0.002	42
GOL2376-SW23		**10/07/2015**	9.86	95.1		490	131	7.82	0.009	0.353	-0.002	-0.002	-0.004	0.060	58
GOL2376-SW26		**10/07/2015**	1.19	109		358	117	8.34	0.031	0.372	-0.002	-0.002	-0.004	-0.002	48

The In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment are more stringent than the SANS 241:2015 drinking water quality standards. The surface water quality assessment thus represents a worst case scenario (use of strict Barrage WQO) as in-stream guidelines for smaller more impacted streams could potentially be less stringent for example, the new proposed RQOs for the Mooirivier allow for an EC of 110 mS/m (compared to Barrage value of 70 mS/m and sulfate values of 500 mg/L compared to the 200 mg/L for the Barrage. The in-stream guidelines for the Rietspruit in fact allows for an EC of 120 mS/m and sulfate of 500 mg/L.

In general, Sulfate, Nitrate, Electrical Conductivity, Ammonia and Fluoride indicate high concentrations that exceed the In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment at most sampling points as indicated in Table 9-21.

High pH levels that exceed the In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment (<6.5 and > 8.5) were observed at sampling sites DSW9 and SW12.

Surface water runoff draining from the Ezulwini, Cooke 4 and the Kloof mining complexes ultimately report to sampling points SW03, L2, L3 and SW05. Monitoring point SW03 located downstream of the RTSF and associated infrastructure, on the Leeuspruit, indicated a high Sulfate concentration (417 mg/L), with existing mine sampling points L2 and L3 located on the upstream tributary of the Leeuspruit measuring Sulfate concentrations of 387 mg/L and 415 mg/L respectively. Sampling point SW05, located within the Kloof mining complex, on a tributary of the Leeuspruit, indicate a Sulfate concentration of 494 mg/L.

At the Driefontein mining complex, most of the water quality monitoring points was dry, however sampling sites SW08 and SW09, taken on the upstream and downstream tributary of the Wonderfonteinspruit indicate Sulfate concentrations of 362 mg/L and 372 mg/L respectively.

Water quality monitoring points LP004, LP005, LP006, LU014 and W12 indicate high concentrations of Nitrate, with the latter four exceeding 230 mg/L. Sampling points LP004, LP005 and LP006 drain a portion of the Kloof and Driefontein mining areas, whilst LU014 and W12 drain a portion of the Kloof and Cooke mining areas.

When compared against the South African Water Quality Guidelines for Agricultural Use: Irrigation (Table 9-22), Manganese is the only chemical of concern with isolated exceedances of pH and Sodium also measured.

High pH levels exceeding the standards (<6.5 or >8.4) were observed at sampling points DSW9, DSW42 and SW21. Measurements were 8.8, 8.5 and 8.8 respectively.

Table 9-22: Water Quality Results benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996)

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
South Africa Water Quality Guidelines: Agriculture Irrigation	Ideal		<6.5 - >8.4	N/A	N/A	N/A	N/A	115	N/A	N/A	N/A	N/A	2	5	5	0.02	N/A
	Max. Allowable		<6.5 - >8.4	>540**	N/A	N/A	N/A	>460	N/A	N/A	N/A	N/A	>15.0	>20	>20	>10.0	N/A
		Date	pH	EC mS/m	TDS mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_3-N mg/L	F mg/L	Al mg/L	Fe mg/L	Mn mg/L	Ammonia mg/L
LP002		03/03/2015	6.9	8	34	7	5	5	0	5	7	0	0.2	0.1	0.0	0.0	0.00
LP004		03/03/2015	7.2	92	688	95	31	75	0	31	95	1	0.4	0.0	0.0	0.0	0.00
LP005		03/03/2015	7.5	93	708	96	31	75	0	31	96	1	0.4	0.0	0.0	0.0	0.00
LP006		03/03/2015	8.0	101	754	106	36	78	0	36	106	1	0.4	0.0	0.0	0.0	0.00
LU014		02/03/2015	7.5	113	970	124	50	65	0	50	124	0	0.4	0.0	0.0	0.0	0.00
DSW9	50th percentile	2013 to 2015	8.3	90	662	183	212	52	0	42	278	1	0.3	0.1	0.0	0.0	0.0
	95th percentile		8.8	101	1009	224	225	61	0	49	304	2	0.6	0.1	0.1	0.1	0.1
DSW42	50th percentile	2013 to 2015	8.3	74	520	158	192	26	0	35	143	1	0.1	0.1	0.0	0.0	0.0
	95th percentile		8.5	80	579	175	207	29	0	38	149	1	0.2	0.1	0.1	0.0	0.1
L1	50th percentile	Jan 2013-March 2015	7.7	90	743	96	41	32	0	19	428	2	0.5	0.0	0.0	0.1	2.9
	95th percentile		8.2	100	933	125	55	53	0	29	502	5	0.7	0.1	0.0	0.4	6.1
L2	50th percentile	Jan 2013-March 2015	7.5	88	696	84	48	37	0	17	387	1	0.6	0.0	0.0	0.1	0.2
	95th percentile		8.0	94	889	155	62	44	0	24	410	1	1.1	0.0	0.0	0.3	0.4
L3	50th percentile	Jan 2013-March 2015	7.6	114	877.0	119	38	76	0	70	415	2	0.4	0.0	0.0	1.2	2.1
	95th percentile		8.0	173	1480.0	186	54	144	0	97	719	5	0.7	0.1	0.0	9.7	4.6

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
W12	**50th percentile**	**Jan 2013-March 2015**	7.8	75	460.0	59	18	57	0	36	415	75	0.4	0.0	0.1	1.4	4.0
	95th percentile		8.1	82	538.2	116	22	85	0	50	719	215	0.7	0.1	0.1	3.7	18.4
W13	**50th percentile**	**Jan 2013-March 2015**	7.8	75	474.0	55	19	57	0	40	82	8	0.4	0.0	0.0	1.3	4.8
	95th percentile		8.1	82	606.0	119	25	92	0	52	236	14	0.5	0.1	0.0	3.0	19.8
W15	**50th percentile**	**Jan 2013-March 2015**	8.0	94	692.0	86	28	73	0	50	267	5	0.3	0.0	0.1	0.0	3.6
	95th percentile		8.3	107	853.6	128	48	105	0	64	310	9	0.6	0.0	0.2	0.6	6.7
Klein Wes Rietspruit			7.7	85	690	93	41	32		19	379	0.9	0.4	0.0	0.0	0.0	2.4
C2H080			7.6	103	747	98	39	80		53	322	2.6	0.3	0.0	0.3	0.0	1.0
DP006		**02/03/2015**	7.7	11	82	11	6.6	6	0	4	6	0	0.0	0.004	0.0	0.2	0.2
DP003		**02/03/2015**	7.0	36	306	33	23.1	14	0	65	14	0	0.0	0.021	0.0	0.2	0.2
LU009		**02/03/2015**	7.6	114	896	133	55	63	0	112	386	1	0.0	0.001	0.019	0.0	0.1
GOL2376-SW1		**25/03/2015**	7.0	5	32	3	3	3	1	5	1	0	0.3	-0.003*	0.115	-0.001*	0.1
GOL2376-SW2		**25/03/2015**	7.7	57	358	49	28	36	5	42	78	0	0.3	-0.003	-0.003	0.003	0.2
GOL2376-SW3		**25/03/2015**	7.9	120	764	149	50	72	11	98	417	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW4		**25/03/2015**	8.3	119	826	156	50	67	10	90	454	2	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW5		**25/03/2015**	7.8	123	862	157	46	70	13	83	494	3	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW6		**25/03/2015**	8.1	101	654	102	41	81	8	90	315	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW7		**25/03/2015**	7.6	7	48	4	4	3	1	6	1	0	0.2	-0.003	-0.003	-0.001	0.1
GOL2376-SW8		**10/07/2015**	8.4	110	777	107	43	81	5	88	362	1	0.3	-0.002	-0.004	-0.002	0.1
GOL2376-SW9		**10/07/2015**	8.3	111	790	109	44	84	6	90	372	1	0.3	-0.002	-0.004	0.196	0.1
GOL2376-SW13		**10/07/2015**	8.2	91	616	82	28	77	6	70	283	4	0.5	-0.002	-0.004	-0.002	0.1
GOL2376-SW21		**10/07/2015**	8.8	89	628	70	42	66	2	55	343	2	0.6	-0.002	-0.004	-0.002	0.0
GOL2376-SW23		**10/07/2015**	7.8	131	985	142	58	77	6	95	490	10	0.4	-0.002	-0.004	0.060	0.0
GOL2376-SW26		**10/07/2015**	8.3	117	810	126	48	73	7	109	358	1	0.4	-0.002	-0.004	-0.002	0.0

Manganese is a relatively abundant element, constituting approximately 0.1% of the earth's crust. It is found in solution predominantly as the manganous Mn(II) ion, which can be stabilised by complexation to humic acids. On oxidation to the manganic, ion, Mn(IV), manganese tends to precipitate out of solution to form a black hydrated oxide, which is responsible for the staining problems often associated with manganese bearing waters. Its concentration in the soil solution is largely determined by soil pH and oxidation-reduction reactions. This is further modified by sorption and desorption reactions with the soil exchange complex. Manganese is reduced (and the solubility increased) under waterlogged conditions in association with low pH (DWAF, 1996). The study area is also underlain by dolomites, commonly associated with elevated manganese concentrations in local water sources.

9.1.6.3 Overall Water Quality

The project area falls within Upper Vaal WMA 8, with major rivers and their respective tributaries draining into the Vaal River. For this reason water quality results were benchmarked against the In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment.

The overall water quality data indicated elevated concentrations of Sulfate, Nitrate, Fluoride, Manganese and Ammonia; exceeding the mentioned standards. This indicates that rivers within this area are already impacted. The project area is comprised of various land uses which includes mining, old tailings storage facilities, industrial areas, residential areas, and agricultural activities. All these land uses could possibly have contributed to the current water quality status of the identified rivers and drainages.

Ammonia occurs naturally in water bodies arising from the breakdown of nitrogenous organic and inorganic matter in soil and water, excretion by biota, reduction of the nitrogen gas in water by micro-organisms and from gas exchange with the atmosphere. It is also discharged into water bodies by some industrial processes and as a component of municipal or community waste. Higher concentrations could be an indication of organic pollution such as from domestic sewage, industrial waste and fertiliser run-off. Ammonia is therefore a useful indicator of organic pollution (Chapman, 1996). This will also contribute in high Nitrate concentrations from when microorganisms break down organic residues such as decaying plants, fertilizers, and manure.

Possible sources of chloride could be wastewater runoff, agricultural runoff, and industrial effluent.

9.1.7 Fauna & Flora

The project area falls within four vegetation types according to Mucina and Rutherford (2006) as described below and shown in Plan 15. The sections below also discuss the fauna and flora of the area.

9.1.7.1 Carltonville Dolomite Grassland

This vegetation unit mainly occurs in the North-West Province but also in Gauteng and marginally into the Free State Province. It is distributed in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province.

This vegetation occurs on slightly undulating plains dissected by prominent rocky chert ridges. It forms a complex mosaic pattern dominated by many species. Grasses such as: *Loudetia simplex* (Common Russet Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Brachiaria serrata* (Velvet Signal Grass) and *Heteropogon contortus* (Spear Grass) are prominent while shrubs such as: *Euclea undulata* (Common Guarri), *Searsia magalismontana* (Berg Taaibos), *Zanthoxylon capense* (Small Knobwood) and *Diospyros lycioides* (Bluebush) are scattered in protected places (e.g. among rocks and boulders). The geology of this vegetation unit consists of dolomites and cherts of the Malmani subgroup from the Transvaal super group.

Conservation status is currently considered vulnerable, with only a small extent conserved in statutory reserves (Sterkfontein Caves— part of the Cradle of Humankind World Heritage Site, Oog Van Malmani, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof) and in at least six private conservation areas. Almost a quarter of the vegetation type has already been transformed by cultivation, urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams. Erosion is considered to be very low (84%) and low (15%).

9.1.7.2 Gauteng Shale Mountain Bushveld

This vegetation unit occurs in Gauteng and North-West Provinces, mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia. It occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short, semi-open thicket, dominated by a variety of woody species such as: *Acacia caffra*, *Searsia leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by grasses such as: *Cymbopogon pospischilii* and *Digitaria eriantha*. Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup).

Conservation status is currently considered to be Vulnerable, statutorily conserved in Skanskop and Hartebeesthoek Nature Reserves, Magaliesburg Nature Area and Groenkloof National Park.

9.1.7.3 Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is characterised by species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High numbers of herbs belonging to the Asteraceae family are also found. In rocky areas, shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana* and *Searsia* spp.

Due to the low conservation status, this vegetation type is classified as Endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (most prominently *Acacia mearnsii*) are present in the unit.

9.1.7.4 Soweto Highveld Grassland

This vegetation unit occurs in Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North-West) Provinces. It lies in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State.

The vegetation occurs on gently to moderately undulating landscape on the Highveld plateau supporting short to medium high, dense, tufted grassland dominated almost entirely by *Themeda triandra* (Rooi grass) and accompanied by a variety of other grasses such as *Elionurus muticus* (Wire grass), *Eragrostis racemosa* (Small heart grass), *Heteropogon contortus* (Spear grass) and *Tristachya leucothrix* (Trident grass).

Only small scattered wetlands, narrow streams and occasional ridges or rocky outcrops interrupt the continuous grassland cover. The geology of the Soweto Integration consists mainly of shale, sandstone or mudstone of the Madzarinwe formation (Karoo supergroup).

The conservation status is currently considered to be Endangered, only small areas are statutorily conserved (Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves) or privately conserved (Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site). Almost half of the area already transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been flooded by dams (Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer dams). Erosion is generally very low (93%).

Plan 15: Vegetation Types

9.1.7.5 Possible Floral Species of Special Concern

The project area lies within three Quarter Degree Square (QDS) grids, namely 2627AD and 2627BC and 2627DA. According to the PRECIS, no Red Data species are expected to occur for the QDS for each of the sites.

The Plants of South Africa (http://posa.sanbi.org) website list was obtained from the South African National Biodiversity Institute (SANBI) website; it lists all the Red Data plant species officially recorded by SANBI for Quarter degree square grid. In order for a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur here. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these Plants of South Africa (POSA) lists may not be present at the sites sampled. It is therefore not unusual for species in the POSA list to be absent from the sampling sites.

Certain species included in the below list was confirmed by scrutinising previous specialist studies that were undertaken in the past. Species of Special Concern (SSC) likely to occur on site are listed in Table 9-23.

Table 9-23: Plant SSC Likely to occur on Site

Plant species	Status
Kniphofia typhoides	NT (confirmed)
Trachyandra erythrorrhiza	NT (confirmed)
Hypoxis hemerocallidea	Declining (confirmed)
Eucomis autumnalis subsp. clavata	Not Evaluated (confirmed)
Boophone disticha	*Declining*
Adromischus umbraticola subsp. umbraticola	NT
Drimia sanguinea	NT
Khadia beswickii	VU

After consultation with Lorraine Mills, the Red List Manager from Gauteng Nature Conservation, GDARD, the following species of plants were identified as having previous distribution over the study areas.

Table 9-24: Expected List of plant SSC

Plant species	Threat Status	Current Threats	Proffered habitat on site
Hypoxis hemerocallidea	Declining	Commercial exploitation, habitat loss and degradation	Open, rocky grassland, dry, stony, grassy slopes
Boophone disticha	*Declining*	habitat loss, trade, harvesting	Grassland, rocky areas
Adromischus umbraticola subsp. umbraticola	NT	South African endemic, habitat loss	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld.
Drimia sanguinea	NT	Highly poisonous bulb that has caused mass livestock mortality in the pass and was subject to frequent land clearance by farmers, hence its status	Open veld and scrubby woodland in a variety of soil types.
Khadia beswickii	VU	Habitat loss, invasive alien species (direct effects), harvesting	Yes, open shallow soil over rocks in grassland.
Kniphofia typhoides	NT	Habitat loss, plant invasion	Wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils.
Gunnera perpensa	Declining	Traditional medicine	Grassland areas.
Lithops lesliei subsp.lesliei	NT	Harvesting (gathering), specifically for commercial sale	Arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.

Fauna expected to occur on site include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats and the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassland plains and pans, with little altitudinal variation.

9.1.7.6 Amphibians

Amphibians are viewed as good indicators of changes to the whole ecosystem because they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction (Duellman and Trueb 1986). Additionally, amphibians are sensitive to water quality and ultra violet radiation because of their permeable skin (Gerlanc and Kaufman 2005). Activities such as feeding and dispersal are spent in terrestrial environments (Waddle, 2006). According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the study area should provide a number of different species of amphibians.

According to Carruthers (2001), frogs occur throughout southern Africa. A number of factors influence their distribution, and they are generally restricted to the habitat type they prefer, especially in their choice of breeding site. The choices available of these habitats coincide with different biomes, these biomes in turn, are distinguished by means of biotic and abiotic features prevalent within them. Therefore a collection of amphibians associated with the Grassland biome will all choose to breed under the prevailing biotic and abiotic features present. Further niche differentiation is encountered by means of geographic location within the biome, this differentiation includes, banks of pans, open water, inundated grasses, reed beds, trees, rivers and open ground, all of which are present within the area of interest. No previous records of amphibians that occur on site were found on the South African Reptile Conservation Assessment (SARCA) website (http://sarca.adu.org.za/). The Near threatened Giant Bullfrog (*Pyxicephalus adspersus)* is expected on site due to available habitat.

9.1.7.7 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007). Land cover is directly linked to habitats within the study area. The diversity of these habitats should give rise to many different species. According to the South African Bird Atlas Project (SABAP2), 324 species of birds have been identified in the area; the majority of these birds are comprised of Grassland species. All birds that could be present within QDS 2627 AD, 2627 BC and 2627 DA. Of these species, 10 have been assigned an international Red Data status with one Endangered, six Near Threatened, and three Vulnerable species recorded. These species are listed in Table 9-25 below.

Table 9-25: Red Data Bird Species

Common Name	Scientific Name	Red Data Status
Maccoa duck	*Oxyura maccoa*	Near threatened
Lesser flamingo	*Phoenicopterus minor*	Near threatened
Grass owl	*Tyto capensis*	Vulnerable
Black winged pratincole	*Glareola nordmanni*	Near threatened
Blue Korhaan	*Eupodotis caerulescens*	Near threatened
European Roller	*Coracias garrulus*	Near threatened
Pallid Harrier	*Circus macrourus*	Near threatened
White Backed Vulture	*Gyps africanus*	Endangered
Cape Vulture	*Gyps coprotheres*	Vulnerable
Secretarybird	*Sagittarius serpentarius*	Vulnerable

9.1.7.8 Invertebrates

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. Red Data species expected to occur on site are the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis VU*) and Highveld Blue (*Lepidochrysops praeterita EN*).

9.1.7.9 Mammals

A database search for mammal species that have been recorded in the three QDS grids (2627 AD, 2627 BC and 2627 DA) on the virtual museum of the Animal Demography Unit (ADU) (http://www.adu.org.za). This database forms part of the Department of Biological Science at the University of Cape Town. No recent records of mammals have been recorded in the study area. Mammal species that have been recorded in the Gauteng Province, and could possibly occur in the area of interest are discussed below.

Mammal species expected to occur in the area of interest include 5 species Table 9-26 as per ADU database searches. The variety of vegetation types occurring in the area of interest ensures an ecologically diverse assemblage of plant species which in turn could support a variety of mammal species, therefore the current expected species list could be more extensive than is currently thought.

Table 9-26: Expected Mammal Species

Family	Genus	Common name	Red list category
Sciuridae	*Xerus (Geosciurus) inauris*	South African Ground Squirrel	LC
Bovidae	*Taurotragus oryx*	Eland	LC
Bovidae	*Hippotragus niger*	Sable	LC
Bovidae	*Antidorcas marsupialis*	Springbuck	LC
Bovidae	*Kobus ellipsiprymnus*	Water Buck	LC

9.1.7.10 Reptiles

Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result reptiles are dependent on environmental heat sources. Due to this many reptiles regulate their body temperature by basking in the sun, or in warmer areas. Substrate is an important factor determining which habitats are suitable for which species of reptile. The presence of few rocky out crops within the study area is could mean few reptile species are present.

According the Animal demography unit's virtual museum a total of 40 species have been recorded in this QDS in the past (http://sarca.adu.org.za/). These species are listed in Table 9-27. Four species in this list are designated as endemic.

Table 9-27: Expected Reptiles

Genus	Species	Common name	Status	Endemic
Agama	*Aculeate, distanti*	Distant's Ground Agama	NE	Yes
Agama	*atra*	Southern Rock Agama	NE	0
Aparallactus	*capensis*	Black-headed Centipede-eater	NE	0
Rhinotyphlops	*lalandei*	Delalande's Beaked Blind Snake	NE	Yes
Crotaphopeltis	*hotamboeia*	Red-lipped Snake	NE	0
Boaedon	*capensis*	Brown House Snake	NE	0
Dasypeltis	*scabra*	Rhombic Egg-eater	NE	0
Lamprophis	*aurora*	Aurora House Snake	NE	Yes
Pachydactylus	*affinis*	Transvaal Gecko	NE	Yes
Pachydactylus	*capensis*	Cape Gecko	NE	0
Gerrhosaurus	*flavigularis*	Yellow-throated Plated Lizard	NE	0

9.1.8 Aquatics

Within the quaternary catchments (as identified in the surface water baseline section), a total of nine river systems will be affected by the proposed project and a total of 13 Sub Quaternary Reaches (SQRs).

Based on the findings of the specific baseline information for each SQR potentially affected by this project, the majority of river systems are largely modified with the Present Ecological State (PES) of these systems ranging from Class D to Class E. The modification of these systems is largely attributed to the location of the sources of the associated river systems. The sources of the river systems are located within urban and industrial areas and as such, associated impacts to instream and riparian conditions have resulted in the large modification of the systems. Consequently, aquatic biota is considered to be of low importance with low sensitivities within these systems.

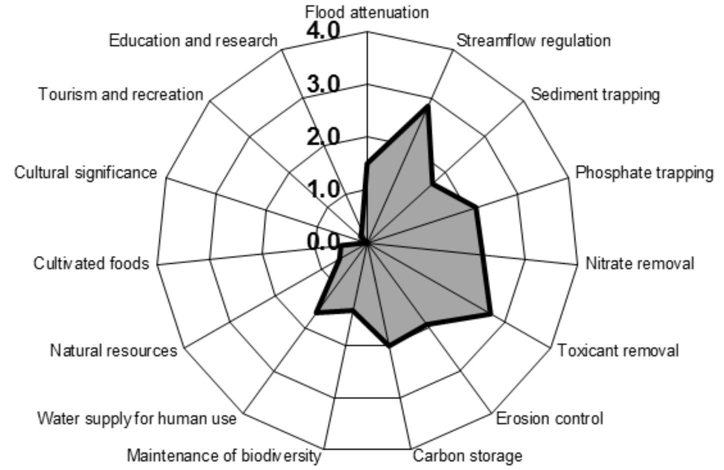
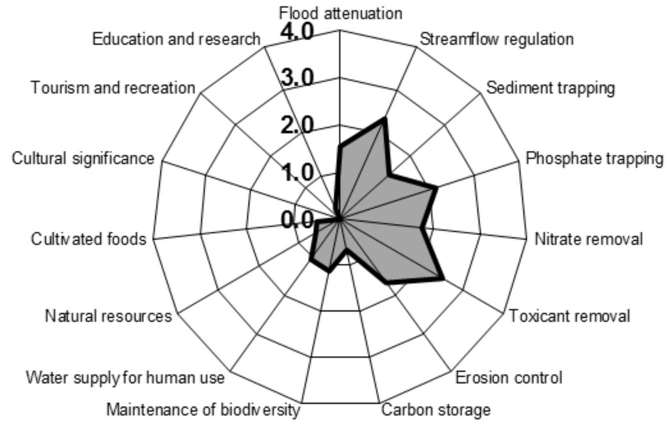
Dominant existing instream impacts within the project area include impoundments, water quality modification (industrial runoff), sewage effluent and solid waste disposal. Riparian impacts in the included vegetation removal, channel and bed modification and urban/industrial encroachment. Overall, only moderately important and sensitive aquatic ecosystems were found (based on desktop information) with no red data aquatic taxa excepted to be present.

9.1.9 Wetlands

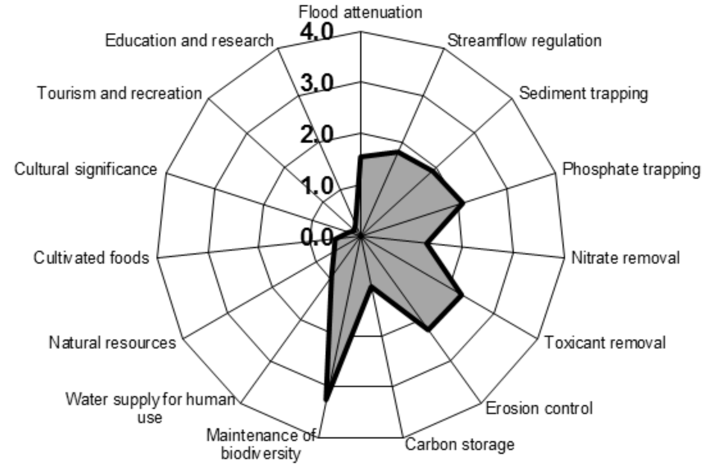
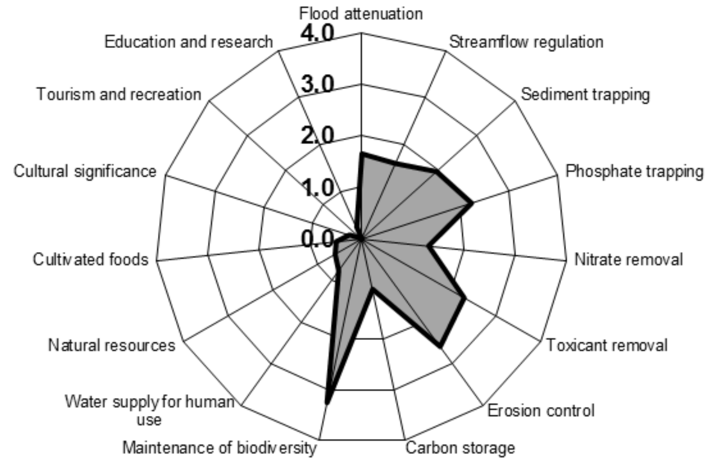
The WRTRP area spans over several quaternary catchments and therefore is characterised by several different watercourses as summarised in the surface water section above. There are several information layers that have fed into the desktop analysis of the wetlands for the WRTRP. The area is found to have many valley bottom systems which mostly correlate to the rivers and their tributaries. These systems are both channelled and unchannelled. There are also multiple pan systems occurring at multiple parts in the landscape.

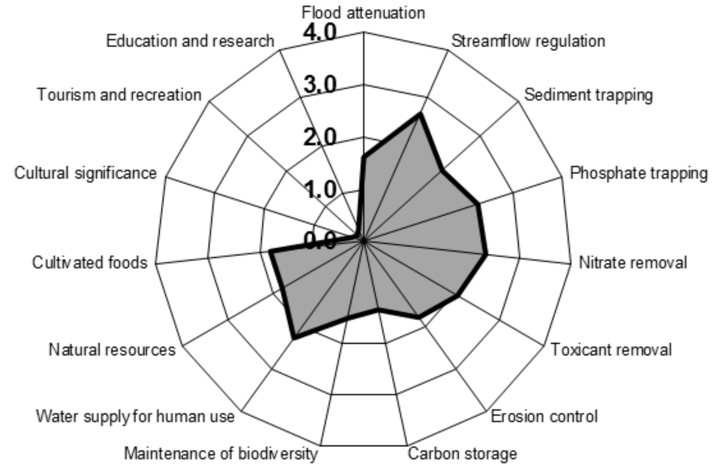
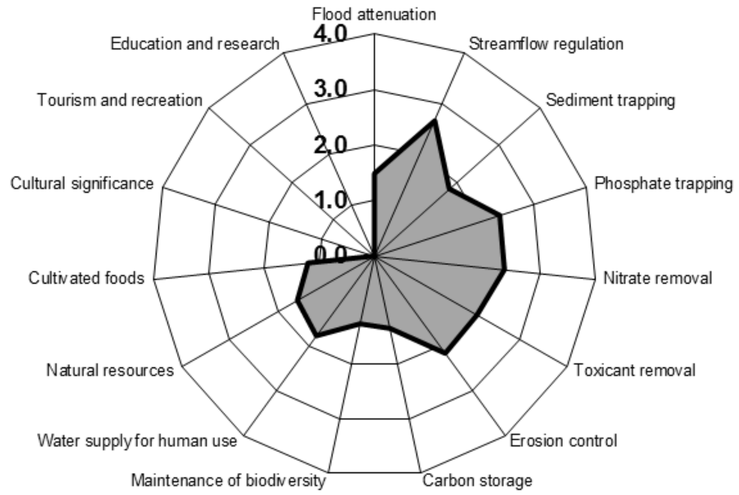
The majority of river systems associated with the project area are largely modified. The modification of these systems is largely attributed to the location of the sources of the associated river systems, which are located within urban and industrial areas and associated impacts to instream and riparian conditions have resulted in the large modification of the systems. The project area is characterised by the valley bottom systems associated with the Wonderfonteinspruit, Leeuspruit, Loopspruit and other tributaries. In addition, in the midslopes and valley heads of the catchments, there are pan and seep systems associated with the landscapes. The NFEPA wetlands within the project area are shown in Plan 16 and the wetlands associated with the RTSF in Plan 17. Table 9-28 serves as a comprehensive summary of the wetlands assessed in the Project areas.

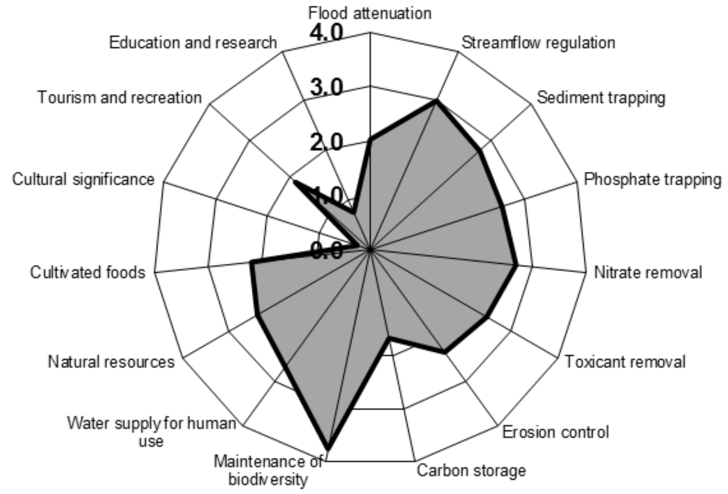
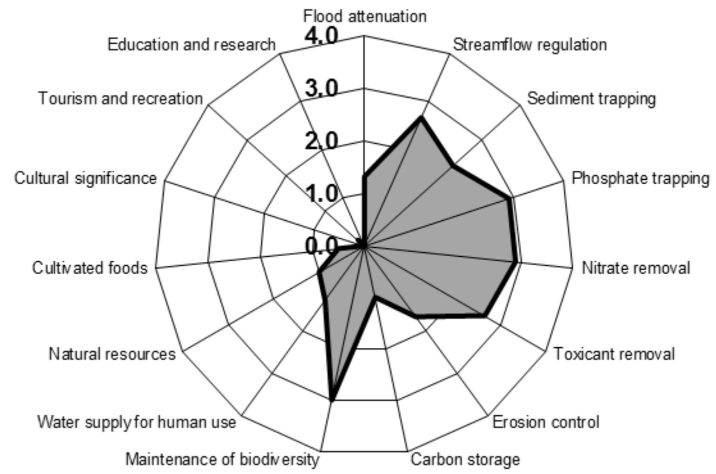
Table 9-28: Summary of Wetland Findings in WRTRP Area

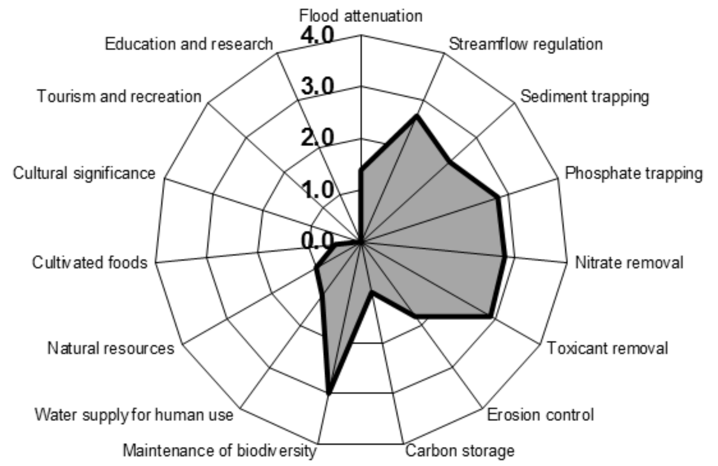
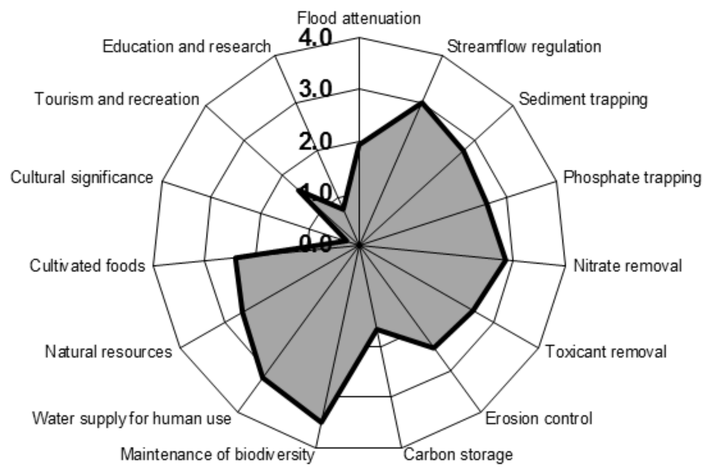
Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23E	1	CVB	Drie	40.9	This is a small unnamed stream flowing northwards past the western side of the Driefontein 5 TSF. This wetland has been significantly impacted upon by the mining activities immediately adjacent to the wetland. Water quality has therefore been significantly compromised. The wetland hydrology has been altered due to the establishment of numerous farm dams. Parts of the wetland have been significantly impacted by colonisation of alien species, particularly Acacia mearnsii (Black Wattle). With regard to ecological sensitivity, no Red Data species were recorded in this wetland area and there is no suitable habitat to support such species. Further to this, due to the general transformation of habitat, significant natural features were absent. This wetland still serves an important role in streamflow regulation.	E 6.2	Low 1.0	
	2	VB	RC1	17.1	This is a small unnamed stream flowing northwards past the western side of the Driefontein 3 TSF . This wetland has been largely impacted on through drainage modifications, vegetation removal due to historical mining activities and part of the upstream wetland has been completely destroyed through mining. Given the severity of the impacts to this wetland, the services provided by the wetland are low and therefore the importance and sensitivity is low. The EcoServices too are not significant. This wetland would require significant rehabilitation measures to restore functionality. The pipeline from D5 to D3 TSF will cross over this wetland. This pipeline then continues on from D3 towards the WBT and follows along the R501 road. Coming from the opposite direction are two additional pipelines bringing water from the BWSF (found with the WBT); these too will cross the wetland. These pipelines in addition cross over two artificial drainage lines that have been put in place to manage water within these highly impacted areas such as the two TSF's. These are not delineated as wetlands. Similarly, the PCDs associated with the TSFs are not delineated as wetlands.	E 6.8	Low 1.0	

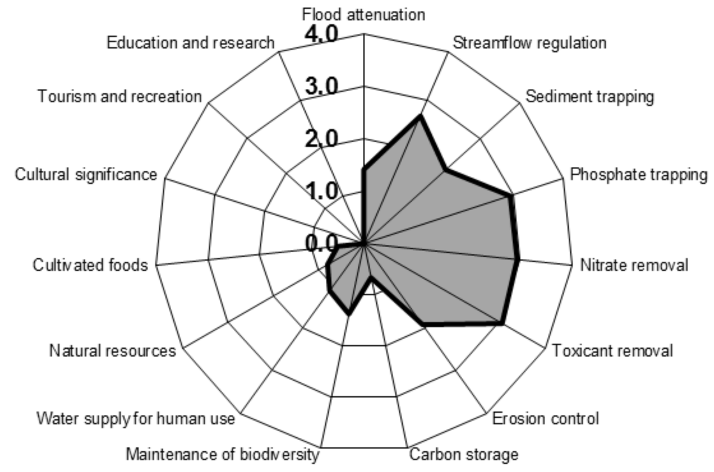
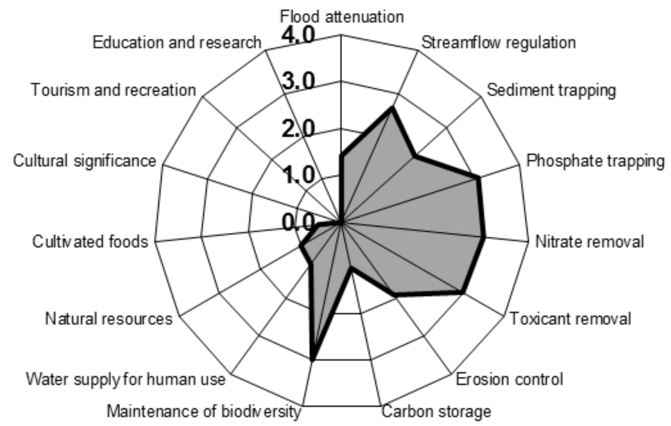
[3] This refers to the code used for the WULA per wetland/ stream being a crossing (RC) or just within 500m of the wetland (WB). This is subject to change and those changes may not be captured in this report.

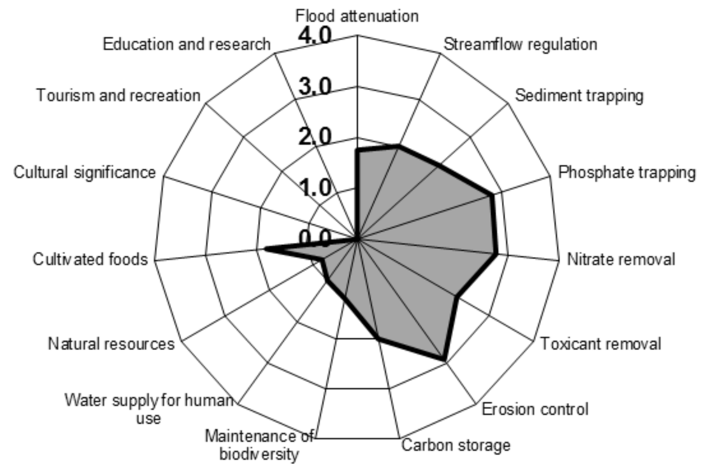
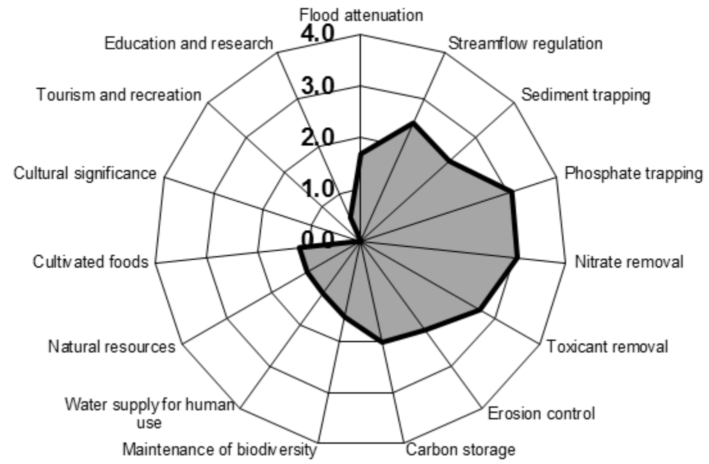
Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	3a	Pan	RC23	4.7	This is a small pan found in the bend of the R501 road, approximately 230m wide by 310m in the longest reach. It is a very shallow depression as it is found on a thick layer of hard plinthite (ferricrete). The dominant wetland indicator grass species were Snowflake Grass (*Andropogon eucomis)* and Golden Bristle Grass (*Setaria sphacelata* var. *sericea*). The Giant Bullfrog (Pyxicephalus adspersus) has been recorded in this pan based on the Driefontein Biodiversity Assessment Report (NSS, 2009). This pan is delineated as an NFEPA wetland, designated as an artificial hillslope seep. The pan has been significantly impacted as the plinthite has been quarried, most likely leading to deeper depression than that which naturally occurred. Within the wetland and the immediate catchment, unnatural depressions due to the collapse of unconsolidated strata are present due to the historical underground mining of gold. This remains a risk due to the presence of unstable dolomite layers in the area. The vegetation, although mostly intact, showed low diversity and signs of over grazing. Given the reports of the Giant Bullfrog as well as the rarity of the wetland type, this wetland is important for the maintenance of biodiversity. The EIS score however was determined to be low as the wetland itself has been significantly impacted upon and it is found within a highly impacted catchment. Despite the wetland not being in pristine condition, it remains important for conservation purposes. The proposed pipeline from the D3 TSF will run past along the farm road just south of the pan. The pipeline in running eastwards towards the WBT, which is to be placed within immediate surroundings. Coming from the opposite direction are the pipelines carrying water from the BWSF (found together with the WBT) to D5 and D3 TSFs.	D 4.5	Low 1.0	
	3b	Pan	RC24 WBT3	2.7	This, too, is a small pan found in the bend of the R501 road, located 230m east of the pan Wetland 3a. This wetland is approximately 55m in width with a length of almost 450m; giving it an atypical shape. The dominant wetland indicator grass species was Red Autumn Grass (*Schizocarium sanguineum*) and Snowflake Grass (*Andropogon eucomis)*. The hydrology of the pan has been impacted by the surrounding land-use, predominantly road construction and farming as well as potentially from undermining. The native invasive and indicator of overgrazed/ overused grassland, Bankrupt Bush (*Seriphium plumosum),* was present in this wetland and its immediate catchment. This pan was found to be intact with regard to geomorphology. Due to the HGM unit being that of a threatened wetland, as well as due to an intact vegetation component, this wetland was seen to be important for maintenance of biodiversity. The EIS score however was determined to be low as the wetland is found within a highly impacted catchment. The proposed placement of the WBT and the BWSF is within this wetland. The pipeline containing tailings slurry from D5 and D3 TSFs reports to the WBT. The BWSF receives water from a pipeline coming from the K10 shaft water supply. From the WBT, a pipeline is designated to carry the thickened slurry to the CPP. There are two alternative routes that this pipeline is designated to follow.	D 4.0	Low 1.0	

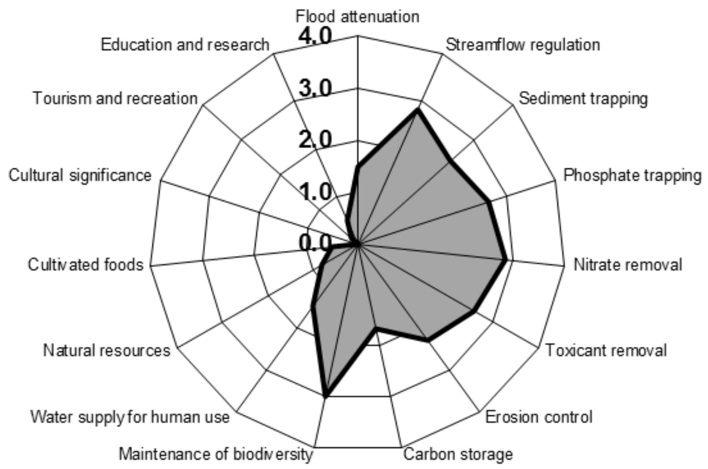
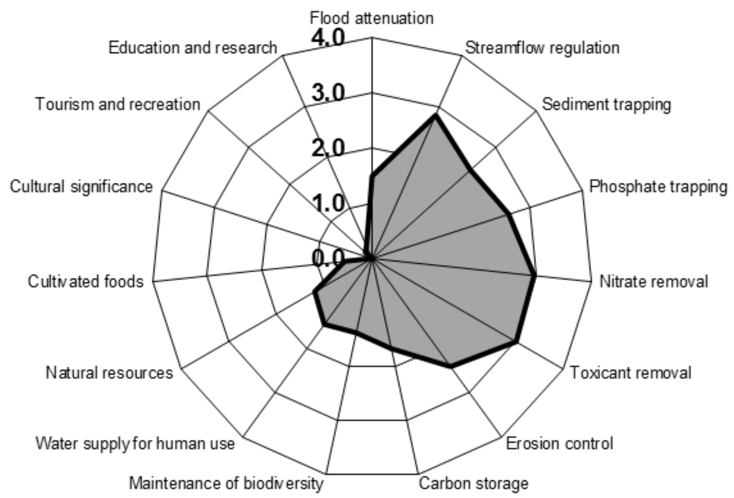
Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23D	4	VB	RC2 RC3 RC27	154.3	This is an unchannelled valley bottom system associated with the Bank Fault Spruit, which leads to the Wonderfonteinspruit. The wetland indicator grass species present was Red Autumn Grass (*Schizocarium sanguineum*) and Garden Bristle Grass (*Setaria pumila).* The natural vegetation wetland indicators, however, were difficult to identify in many places due to the land-use impacts that have led to long-term vegetation changes, which mainly included grazing and intense agriculture. The wetland and its immediate catchment are dominated by farming activities that have significantly impacted on the natural vegetation. The farming activities mainly include maize (*Zea mays*) crops and cattle farming. In addition, this wetland has been affected by surrounding infrastructure (including a large sub-station) and damming of the water flow. The common invasive species of impacted wetlands, Garden Cosmos (*Cosmos bipinnatus*), is dominant in many parts of the wetland. The most important service provided by this wetland is that of streamflow regulation as it is associated with the Bank Fault Spruit. The wetland is highly transformed from its natural state with respect to hydrology and vegetation and therefore plays little to no role in maintenance of biodiversity. The wetland has therefore scored low on the EIS rating. This wetland will potentially interact with two pipelines of the project, being the tailings pipeline from the WBT to the CPP and the water pipeline running along the R501 from K10 shaft to the BWSF. The tailings pipeline to the CPP has two alternative routes; both routes are designated to cross this wetland.	D 5.6	Low 1.0	
	5	VB	RC20	25.1	This is a small unchannelled valley bottom wetland, which appears to be a leading towards Wetland 4, which leads to the Wonderfonteinspruit. Wetland vegetation found in this wetland includes Common Reed (*Phragmites australis*) and Yellow Nut Sedge (*Cyperus esculentus*). Part of this wetland has been delineated as an NFEPA wetland and characterised as a natural hillslope seep. This wetland has been significantly impacted upon by multiple surrounding land-uses, including pipeline routes, roads and farming. A water pipeline is crossing this wetland, which runs through a maize farm, and not only does this pipeline impact on the wetland by traversing through it, the pipeline was recorded to be leaking. The pipe has been leaking for a long time through investigation of historical imagery and this has led to the wetland being wider below the leak. This has also led to permanently wet conditions being created that may not be present naturally. Upstream of this wetland there are mining activities, which appear to be discharging water into this wetland as well through a culvert under the N12 national road. This too had led to unnatural permanently wet conditions and a potential decrease in water quality. The hydrology therefore has been significantly impacted. The vegetation has also been altered significantly from the natural state as much of the wetland is now under maize farming and other areas are dominated by *Phragmites australis.* The wetland is highly transformed from its natural state with respect to hydrology and vegetation and therefore plays little to no role in maintenance of biodiversity. The wetland has therefore scored low on the EIS rating. Streamflow regulation is the major service provided by this wetland. This wetland will interact with the proposed route of the water pipeline that runs along the R501 road from the K10 shaft to the BWSF. This same area of contact is had with the alternative route for the tailings pipeline from the WBT to the CPP.	E 6.1	Low 1.0	

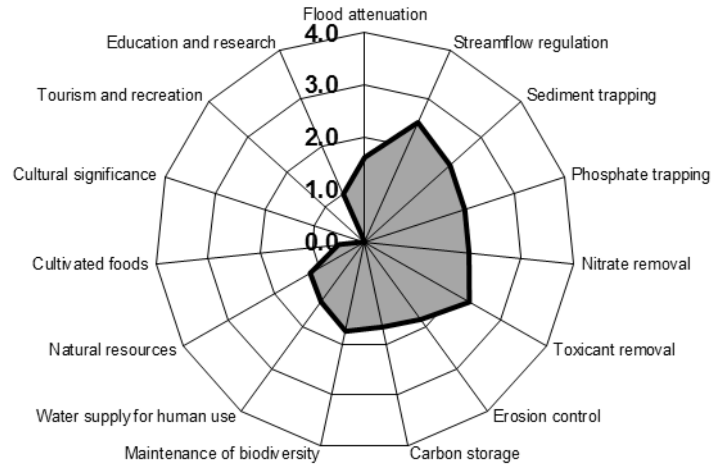
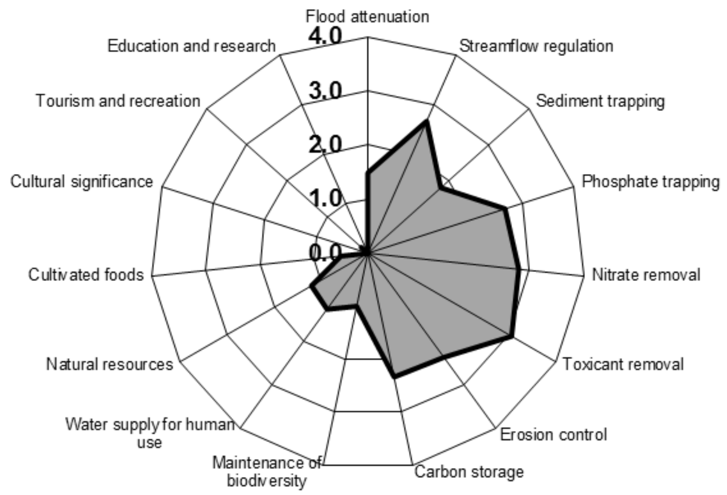
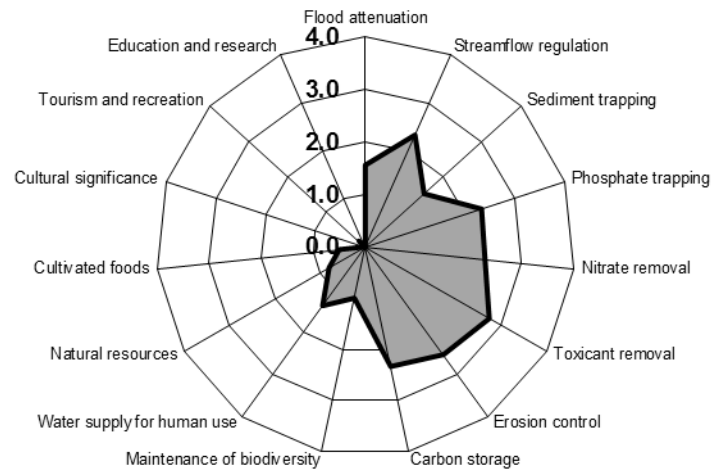
Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23J	6	CVB	RC4 RC5	50.3	This is a long and narrow channelled valley bottom wetland associated with the Loop Spruit River. The upper reaches are very steep as they are in the ravines characteristic of upper catchment areas. Wetland vegetation recorded in the studied transects included Common Reed *(Phragmites australis*) and Common Rush (*Juncus effuses)*. Mine water is being released into the stream and wetland at the coordinates: longitude 26°25'53.45"S; latitude 27°33'9.40"E. (this was not investigated further). The wetlands hydrology as well as natural vegetation has been impacted upon mainly from farming and damming of the river at the base of the steep areas as well as due to the rtelaease of treated mine water. A large dam exists just below the water release, after which extensive farming becomes dominant adjacent to the river and extended into the wetland as well. The wetland is greatly utilised by the land owners. Alien invasive plants are also a problem in the catchment and the wetland, including Black Wattle (*Acacia mearnsii).* This wetland, although not in a pristine condition, has been scored a moderate importance and sensitivity. There is habitat within the upper reaches that are suitable for species of special concern and therefore is very important for maintenance of biodiversity. The wetland also forms an important role in the ecological services of streamflow regulation and trapping of sediments, phosphates and nitrates. The pipeline from the WBT to the CPP is designated to run along farm roads that traverse this wetland in two places; one just below the N12 national road and one at the spring.	D 5.9	Moderate 2.0	
	7a	VB	RC6	12.6	This is a small unchannelled wetland leading to the Loop Spruit, namely Wetland 6. At the confluence to the river, it is characterised by Common Bulrush (*Typha capensis*). This wetland appears to originate artificially from a mine water pipeline output (similar to that of Wetland 6) at longitude 26°26'0.90"S; latitude 27°33'45.14"E. A small dam wall has been put in place to collect water. The hydrology and geomorphology has been highly impacted due to the pump and dam placed at the origin as well as due to the presence of drainage network found below this dam. This area too has been overgrazed and thus the natural vegetation has been significantly altered. The alien and invasive grass species Kikuyu (*Pennisetum clandestinum*) has colonised most of this area. As an unchannelled wetland feeding a river system, this wetland is important for streamflow regulation. Additionally, due to the surrounding inputs of nitrates and sediment from the surrounding land-use activities (such as cattle grazing and dirt road infrastructure), the wetland would play a role in trapping of these inputs. The EIS was scored to be low due to the current impacts as well as the surrounding land-uses. The proposed tailings pipeline, which continues on from crossing the Loop Spruit, is located along the farm road approximately 50m from the origin of this wetland.	D 5.2	Low 1.0	

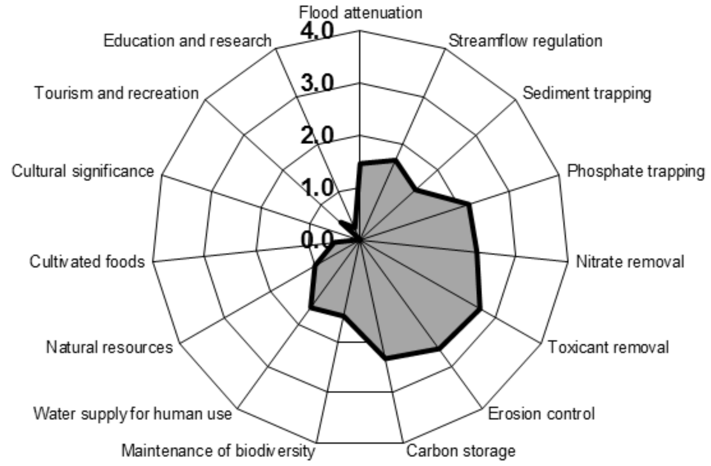
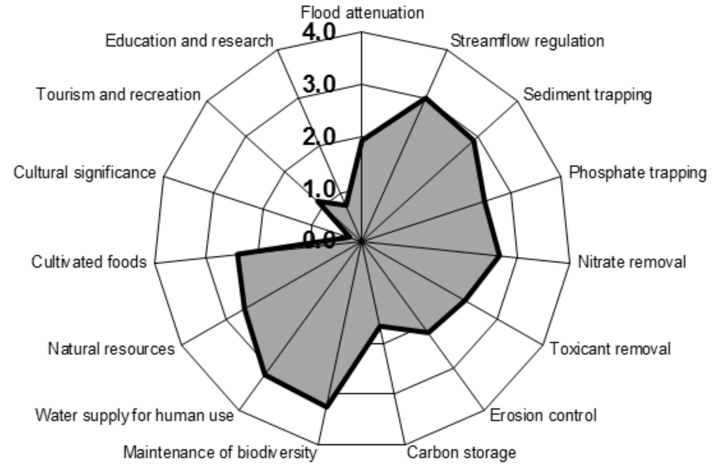
Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	7b	VB	RC7	54.9	This is an unchannelled valley bottom wetland, similarly and in parallel to Wetland 7a that is designated as a tributary of the Loop Spruit, also to Wetland 6. This wetland is greatly impacted by overgrazing and thus is dominated by invasive vegetation such as Garden Cosmos (*Cosmos bipinnatus*), *Verbena bonariensis and* Kikuyu Grass (*Pennisetum clandestinum*). Additionally, this wetland is significantly impacted by mining and industrial activities immediately adjacent to it. This has greatly affected the quality of the water due to seepage from the mining impacted environment. The importance and sensitivity of this wetland was found to be low, despite playing a role in biodiversity maintenance and streamflow regulation. Additionally, due to the surrounding inputs of toxicants and sediment from mining and industrial activities, the wetland would play a role in removal of these. Similarly to Wetland 7a, the proposed preferred route for the tailings pipeline continues on along the top of these wetlands, crossing through this wetland in one location, towards the CPP.	D 4.8	Low 1.0	
C22J	8	CVB	RC9 RC12 RC19 RC26	754.2	This is channelled valley bottom system associated with the Leeuspruit. Wetland vegetation recorded in the studied transects included Common Reed (*Phragmites australis),* Common Bulrush (*Typha capensis*) and Common Rush (*Juncus effuses).* This river and wetland are greatly impacted by the surrounding mining and industrial activities as well as farming practices. This includes impacts to the hydrology due to the river being dammed multiple times in the upper reaches, as well as significant impacts to the natural vegetation as dense stands of alien invasive trees are present within the wetland and the catchment, mainly Black Wattle (*Acacia mearnsii*). The industrial and agricultural land-uses in the catchment of the Leeuspruit have led to the water quality being significantly compromised as well as over sedimentation occurring as erosion is a problem.This therefore leads to the characteristic dominance of parts of the wetland and stream by the Common Reed (*Phragmites australis)* and Common Bulrush (*Typha capensis*). The EIS of this wetland was determined to be moderate as the Leeuspruit is an important tributary to the Vaal River. The system therefore plays an important role in water supply for human use. There is diversity still within the system that would support important species and thus the wetland plays a role in the maintenance of biodiversity. As a main river system, the wetland is also playing an important service for streamflow regulation and trapping of sediments. Although this wetland has received a low health state of D (largely modified), it is still a very important wetland and river and all efforts to protect and rehabilitate it should be done. This wetland and river interacts with the proposed infrastructure on more than one occurrence. Firstly, the pipeline continues from the interaction with Wetland 7b to reach the CPP that is found in close proximity to this wetland, which interacts with a wetland tributary to the Leeuspruit, see Wetland 9b. From the CPP, a pipeline containing the waste will run southwards, crossing over this wetland towards the new RTSF location, which is found adjacent to this wetland further downstream. The RTSF and the associated PCD is proposed to be immediately southwest of this wetland; between this wetland and Wetland 11. This wetland is delineated as a large connected river and channelled tributaries and therefore is the wetland that is to be the most interacted with for the proposed project infrastructure.	D 5.3	Moderate 2.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	9a	**VB**	RC8	22.1	This is an unchannelled valley bottom wetland leading eastwards towards Wetland 8, associated with the Leeuspruit. This wetland has been significantly impacted by the surrounding land-uses, which are dominated by mining and related activities, industrial activities, farming and grazing as well as road infrastructure. Through analysis of historical imagery, there is evidence of mining of this wetland. Upon investigation with a hand auger, it was found that a layer of approximately 10cm of tailings material is found within the soil profile. Planted rows of grasses indicate that this area has undergone rehabilitation. Further downstream, this wetland has been dammed many times before it reaches the Leeuspruit main channel, Wetland 8. All aspects of this wetland, being hydrology, geomorphology and the natural vegetation have been significantly impacted in parts of this wetland. Given the above described impacts, the wetland was found to be of a low importance and sensitivity and a health state of E (significantly modified). The ecological services provided by this wetland have been compromised and thus it plays a small role in streamflow regulation and toxicant removal where vegetation is intact. This wetland is designated to coincide with the tailing pipeline preferred route, which continues on to reach the CPP, as mentioned in Wetland 8.	E 6.5	Low 1.0	
	9b	**VB**	RC10 RC11	49.8	This wetland consists of two unchannelled valley bottom wetlands, leading westwards towards Wetland 8, associated with the Leeuspruit. The natural vegetation of the wetlands is impacted by the surrounding land uses which are predominantly cattle grazing, infrastructure and mining related activities. An existing pipeline runs through both the wetlands and was found to be leaking at a point in the one wetland at latitude 26°25'6.25"S; longitude 27°36'46.69"E. The pipe appears to have been leaking for a significant time period through investigation of historical imagery. This has also led to permanently wet conditions being created that may not be present naturally, thus altering the natural hydrological conditions of the wetland. Industrial activities and infrastructure is found upstream of and around these wetlands; which include a TSF, substation and processing plant; this impacts on the water quality. Due to the current impacts, the wetlands were found to be of low ecological importance and their main ecological services provided are trapping and some removal of the toxicants and sediments that are unnatural fed to this system due to the surround land-use impacts. The wetland, too, would play a role in maintenance of biodiversity as it is a sensitive ecological system and is a tributary of the Leeuspruit. These wetlands will be impacted by the proposed placement of the CPP as well as the pipelines leading to and from the CPP. 11.0 ha is designated to be removed by placement of the CPP.	D 5.2	Low 1.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	10	**PAN**	PAN1 to PAN5	38.5	Five pans, between 100-250m apart, form a cluster across a relatively flat topography. These pans were small and shared the same catchment. Found completely within agricultural farms of maize and sunflowers, the natural vegetation of this area has been significantly altered. This has also impacted the soil, which comprised of mostly black turf, showing limited signs of wetness. In some places, soft and hard plinthite had been displaced by the farming activities. Due to these impacts, the pans are characterised by limited natural vegetation indicators, and therefore dominated by plants such as Garden Cosmos (*Cosmos bipinnatus*) (a problem plant) and Garden Bristle Grass (*Setaria pumila*), which is a grass that dominates in disturbed places especially where water collects. These pans are largely modified and their EIS was scored to be low. Their main role is trapping of inputs and erosion control. Due to these pans being transformed hydrologically as well as having little to no natural vegetation left as they are found fully within agricultural fields, their role in biodiversity maintenance is little to none. These pans are designated to be destroyed through the placement of the new RTSF.	D 5.0	Low 1.0	
	11	**VB**	WET1 WET2	811.6	This is an extensive unchannelled valley bottom wetland system leading to the Leeuspruit. Similar to the other wetlands in this area, much of the natural vegetation has been removed and thus the remaining wetland indicator species such as Garden Cosmos (*Cosmos bipinnatus*), Yellow Nut Sedge (*Cyperus esculentus*), Garden Bristle Grass (*Setaria pumila*) and Golden Bristle Grass (*Setaria sphacelata var. sericea)*, most of which are or can be problem plants. There is a spring present in this wetland at longitude: 26°31'15.61"S; latitude 27°36'44.71"E according to the farm owner; it was not observed to be flowing at the time of assessment. This wetland is significantly impacted by the surrounding land-use of agricultural practices. Through investigation of historical imagery, a portion of this wetland has been ploughed through the entirety of the wetland width. This doesn't seem to be the case for the entire wetland length where crops are only planted up to the approximate wetland edge. Given the highly compromised hydrology of this wetland as well as very little natural vegetation remaining, this wetland is found to be low in EIS. Due to the extensive nature of this diffuse unchannelled wetland, the main ecological services it provides is streamflow regulation (as it leads towards the Leeuspruit) and phosphate and nitrate trapping. This wetland is immediately adjacent to the placement of the new RTSF. Some small upper parts of the wetland, 4.4 ha, will be removed as it falls within the footprint.	D 5.2	Low 1.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	12	**CVB**	RC13 RC14 WB3	128.4	This is a channelled valley bottom wetland and is a tributary of the Leeuspruit River. This is a long wetland unit and the characteristics vary along the wetland. The banks of the channel and valley wetland are characterised by wetland indicators such as Common Bulrush (*Typha capensis*) and Cottonwool Grass (*Imperata cylindrica*) in most parts; Popplar trees are found in the stream in the southern extent near the confluence with main Leeuspruit River, where *Knifofia ensilfolia* was found to occur as well. The hydrology of and water quality entering into this wetland is impacted by the surrounding land use, which mainly includes agriculture, grazing, damming and some mining activity. These impacts continue throughout the wetland length. The natural vegetation of the wetland and its local catchment is impacted upon significantly by grazing as well as alien and invasive species, mainly Black Wattle (*Acacia mearnsii*), *Seriphium plumosum* (Banktrupt Bush) and *Verbena bonariensis*. The Common Bulrush (*Typha capensis*) has become dominant in long stretches of the stream. Being a tributary of the Leeuspruit, this wetland serves the purpose of streamflow regulation as well as biodiversity maintenance; even thought his wetland is not in a pristine condition. Given the many current impacts to the ecological catchment, the EIS was determined to be low. Nitrate and toxicant removal as well as phosphate trapping were found to be important ecological services provided by the wetland. This wetland is involved with two pipeline routes: The proposed pipeline that will transport the uranium rich slurry from the CPP to the Ezulwini uranium treatment plant is designated to traverse this wetland on two occasions. These crossings (RC13 and RC14) follow existing roads and bridges, however these will need to be upgraded and improved; especially RC14 and it is in very poor condition. The proposed pipeline transporting the tailings material from the CPP to the RTSF is within 500m (WB3) of this wetland as it follows towards and crosses over the Leeuspruit (see Wetland 8).	D 5.8	Low 1.0	
	13	**CVB**	RC15	12.0	This is a small channelled valley bottom wetland, linked to the Kariega tributary of the Leeuspruit River. The Common Bulrush (*Typha capensis*) is a main wetland indicator found in this wetland and it has become dominant in long stretches of the stream. This wetland is significantly impacted upon from the mining infrastructure and industrial activities that have been built in direct contact with the wetland. This has had major negative effects on the natural hydrological and geomorphological state of the wetland. In addition the vegetation has been altered significantly from its natural condition in many parts with alien plants present; including Black Wattle (*Acacia mearnsii*) and *Eucalyptus* sp. Agricultural transformation of the wetland vegetation is also a main impact, mostly downstream of the delineated wetland. This has led to the wetland being scored and E, being significantly impacted. Given the above, the wetland was determined to have an EIS of low. The wetland serves little to no role in biodiversity maintenance; however the wetland is still important for streamflow regulation as well as removal of toxicants and nitrate inputs. The proposed pipeline that will transport the uranium rich slurry form the CPP to the Ezulwini uranium treatment plant is designated to traverse this wetland. The proposed route follows an existing pipeline servitude.	E 6.1	Low 1.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	14a	**CVB**	WB1 WB2	20.6	This is a narrow channelled valley bottom wetland that is characterised as a tributary of the Leeuspruit. Typical of impacted wetlands in this catchment, the Cape Bullrush (*Typha capensis*) is a main wetland indicator and has become dominant in much of the stream. The catchment and wetland is used for grazing and is also open for local community use, although privately owned. The health of this wetland was found to be a D, largely modified, due to the impacts instream as well as in the surrounding catchment. These include grazing, agriculture, dense alien trees, erosion as well as some mining activities. The EIS therefore is low but the wetland still provides some important ecological services. These are predominantly streamflow regulation and pollutant removal.	D 4.6	Low 1.0	
	14b	**CVB**	RC16 RC17	61.2	This is a continuation of the 14a channelled valley bottom wetland that is characterised as a tributary of the Leeuspruit. This wetland is a significantly impacted part of the channelled wetland and this is due to the mining and industrial activities through which this stream and wetland flows. Further upstream (Wetland 14a) and downstream of this section of wetland this wetland resembles a more natural state; however for this 3km stretch this wetland has been markedly altered; so far so that part of the wetland has been designated as artificial. The hydrology has been almost fully compromised due to the adjacent TSF and mining activities and the adjoining series of roads and pipes. The exotic species Pampus Grass (*Cortaderia selloana)* is dominant in this altered wetland. Cattle were also present within the wetland which will have an impact on water quality from the defecation and urination. This wetland is significantly impacted and therefore receives a PES of E. Additionally this wetland scored a low for EIS. The wetland will play some role in streamflow regulation and, due to the significant sources of pollution around the wetland, the wetland will assist in toxicant and nitrate removal from the system as it flows into the Leeuspruit catchment. The proposed pipeline that will transport the uranium rich slurry from the CPP to the Ezulwini uranium treatment plant is designated to traverse this wetland. The proposed route follows existing pipeline and road servitudes.	E 6.5	Low 1.0	
C22H	**15**	**VB and Dam**	RC18 RC25	92.5 ha	This is a valley bottom wetland at the top of the catchment that leads into Peter Wright Dam. This wetland is significantly impacted upon as it found at the top of the catchment where the dominant land-use is industrial and mining. This wetland is found between the Ezulwini uranium treatment plant and the Ezulwini South TSF. The hydrology of this area has been almost completely altered from its natural condition due to the surrounding industrial activity and the wetland is dammed. Water quality of this wetland is also significantly compromised as pollution sources are found immediately adjacent to these systems. Due to the described impacts, the natural vegetation is no longer present and alien and invasive trees such as Black Wattle are a major impact. Further downstream, this wetland becomes a little more natural and the major influence is the adjacent agricultural practices. Due to the above, the wetland PES has been assessed to be an E and the EIS of the wetland is determined to be low. The wetland serves little to no maintenance of biodiversity. The wetland will play a small role in streamflow regulation and, due to the significant sources of pollution around the wetland; the wetland will assist in toxicant and	E 6.9	Low 1.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
					nitrate removal from the system. There are a few proposed pipeline routes near and traversing the wetland as the uranium plant will be used and the tailing from Cooke Dump needs to get the CPP.			
C23D	16	Pan	RC22	8.9	This is a pan wetland that has been bisected by the N12 and therefore now two separate pan systems are present (although referred to as one). It is an ephemeral pan that is significantly impacted by the surrounding historical land-use. Almost no natural vegetation was present at the time of assessment due to grazing, burning and general poor condition. The wetland will be of greater significance during wet periods, where birds would be supported by the wetland. The wetland has a PES of D due to the significance of the impacts to the wetland as well as the catchment. Similarly, the EIS of this wetland was found to be low. The ecological services provided by this pan are limited; mostly playing a role an intermediate role in the removal of pollutants. The pan plays a very small role in the maintenance of biodiversity; however this could be enhanced. There is a culvert that runs under the N12 found on the eastern edge of this wetland that is to be used for the tailings pipeline from Cook Dump southwards.	D 4.7	Low 1.0	
	17	Pan	NA	9.8	This is a pan wetland east of the Cooke 2 and 3 shafts. The catchment of this pan is characterised by Dresden soil type where there is shallow topsoil over hard plinthite. This indicates that this area was an extensive wetland historically as plinthite indicates old wetland conditions. The present wetland; however is at a smaller extent than before. Similarly to other wetlands in this area, the hydrology has been significantly altered due to surround industrial and agricultural activities; this includes the release of water into the pan creating an artificially large open-water extent. The water quality appears to be significantly compromised. Cattle and agriculture have significant impacts on the natural vegetation as well on the natural state of the wetland. The dominant wetland plant is *Juncus effusus* (common rush). This wetland is outside of 500m from the tailings pipeline from Cooke dump running south.	Not assessed (outside 500m of proposed infrastructure)		
	18	CVB	WB4	372.1	This is the Wonderfonteinspruit River and wetland, which is delineated from Cooke 2 and 3 to the Cooke Dump; however it extends further than this as this is a river system. This is designated as a NFEPA wetland. The wetland is highly impacted and the Common Bulrush (*Typha capensis*) is a main wetland indicator and it has become dominant in long stretches of the river. The river and wetland has been dammed in multiple places and significant negative land uses characterise the Wonderfonteinspruit catchment and upper reaches; these include urbanisation, agriculture industrial and mining activities. Downstream of the delineation, the Wonderfonteinspruit has been piped for a significant distance. The PES of this wetland was determined to be an E due to the significance of the local and catchment scale impacts. This is in agreement with the 2013 Department of Water Affairs (DWA) data which states the upper, middle and lower Wonderfonteinspruit to be in a seriously modified state (class E). The EIS was therefore determined to be low. The wetland does play a role in providing ecological services as it is the main river draining the catchment. Despite being highly impacted, the wetland and river are important features for maintenance of biodiversity, streamflow regulation as well as removal of pollutants. All of these can be improved if the health status of the wetland is improved.	E 6.6	Low 1.0	

Catchment	Wetland and HGM unit		Interaction code[3]	Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
					The pipeline from Cooke dump containing tailings as well as the water pipeline to Cooke Dump is proposed to be within 500m of this wetland.			

Plan 16: NFEPA Wetlands

Plan 17: RTSF Wetlands

9.1.10 Topography and Visual

The proposed activities of the Cooke Mining Right Area fall within the City of Johannesburg Metropolitan Municipality. The nearest other town is Mohlakeng situated 4.6 km west-north-west of the Cooke TSF. The nearest major town is Randfontein situated 8.7 km north-west of the Cooke TSF.

The residential areas and road users near the proposed activities are all potential visual receptors of the proposed project. The closest towns and settlements, as well as their direct distance and direction from the proposed activities are summarised in Table 9-29. All distances are straight line distances measured from the edge of the proposed activities to the centre of the towns / settlements unless otherwise stated.

Table 9-29: Closest Towns and Settlements to the Cooke Mining Right Area

Name	Type	Direct Distance	Direction	Proposed Activity
Mohlakeng	Other Town	4.6 km	WNW	Cooke TSF
Bekkersdal	Other Town	5.8 km	SW	Cooke TSF
Randfontein	Major Town	8.7 km	NW	Cooke TSF
Finsbury	Other Town	9.6 km	WNW	Cooke TSF
Kocksoord	Other Town	9.9 km	WNW	Cooke TSF
Soweto	Major Town	10.7 km	E	Cooke TSF
Lenasia	Secondary Town	12 km	SE	Cooke TSF
Westonaria	Major Town	12 km	SW	Cooke TSF
Venterspos	Other Town	12.2 km	WSW	Cooke TSF
Battery	Settlement	14.5 km	NNW	Cooke TSF
Jagfontein	Settlement	14.5 km	S	Cooke TSF
Luipaardsvlei	Settlement	14.6 km	NNE	Cooke TSF
Eldorado Park	Other Town	15.4 km	SE	Cooke TSF
Hillshaven	Settlement	15.9 km	SW	Cooke TSF
Roodepoort	Major Town	16 km	NE	Cooke TSF
Krugersdorp	Major Town	16.7 km	N	Cooke TSF

Name	Type	Direct Distance	Direction	Proposed Activity
Lawley Estate	Other Town	16.7 km	SSE	Cooke TSF
Florida	Other Town	17.8 km	NE	Cooke TSF
Libanon	Settlement	17.9 km	SW	Cooke TSF
Van Wyksrust	Settlement	19.2 km	SE	Cooke TSF
Ennerdale	Other Town	19.4 km	SSE	Cooke TSF

The N12 national route is situated 6.7 km south of the Cooke TSF. The R559, R558, R28 and R41 regional roads are situated 0.65 km south-west, 4.4km east, 5.7 km west and 6 km north of the Cooke TAF respectively. Plan 4b in this document and attached in Appendix A illustrates the local setting of the Cooke Mining Right Area.

The Cooke TSF covers an area of 179.5 ha and has centre coordinates of 26° 14' 37.780" S and 27° 45' 01.066" E.

The proposed activities of the Cooke MRA fall within the Upper Vaal River catchment. The Wonderspruit River runs 0.8 km west of the Cooke TSF. The Cooke TSF is situated on a relatively flat area with a ridge to the north.

The nearest IBA is the Magaliesberg IBA situated 17.2 km north of the Cooke TSF. The Krugersdorp Municipal Nature Reserve is situated 14.4 km north, the Blougat Municipal Nature Reserve is situated 16.6 km north, the Kloofendal Municipal Nature Reserve is situated 16.3 km north-east, the Walter Sisulu National Botanical Garden is situated 17.3 km north-east and the Cradle of Humankind World Heritage Site is situated 19.4 km north of the Cooke TSF respectively. Protected areas such as nature reserves, and recreational and tourism areas are considered sensitive visual receptors.

9.1.10.1 Visual / Aesthetic Character and Topography

The topography of the Cooke MRA is undulating with ridges and valleys. The topographical model indicates that the elevation of the Cooke MRA increases from 1579 m.a.m.s.l. in the Wonderfonteinspruit River valley which runs through the MRA from north to south to 1726 m.a.m.s.l. on the ridge running east-west along the northern part of the MRA.

The majority of the project area has gentle slopes of less than 4.3°. Steeper slopes of between 4.4° and 14.1° occur in isolated areas of the Wonderfontein River valley. The steepest slopes occur on the sides of the Cooke TSF and range between 14.2° and 33.4°.

The slope aspect / direction of the Cooke MRA is not in any specific direction. The Cooke TSF is situated on a relatively flat area and the topography is expected to only provide minimal screening of the proposed activities of the Cooke MRA.

According to Mucina and Rutherford (2006) the dominant vegetation type in the area of the Cooke TSF is Carltonville Dolomite Grassland interspersed with Eastern Temperate Freshwater Wetlands while the dominant vegetation type in the area of the Cooke 4 South TSF is Gauteng Shale Mountain Bushveld. Much of the area has been transformed by residential areas, small holdings, agriculture and mining and little natural vegetation remains. The agricultural and remaining natural vegetation will only provide minimal screening of the proposed activities of the Cooke MRA.

9.1.11 Heritage

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Karst topography is characterised by underground drainage systems with sinkholes, dolines and caves. This geological phenomenon creates karst caves that can be filled with fine to coarse-grained alluvium during periodic flooding. The alluvium may be represented by bodies of breccia, sandstone and siltstone which have an increased potential to contain archaeological material. This geological feature is one of the motivating factors in implementing the proposed project. Many of the historical TSFs are at risk as the potential for sinkholes is high in some areas.

Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger area under consideration here. Stone Age lithics recorded have been found as surface scatters outside of any discernible context thereby limiting the information potential and overall significance of these resources. Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg. Only one potential stonewalled site has been identified in the routing option for the powerlines on the farm Doornpoort 347 IQ Portion 73. No other archaeological sites have been identified within the development footprint of the proposed infrastructure.

Within regional, local and site specific contexts the project is located in historically significant mining-industrial and agricultural-rural cultural landscapes (Plan 18). In terms of the mining landscape, there are several features and markers such as many of the historical TSFs created by the original mines established during the first half of the 20th century. The agricultural landscape is represented in turn by several structures and werwe that were recorded during the scoping survey completed on 16 February 2015. The potential impacts to these will be assessed during the Impact Assessment phase of the project.

Plan 18: Heritage Sensitivity

9.1.12 Socio-Economic

The West Rand DM encompasses 2 442 km^2 of the province's land mass and is predominantly rural. The main economic hubs in the DM are Krugersdorp, Randfontein, and Westonaria; the dominant land uses in the region include mining, residential, and agriculture. Developments of residential settlements are concentrated towards the east of the district, and are reflective of current developmental dynamics and historical patterns and trends. As a result of the mining activities, and due to the dolomitic nature of the land in the district, land use patterns are often dispersed. This has meant that major economic centres in the district take on a fragmented form. In addition to the significant impact mining has had on the district, tourism and conservation opportunities exist to the north and north-east of the district, while agricultural holdings in the western side of the district represent possibility for development of the agricultural sector in the region.

The dispersed main economic centres are linked by various roads and rail routes, which also provide links to areas beyond the DM. The N14 and N12 form a strong south-east and north-west linkage, while the R500 provides road connection to the north via the linkage with the N14. The R512 is the access road to Lanseria airport, and the R559 links Soweto and Randfontein.

9.1.12.1 Towns, Resources and Land Capabilities

The Westonaria LM is bordered by the Randfontein LM, Johannesburg Metropolitan Municipality, Merafong City LM, Sedibeng DM, and Emfuleni LM. The LM's residential development is generally dispersed with the dominant townships including (Plan 19):

- Westonaria;
- Bekkersdal;
- Hillshaven;
- Glenharvie;
- Venterspost;
- Simunye; and
- Mining towns such as Libanon and Waterpan.

The only significant business node occurs within Westonaria town's Central Business District (CBD); the rest of the Westonaria LM is characterised by scattered residential areas and various mining developments. The main reason for the perceived low population density in the LM is due to the dolomitic conditions in the region. Westonaria town is linked to Johannesburg via the N12; the prominent entrance point into Johannesburg from Gauteng, various developments are planned for along this route to take advantage of its strategic positioning.

The only notable agricultural holdings areas in the LM are located to the north-eastern and central parts of the district. The local government, based on the vision of a global city, or the Unicity, supports future development to the west of the LM. Development on this side of the LM would mean that the area's development follows the natural market forces, ensuring that commercial and industrial developments remain close to the current and future workforces.

The Westonaria LM's Spatial Development Framework makes mention of the fact that apart from the development potential to the west of the LM, as discussed above, the south of the LM has been demarcated for mining and conservation. The dolomitic nature of the areas located to the north of the LM make the land primarily suitable for the agricultural and mining activities. In addition to mining, the northern regions of the LM have potential for the development of small-scale or subsistence farming opportunities.

Land uses in the Merafong City LM can be categorised in three main divisions, i.e. agriculture, mining, and residential. Agriculture is the dominant land use in the LM, followed by mining and residential land uses, with the latter accounting for approximately 8% of the total land area of the LM.

The municipality's human settlements are relatively scattered due to the mining activities taking place, the prominent settlements are:

- Fochville;
- Carletonville;
- Weverdiend;
- Greenspark;
- Wedela;
- Blyplank;
- Khutsong; and
- Kokosi.

Carletonville is located to the north of the LM, which is also were the majority of the municipality's high value agricultural land is located. The Carletonville-Khutsong-Welverdiend area is also the LM's most populous region. The townships of Kokosi and Graanspark and the relatively wealthier Fochville is located to the South of the LM, with the central part of the LM being characterised by mining activities and the associated scattered housing developments. As with the rest of the Westrand mining belt, the LM's infrastructure development is hindered by the high occurrence of dolomite.

The economy of Merafong is dominated by the mining activities, which has led to the development of dispersed human settlements leading to a loss of purchasing power across the region as central town functions are not well developed in the LM.

Plan 19: Local Municipalities

9.1.12.2 Demographic Profile and Income Levels

Based on a combined population of 333 444, the Westonaria and Merafong City LMs comprise just about 40.1% of the West Rand DM's total population, which was estimated at 831 241 individuals in 2013. The average household size in the DM is 2.8. Based on Census 2011 (Stats SA, 2015), approximately 65% of households in the district are living in formal residential properties; the remaining 35% reside in informal or traditional dwellings. In South Africa, approximately 71% of households reside in formal residences (Stats SA, 2015). Traditionally, smaller household sizes are indicative of an increase in development, however, based on the relatively high number of households living in informal dwellings and considering the fact that the region is classed as a mining region it can be assumed that in this case the smaller household size is rather a result of migrant workers working or searching for opportunities, with the aim of sending money home to their families.

The male population of the West Rand DM exceeds the female population at 52% versus the 48% females residing in the region (Stats SA, 2015). The fact that 71% of the DM's population is of working age (Stats SA, 2015), i.e. between the ages of 15 and 65, could be seen as an additional indicator of the fact that the area attracts migrant workers. Moreover, in the two local municipalities within which Phase 2 of the project will be located an even higher number of individuals are of working age with 73.3% in the Westonaria LM, and 72.6% in the Merafing City LM (Stats SA, 2015).

Within the Westonaria and Merafong City LM's, the proportion of the population aged 20 and older with no education is greater than in the district, with 6.2% and 6% versus the 5.0% observed in the DM (Stats SA, 2015). Furthermore, the percentages of individuals who have obtained a matric qualification in these local municipalities are also below that of the district, province, and even South Africa.

The average income within the Westonaria and Merafong City LMs were significantly lower than that of the other study areas at R5 597 and R6 625 per month (in 2011 in current prices), respectively (based on Stats SA, 2015).

9.1.12.3 Labour Force and Employment Structure

In South Africa, the unemployment rate is defined as comprising of those individuals aged between 16 and 65 years old, actively looking for employment that are unable to find gainful opportunities; it therefore does not take into consideration discouraged job seekers. Based on Stats SA's Census 2011 data, the West Rand DM had 590 206 individuals of working age in 2011 with 3.3% of these individuals being discouraged job seekers. The situation was slightly worse in the Westonaria and Merafong City LMs, where 4.1% and 3.6% respectively of the working age population groups were discouraged job seekers; however, it was still better than at the national level where the figure was 5.5% (Stats SA, 2015).

The labour force participation rate in the West Rand DM was estimated at 56.9% in 2013. The unemployment rate in the West Rand DM was 24.4% in 2013. In the Westonaria LM, unemployment was recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%.

Between 2003 and 2013, the economy of Westonaria, due to the decline in its mining sector's production output lost over 24 thousand employment opportunities. At the same time, the Merafong City economy managed to increase its employment by over five thousand people during the same period, despite experiencing negative economic growth rate. This means that the losses in the mining sector's employment due to the contraction of that industry in the Merafong City LM were possible to offset by the increased employment in other industries.

In the West Rand DM, 75.3% of jobs are formal employment opportunities, while in the LMs formal employment opportunities comprise even a greater percentage, i.e. 81.5% and 80.5% in the Westonaria and Merafong City LMs, respectively (Quantec Research, 2015). At the same time, it is estimated that 2.4% of those employed in the West Rand DM are working in private households.

It is estimated that just about two thirds of all employment opportunities within the DM are created by the tertiary sector. Mining provides 15.0% of employment opportunities in the West Rand DM.

Within the Westonaria LM the importance of the mining sector for job security is significantly greater than in the district, as it provides 36.7% of opportunities in the LM's economy. It again shows the economy's reliance on the mining sector. In 2003, though, the mining sector contributes 74.2% of all jobs created in Westonaria; at the same time, though, the total employment in the local area was 51 409.

In the Merafong City LM, the employment structure was largely skewed towards the tertiary and mining industries. The mining sector created 42.7% of all employment opportunities in this economy in 2013 with the tertiary industries accounting for 48.8%. Unlike the situation observed in the Westonaria LM, employment in mining has increased between 2003 and 2013 despite the sector experiencing decline post 2008 period. Losses in employment in agriculture, manufacturing and finance and business service, though offset some of the employment gained during that period in mining and other industries.

9.2 Description of Current Land Uses

9.2.1 Land Use

The present land use in the region is categorized as follows (refer Plan 12):

- Cultivated;
- Natural/Grazing;
- Mined; and
- Urban built-up.

These land uses will be verified in the field survey for the EIA phase of the study.

9.2.2 Land Capability

Land capability (refer Plan 13) is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long term use of land under rain-fed conditions. An indication is also provided about the permanent limitations associated with the different land use class definitions

The land capability of the pipeline routes and RTSF and CPP sites are as follows:

- Class II (Intensive cultivation);
- Class III (Moderate cultivation); and
- Class VI (Moderate grazing).

9.3 Description of Specific Environmental Features and Infrastructure on the Site

9.3.1 Water Resources

The WRTRP area is located in the Upper Vaal WMA 8 within the quaternary catchments C23E, C23J, C23D, C22J and A21D. The Cooke Mining Right area falls within the quaternary catchments C22A and C23D. The C23D quaternary catchment area is 510 km^2 and has an MAR of 9.12 Mm^3. Runoff emanating from this quaternary catchment drains in a south westerly direction into the Wonderfonteinspruit which is the largest river in the quaternary catchment.

Water samples were taken at the surface water resources within the WRTRP area and tested against the Vaal Dam Catchment RWQO. It was noted that the surface water resources have elevated concentrations of nitrate, sulphates, chlorides, ammonia and fluoride. This is an indication of the degree to which the rivers within proximity of the project area have been impacted. The river systems in this area have been highly modified. The modification of these systems is largely attributed to the location of the sources of the associated river systems, which are located within urban and industrial areas and associated impacts to instream and riparian conditions have resulted in the large modification of the systems. It was noted that the Present Ecological Status of the river systems within the project area ranged between Class D and Class E. The monitoring location of the Wonderfonteinspruit directly downstream of the 1 m pipeline is represented by monitoring point C2H080. From the results the SANS drinking water standards for Sulfate had been exceeded, with the measured Sulfate quality being 322 mg/L.

The wetland systems found within the area are mostly valley bottom systems which mostly correlate to the rivers and their tributaries of which a majority are largely modified. These systems are both channelled and unchannelled. The project area is characterised by the valley bottom systems associated with the Wonderfonteinspruit, Leeuspruit, Loopspruit and other tributaries. There are also multiple pan systems occurring at multiple parts in the landscape.

9.3.2 Terrestrial Landscape

The land type present within the project area is dominated by red, well drained soils (Ab) which potentially occur 90 % per land type. Other common land types found within the project area include shallow stony soils and rocks (Fb) and mixed soils characterised by shallow Mispah soils, wet soils and heavy clay soils (Bb) which potentially occur 59 % per land type. Deep red and shallow stony soils (Ba) are also present on site with an expected occurrence of 47 % per land type.

The Cooke TSF site falls within the Ab7 land type which is dominated by freely draining deep red soils, most likely to be the Hutton soil form. The C4S TSF is situated in the Fb5 land type (Shallow rocky Soils, Mispah). The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Fb5 land type to the Ab7 land type. With regards to land capability, it moves from the Class VI (moderate grazing) to the Class II land capability (intensive cultivation). The Cooke TSF site was noted to be within the Class II land capability (intensive cultivation/arable), while the C4S TSF is situated in the Class VI land capability.

The project area falls within four vegetation types namely: Carltonville Dolomite Grassland; Gauteng Shale Mountain Bushveld; Rand Highveld Grassland and Soweto Highveld Grassland. According to the PRECIS, no Red Data species are expected to occur within the QDS grids for each of the sites: 2627AD; 2627BC and 2627DA. The SSC which are likely to occur on site are recorded in Table 9-23 above.

A suitable habitat is present within the project area for the occurrence of a number of different species of amphibians. The Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) however is expected on site due to the available habitat. The avifaunal species expected to occur within the project area which fall within the Red data species list and are detailed in Table 9-25 above.

9.3.3 Cultural Heritage

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Karst topography is characterised by underground drainage systems with sinkholes, dolines and caves.

This geological feature is one of the motivating factors in implementing the proposed project. Many of the historical TSFs are at risk as the potential for sinkholes is high in some areas.

Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger area under consideration here.

Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg. Only one potential stonewalled site has been identified in the routing option for the powerlines on the farm

Doornpoort 347 IQ Portion 73. No other archaeological sites have been identified within the development footprint of the proposed infrastructure.

9.3.4 Summary of Environmental Features and Infrastructure

A summary of specific environmental features and infrastructure within the project area is set out below.

- Stone Age walls were found at the proposed CPP site;
- The proposed RTSF site is adjacent to wetlands (including some isolated pans within the footprint) and there are graves within the proposed footprint;
- The Wonderfonteinspruit has been significantly modified and flows within a pipeline for a portion of the river's length. It is colloquially known as the 1 m pipeline; ;
- According to SARCA, the Giant Bullfrog is expected to reside within the project area;
- Sensitive aquatic species are expected within some of the sub quaternary reaches; and
- According to the Gauteng Conservation Plan, there is an area on the western boundary of the proposed RTSF site that is considered as being an "Important Area".

9.4 Environmental and current land use map

The environmental and current land use for the Cooke Mining Right Area is detailed in a series of plans as opposed to one. These plans are detailed in Table 9-30 below:

Table 9-30: Environmental and Land Use Features Plans

Environmental Feature	Plan Number
Land Use	Plan 12
Land Capability	Plan 13
Vegetation Types	Plan 15
NFEPA Wetlands	Plan 16
Heritage Sensitivity	Plan 18

10 Item 3(g)(v): Impacts and risks identified including the nature, significance, consequence, extent, duration and probability

The potential impacts associated with the project were identified as part of the specialist investigations undertaken for the WRTRP, as well as from input provided by affected parties through consultations and submitted comments. The significance of the potential impacts is assessed by the specialists as part of their respective Impact Assessment reports.

The potential impacts, potential mitigation and management measures for the impacts and the significance rating prior to and post mitigation have been provided in the sections below per environmental aspect and activity. The potential impacts contained in this report are specific to the activities associated with the Cooke Mining Right area and do not assess all of the activities and impacts, positive and negative, associated with the Ultimate WRTRP. It is important to note the impacts and benefits of the Ultimate WRTRP, as well as the Mining Right specific impacts and benefits; the WRTRP requires each of the Mining Right area infrastructure and activities. If any component of the project is rejected for authorisation, the entire project must be disregarded.

With Regards to the Ultimate WRTRP, it is important to note that the presence of historical TSFs on the landscape are a permanent source of pollution on the surrounding environment. The TSFs are a source of dust generation which then reduce ambient air quality, as well as impacting on surrounding soils, wetlands and surface water resources due to the mobilised contaminants. In addition, the leaching and seepage of contaminants have significant impacts on the groundwater resources, specifically as the historical TSFs are located on sensitive dolomitic aquifers. The reclamation of these historical TSFs will result in long term positive impacts as the pollution source is removed from the regional landscape, although reclamation activities will result in operational impacts. The operational impacts of the reclamation processes for the Cooke and C4S TSFs will be detailed in the sections which follow.

Activities associated with the RTSF complex and the CPP may also have negative as well as positive impacts on the receiving environment. The RTSF and CPP may be pollution and contamination sources for the surrounding areas, with the AWTF having a positive impact on the surrounding water resources through the treatment of mine affected water. This EIA report associated with the Cooke Mining Right area does not include the activities associated with the RTSF complex and CPP or the AWTF, however it is pertinent to note the potential negative and positive impacts associated with the Ultimate WRTRP, including the reclamation of numerous TSFs throughout the West Rand.

The activities associated with the Cooke Mining Right area, which may result in potential impacts, include the following:

- The reclamation of the Cooke and C4S TSFs;
- The construction and operation of the Cooke Thickener and BWSF; and

- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The methodology used to determine the significance of the potential impacts is provided in Section 10.6. The potential impacts have been discussed per phase of the project, per environmental aspect and according to each activity.

Potential project risks, such as hydrocarbon spillages, pipeline leaks, flooding of dams and storm water management facilities have not been assessed as part of the impact assessment as the probability of these events occurring are not covered by the impact assessment methodology. Mitigation and management measures to prevent project risks from occurring have been provided in the EMP section of this report, however.

10.1 Construction Phase

The construction phase includes site clearing activities of all of the proposed infrastructure footprints and includes vegetation removal and soil stripping, as well as the construction of the infrastructure.

10.1.1 Air Quality Impacts

As part of the Construction Phase, the following activities are identified that may impact on the ambient air quality of the area i.e. increasing particulate matter loading in the atmosphere:

- Site clearing;
- Development of surface infrastructure, pump station and pipeline leading to CPP (both from the Cooke and C4S TSFs)

Table 10-1: Interactions and impacts of Developing Surface Infrastructure and Reclamation of the Cooke and C4S TSFs

Interaction	Impact
Site clearing	Reduction in the quality of ambient air due to dust generation
Wind erosion due to loss of vegetation	Increased particulate matter load in the atmosphere leading to deteriorated air quality

10.1.1.1 Impact Description

Removal of vegetation, grading and paving takes place using a range of construction equipment for the development of the pipeline route. This often leads to the generation of fugitive dust comprising TSP, PM_{10} and $PM_{2.5}$ from the wheels of construction equipment and material handling. The area impacted is considered minimal and impacts on the atmospheric environment will cease once the construction phase ends. Further to this, hydraulic reclamation is a wet process and will have minimal impact on ambient air quality.

There will be development of surface infrastructure e.g. pipelines and pump stations. There is movement of workforce, vehicle activity on access roads, and levelling of surfaces leading to dust generation. The aforementioned will result in fugitive dust emissions containing TSP, PM_{10} and $PM_{2.5}$. Hydraulic reclamation is a wet process and will have minimal impact on air quality.

10.1.1.2 Management Objectives

The management objective is to ensure that emissions on-site and off-site from clearing and wind erosion processes are not in exceedance of the applicable standards for the protection of the environment, human health and wellbeing.

10.1.1.3 Management Actions and targets

Adoption of realistic emissions management programme to assess performance and compliance to regulatory standards. Monitoring dust levels on site, at upwind and downwind locations preferably at discrete receptors to assess public exposure.

The significance impact ratings associated with the construction phase of this project have been detailed in Table 10-2 below.

Table 10-2: Potential impacts of Developing Surface Infrastructure and Reclamation of Cooke TSF and C4S TSF on Air Quality

Activity and Interaction: Site clearing for the development of Surface Infrastructure will lead to dust generation			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality due to dust generation			
Prior to mitigation/ management			
Duration	Short term (1)	Dust generation will be limited to the area disturbed and for few days	Negligible (negative) – 12
Extent	Local (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minimal - negative (-1)	Minor impact on ambient air quality	
Probability	Unlikely (3)	It is unlikely that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ Limit activity to non-windy days; ▪ The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur;			

Activity and Interaction: Site clearing for the development of Surface Infrastructure will lead to dust generation			
▪ Drop heights when loaders and offloading material should be minimised; and ▪ Set maximum speed limits and have these limits enforced.			
Post- mitigation			
Duration	Immediate (1)	Dust generation will be limited to the area disturbed and for few days	Negligible (negative) – 6
Extent	Very Limited (1)	After mitigation measures are implemented, it is expected that dust impacts will be limited to isolated parts of the site.	
Intensity	Minimal - negative (-1)	Generated dust will have limited damage to minimal area and social impact	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low.	
Nature	Negative		
Activity and Interaction: Construction of Surface Infrastructure Pipeline and Pump Stations will result in fugitive dust			
Impact Description: Reduction in air quality due wind erosion.			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration of the construction phase	Negligible (negative) – 12
Extent	Very Limited (1)	Dust generated will be limited to the site and its immediate surroundings	
Intensity	Minimal - negative (-1)	Minor impact on ambient air quality during construction phase	
Probability	Unlikely (3)	It is unlikely that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading and offloading construction materials should be minimised; and ▪ Set maximum speed limits and have these limits enforced.			
Post management			
Duration	Short term (2)	Dust will be generated for the duration of the construction phase	Negligible (negative) – 8

Activity and Interaction: Site clearing for the development of Surface Infrastructure will lead to dust generation			
Extent	Very Limited (1)	After mitigation measures are implemented, it is expected that dust impacts will be limited to isolated parts of the site.	
Intensity	Minimal - negative (-1)	Minor impact on ambient air quality during construction phase	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low.	
Nature	Negative		

10.1.2 Noise Impacts

It is anticipated that noise will be generated from a variety of sources during the project life such as vehicles, pumping activities and the reclamation process. Table 10-3 below details the impacts resulting from the proposed project activities within the environment.

Table 10-3: Interactions and Impacts associated with Noise during the Construction Phase

Interaction	Impact
Site clearance and vegetation removal for the proposed pipeline and pump stations	The ambient noise levels may potentially increase due to the proposed activities during the construction phase
Surface infrastructure development including pump stations at Cooke TSF and pipeline leading to the CPP	

10.1.2.1 Impacts Description

The noise impacts during the construction phase will be a result of the site clearance and the construction of the pump stations and pipeline. It is anticipated that the noise levels emanating from the project site will not exceed the SANS 10103:2008 rating levels (50 dBA) at the surrounding suburban receptors and therefore will not impact on the surrounding receptors. Based on the definition of disturbing noise in the Gauteng Noise Control Regulations there will be no disturbance. Certain noise sources may however still be audible and were rated to have a negligible impact on the surrounding receptors. Measures to take in mitigating the impacts include:

- Restricting construction activities to daylight hours;
- machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;

- Reversing alarms on mobile equipment should be broadband reversing alarms which emit directional, lower, less intrusive sound; and
- Switching off equipment when not in use.

The noise significance impact ratings associated with the construction phase in this project are detailed in Table 10-4 below.

Table 10-4: Pre-mitigation and post-mitigation significance ratings for impacts on noise during the construction phase

Dimension	Rating	Motivation	Significance
Activity and Interaction (Site clearance and vegetation removal for the pipeline and pump stations)			
Impact Description: Noise will emanate from the machinery and vehicles operating during the construction activities along the pipe routes and at the pump stations.			
Prior to mitigation/ management			
Duration	immediate (1)	Noise will be produced for the duration of the construction phase.	Negligible (negative) – 18
Extent	Local (3)	It is expected that during construction noise will extend as far as development site area ie along the pipe routes and at the pump stations and thickener infrastructure.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during construction noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors as the locations of pump stations and pipe routes are largely remote.	
Nature	Negative		
Mitigation/ Management action			
▪ Restricting construction activities to daylight hours; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Switching off equipment when not in use; and ▪ Reversing alarms on mobile equipment should be broadband reversing alarms which emit directional, lower, less intrusive sound			
Post- mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the construction phase	Negligible (negative) – 12

Extent	Local (3)	It is expected that during construction noise will be limited to site if mitigation measures are implemented.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during construction noise will have a minimal social impact	
Probability	Rare (2)	It is improbable that noise will impact on the surrounding receptors as the locations of pump stations and pipe routes are largely remote..	
Nature	Negative		

10.1.3 Groundwater Impacts

No impact on the groundwater is expected during the construction, since all the activities are expected to take place above the water table.

Diesel or other organic fluids and inorganic solvents might be spilled on the ground surface, or leak from underground storage tanks during the construction. Due to the depth of the water level in the dolomitic aquifer, however, they are expected to volatilise unlikely to reach the groundwater.

10.1.4 Soil Impacts

The impact to consider during the construction phase is the placement and construction of pipelines and the potential impacts associated with compaction and loss of topsoil as a resource.

Whilst the construction takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

In saying this, it must be considered that the pipelines that will be constructed will be placed within existing servitudes and alongside roads. Taking this into account the expected impacted as a result would be considered lower than anticipated as these areas have already been impacted upon.

Table 10-5: Interactions and Impacts associated with Soil during the Construction Phase

Interaction	Impact
Exposure of soils due to loss of vegetation	Soil erosion due to wind and surface water runoff; Loss of land capability due to erosion
	Siltation of surface water resources leading to deteriorated water quality and quantity

Interaction	Impact
	Siltation of wetlands due to erosion
	Change in habitat and potential change in species composition.
	Siltation of wetlands)

10.1.4.1 Impact Description

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

10.1.4.2 Management Objectives

The following management objectives have been recommended:

- The management objectives are to limit the impacts that could occur on the site as far as possible;
- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil;
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.
- Vegetation cover on all stockpiled soil is essential to eliminate erosion.
- Soils are only to be stripped by truck and shovel methods.

10.1.4.3 Management Actions and Targets

The following management actions and targets are proposed for the abovementioned impacts to meet the management objectives:

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;

- Only the designated access routes are to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure; and
- Implement land rehabilitation measures as defined in rehabilitation report.

- Follow adequate stripping guidelines, as described in the soil stripping guidelines section.
- The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, as to reduce compaction;
- The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- The handling of the stripped topsoil will be minimized to ensure the soil’s structure does not deteriorate;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be sued for their designated final purposes; and
- The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

The significance impact ratings during the construction phase are detailed in Table 10-6 below.

Table 10-6: Impact rating for loss of topsoil as a resource during construction phase of the pipelines in the Cooke mining right area.

Activity and Interaction: Pipeline routes site clearing and construction			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resource as a result of construction of pipelines			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 60

Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Effective storm water management, erosion protection, rehabilitation and limiting access where only construction will be undertaken.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 30
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

10.1.5 Surface Water Impacts

During the construction phase, the following interactions will occur as a result of infrastructure development, site clearing and grubbing and the construction of infrastructures (pipelines, sumps and pump stations, NBT).

Table 10-7: Interactions and Impacts associated with Surface Water during the Construction Phase

Interaction	Impact
Site clearing and grubbing	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing and grubbing occur.
Construction of infrastructures such as pipelines, sumps, and pump stations	Increase in sedimentation of surface water during construction caused by an increase in runoff from the cleared and stripped areas which is high in suspended solids.

10.1.5.1 Impact Description

As a result of infrastructure development the following potential impacts are predicted:

- Storage of contaminated water/slurry within the sumps during the construction phase may result in seepages/spillages into the nearby natural water bodies;
- Contamination of rivers when dirty water runoff from the reclaimed TSF reports into the nearby rivers;
- Reduction of catchment yield as a result of the footprint areas of the proposed infrastructure. The footprint areas will no longer form part of the natural drainage thereby potentially resulting in a decrease of runoff downstream. The NBT will occupy less than 1% of the C23D quaternary catchment; therefore the reduction of catchment yield may be very small or negligible; and
- Flooding of the pipeline at various river crossings.

10.1.5.2 Management Objectives

The management objectives adopted during the construction phase relate specifically to GN 704.

The three main conditions of GN 704 applicable to this project are:

- *Condition 4* defines the area in which mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, or reservoir together with any associated structure or any other facility should be situated outside the 1:100 year floodline. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year floodline. Where the floodline is less than 100 metres away from the watercourse, a minimum watercourse buffer distance of 100 metres is required for infrastructure and activities.
- *Condition 6* describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows associated with a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.
- *Condition 7* describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion) and ensure that water used in any process is recycled as far as practicable.

10.1.5.3 Management Actions and Targets

In this section management actions relating to the activities envisaged during the construction phase are described together with the targets required to ensure mitigation of the impacts occur.

10.1.5.3.1 Mixing of Clean and Dirty Water (site clearing and grubbing)

To manage the impact of mixing of upstream clean water runoff with dirty water runoff from cleared site areas. This could result in dirty water reporting to the downstream clean water catchment, the following targets are required.

The runoff from the upstream clean water catchment is to be diverted away from the proposed infrastructures. Temporary surface water ditches are to be constructed on the upstream boundary of cleared areas, so as to meet GN 704 requirements regarding the separation of clean and dirty water runoff. All clean water runoff will therefore be diverted away from the cleared area. The temporary surface ditches are to be sized such that the 1:50 year peak discharge can be contained within it.

10.1.5.3.2 Increased Sedimentation

To manage the impact of increase sedimentation on downstream watercourses due to exposed surfaces resulting in siltation of surface water resources, the following targets are required.

Within the cleared area, along the downstream boundary, temporary ditches are to be constructed along with a temporary excavated storage area. All dirty water runoff will then be captured and contained within the temporary storage facility. The temporary storage facility is to be sized based on the runoff volume generated from the cleared area for the 1:50 year storm event. The water contained in the storage facility should be used during the construction phase as much as possible, ensuring the mentioned storage facility is operated empty. The temporary ditches are to be sized such that the 1:50 year peak discharge can be contained within it.

10.1.5.3.3 Reduction in Catchment Yield

No targets are possible to manage the reduction in catchment yield due to the loss of catchment area as a result of the WBT and other associated infrastructure. However, the NBT will occupy less than 1% of the C23D quaternary catchment; therefore the reduction of catchment yield may be very small or negligible and this will not be rated.

10.1.5.3.4 Mixing of Clean and Dirty Water (infrastructure development)

To manage the impact of mixing of upstream clean water runoff with dirty water runoff from newly constructed infrastructure. This could result in dirty water reporting to the downstream clean water catchment, the following targets are required.

Based on GN 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of infrastructures will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event.

All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas is captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event. It is recommended that the containment facility be operated empty such that water captured within these facilities is used within the mine operations between a reasonable time interval, so as to ensure that capacity is always available to store the mentioned 1:50 year storm volume.

The significance impact ratings associated with the construction phase of the project have been detailed in Table 10-8 below.

Table 10-8: Construction phase impact ratings for activities taking place in the Cooke MRA

Dimension	Rating	Motivation	Significance
Activity and Interaction: Site clearing for the Construction of Infrastructure			
Impact Description: Increase in sedimentation due to exposed surfaces			
Prior to mitigation/ management			
Duration	Short term (2)	Sedimentation will only take place while soil is exposed during the construction phase	Minor (negative) – 50
Extent	Municipal Area (4)	Sediments may be washed further downstream than the project site	
Intensity	Moderate - (4)	May moderately affect already impacted water resources	
Probability	Likely (5)	It is likely that sedimentation will occur	
Nature	negative		
Mitigation/ Management actions			
▪ Construct temporary ditches and a temporary storage area along downstream boundary of cleared areas to capture sediment laden runoff. Water within temporary storage area can be used for construction and should be operated empty.			
Post- mitigation			
Duration	Short term (2)	Sedimentation will only take place while soil is exposed during the construction phase	Negligible (negative) – 24
Extent	Limited (2)	Sediments will be contained on the project site	

Dimension	Rating	Motivation	Significance
Intensity	Moderate - (2)	May moderately affect water resources if sediments are not contained correctly	
Probability	Probable (4)	Has occurred elsewhere and may occur again	
Nature	negative		
Activity and Interaction: Site clearing for the Construction of Infrastructure			
Impact Description: Mixing of upstream clean water runoff with dirty water runoff from cleared site areas resulting in dirty water reporting to the downstream clean water catchment..			
Prior to mitigation/ management			
Duration	Beyond project life (6)	May continue beyond the project life if not managed correctly	Moderate (negative) – 80
Extent	Region (5)	May impact water quality on a regional basis	
Intensity	High - (5)	May impact on highly sensitive environments such as the downstream Vaal Dam	
Probability	Likely (5)	Is likely to occur if not managed correctly	
Nature	negative		
Mitigation/ Management actions			
▪ Temporary surface water ditches are to be constructed on the upstream boundary of infrastructure areas to divert clean water into the downstream environment.			
Post- mitigation			
Duration	Short term (2)	Will only last for the duration of the construction phase	Negligible (negative) – 28
Extent	Limited (2)	Limited to the project site if mitigation is applied correctly	
Intensity	Moderate - (3)	May impact already moderately impacted surface water resources	
Probability	Probable (4)	Probable, has occurred elsewhere and may occur here	
Nature	negative		
Activity and Interaction: Construction of infrastructures (pipelines, pump stations, etc.).			
Impact Description: Flooding of pipeline crossings			
Prior to mitigation/ management			
Duration	Permanent (7)	Flooding of the pipelines may occur beyond the construction phase and beyond the project life if the RTSF remains indefinitely	Minor (negative) – 48

Dimension	Rating	Motivation	Significance
Extent	Region (5)	Hazardous substances in the pipelines under exceptional flooding (greater than 1:100 year flood) may affect surface water resources on a regional scale	
Intensity	Moderate - (4)	May impact on already moderately impacted surface water resources	
Probability	Unlikely (3)	Highly unlikely as the pipeline will be constructed above the 1:100 year flood elevation and can be designed to withstand exceptional rainfall. However, there is always a possibility of exceptional flooding	
Nature	negative		
Mitigation/ Management actions			
▪ Ensure that all pipelines are constructed above the 1:100 year flood elevation and/or designed to withstand exceptional rainfall events. ▪ Minimum flanges within flood line area. ▪ Sound engineering of support infrastructure across floodplain.			
Post- mitigation			
Duration	Permanent (7)	The RTSF will remain indefinitely and there is always a possibility that an exceptional flood greater than the 1:100 year peak flood may occur	Minor (negative) – 39
Extent	Limited (2)	If flood protection measures are implemented then restricted to the project site	
Intensity	Moderate - (4)	May impact on already moderately impacted surface water resources	
Probability	unlikely (3)	Highly unlikely as the RTSF is outside of the 1:100 year floodline and can be designed to withstand exceptional rainfall. However, there is always a possibility of exceptional flooding	
Nature	negative		
Construction of infrastructures (pipelines, sumps, RTSF return water Dam).			
Impact Description: Mixing of upstream clean water runoff with dirty water runoff from within infrastructure areas resulting in dirty water reporting to the downstream clean water catchment.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	May continue beyond the project life if not managed correctly	Moderate (negative) – 80
Extent	Region (5)	May impact water quality on a regional basis	

Dimension	Rating	Motivation	Significance
Intensity	High - (5)	May impact on highly sensitive environments such as the downstream Vaal Dam	
Probability	Likely (5)	Is likely to occur if not managed correctly	
Nature	negative		
Mitigation/ Management actions			
▪ Clean water emanating from upstream of infrastructure areas will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.			
Post- mitigation			
Duration	Project Life (5)	Will last for the project life	Minor (negative) – 40
Extent	Limited (2)	Limited to the project site if mitigation is applied correctly	
Intensity	Moderate - (3)	May impact already moderately impacted surface water resources	
Probability	Probable (4)	Probable, has occurred elsewhere and may occur here	
Nature	negative		

10.1.6 Aquatics Impacts

Activities within this mining right area will potentially impact the main stem of the Wonderfonteinspruit (C23D-01313; C23D-01365; C23D-01384). These systems were established to be of a largely or seriously modified state. The potential impacts of the proposed project will be viewed in light of this classification.

This impact assessment does not take into consideration the potential risk and impacts of unplanned events.

Table 10-9: Interactions and Impacts associated with Aquatics during the Construction Phase

Interaction	Impact
Site clearing for infrastructure placement	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.
Construction and removal of infrastructure	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.

10.1.6.1 Impact Description

Potential water and habitat quality degradation causing resultant negative impacts on local aquatic ecology. Water quality impacts may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Habitat quality impacts may include sedimentation, bed, channel and flow modification. The interactions of the activities, their physical impact and resulting biological impact are illustrated in Table 10-9.

10.1.6.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

10.1.6.3 Management Actions and Targets

General mitigation actions provided in the surface and groundwater studies (Digby Wells, 2015) for this project should be used to guide the effective management of aquatic resources potentially affected by the proposed project. However, important management actions are briefly listed below;

- Establish riparian buffer up to 500m (minimum 100m).

- Silt traps placed within clean water return channels.
- Re-vegetation of construction footprint and unpaved roads as soon as possible.
- Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with construction sequencing is proposed.

Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.

The improvement and maintenance of the PES of the Wonderfonteinspruit is the overall management target in this mining right area. However, more specific management targets are provided below.

Using the sites assessed in this study, the SASS5 and ASPT values should not be reduced by more than 25% of this baseline study. More specific taxa that should be monitored, as well as the impactions of their presence/absence in the monitoring program are provided in the table below (Table 10-10).

Table 10-10: Monitoring taxa, threshold diversity/abundance and relevance in monitoring program

Taxa	Diversity/abundance	Relevance
Hydropsychidae	>2 species/B	Baseline maintenance
Caenidae	Presence/A	Baseline maintenance
Baetidae	>2 species/B	Baseline improved
Heptageniidae	Presence/A	Baseline improved

The aquatic significance impact ratings associated with the construction phase pf the project are detailed in Table 10-11 below.

Table 10-11: Potential water and habitat quality impacts during the construction phase

Activity and Interaction: Site clearing for infrastructure placement (Pipelines)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Medium term (3)	The site clearing and infrastructure placement will occur and potentially recover within a three-five year period	42 (Minor)
Extent	Limited (2)	The impacts are anticipated to occur around the activities which are located in proximity to the Wonderfonteinspruit	

Intensity	Minor natural impacts (-2)	Water and habitat quality deterioration will be expected to occur downstream of the various activities. Although these impacts are limited due to the small size of the infrastructure (limited clearing required)	
Probability	Almost certain (6)	Pollution from the proposed activities is almost certainly going to occur as the activities, especially without mitigation, are located within proximity to various river systems.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with construction sequencing is proposed. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.			
Post- mitigation			
Duration	Medium term (3)	The construction will be short term and if mitigated so will the impacts be short term.	21 (Negligible)
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a limited extent.	
Intensity	Discernible change (-2)	Impacts limited due to mitigation actions.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		
Activity and Interaction: Construction of infrastructure			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Medium term (3)	The site clearing and infrastructure placement will occur and potentially recover within a three-five year period	42 (Minor)

Extent	Limited (2)	The impacts are anticipated to occur around the activities which are located in proximity to the Wonderfonteinspruit	
Intensity	Minor natural impacts (-2)	Water and habitat quality deterioration will be expected to occur downstream of the various activities. Although these impacts are limited due to the small size of the infrastructure (limited clearing required)	
Probability	Almost certain (6)	Pollution from the proposed activities is almost certainly going to occur as the activities, especially without mitigation, are located within proximity to various river systems.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ▪ Construction sequencing is proposed.			
Post- mitigation			
Duration	Medium term (3)	The construction will be short term and if mitigated so will the impacts be short term.	21 (Negligible)
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a limited extent.	
Intensity	Discernible change (-2)	Impacts limited due to mitigation actions.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		

10.1.7 Fauna and Flora Impacts

The construction of various surface infrastructure components, specifically the pipeline will mean the removal, partial or complete of vegetation/habitat types present.

Table 10-12: Interactions and Impacts associated with Fauna and Flora during the Construction Phase

Interaction	Impact
Site clearing for infrastructure placement	Direct loss of floral species/vegetation types and biodiversity.
	Direct habitat loss and degradation.
	Loss of species of special concern (protected species).
	Alien vegetation recruitment

10.1.7.1 Impact Description

The construction of surface infrastructure within the Cooke mining right area will take place in various areas which will affect the current habitat and vegetation types present. There are three main types of habitat found on this site, 49 ha of grassland areas, 1.3 ha of ridge areas, and 49 ha agricultural/alien vegetation. Of concern is the remaining natural areas (grassland) found in the pipeline servitude to Cooke 4 South. The existing vegetation (grassland, ridges and alien vegetation/agricultural areas) will be directly impacted on to facilitate the construction of the pipeline. This will remove the remaining habitat that the vegetation types present is currently providing.

The partial degradation of natural vegetation and habitat for animal life has already taken place within the surrounding environment due to current land use practices this mining and agriculture. The pipeline will affect 48 ha of transformed vegetation habitat, and 16 ha of grassland, only 1.3 ha of ridge will be affected by the construction activities.

The Nationally protected plants *Boophone disticha* (Poison bulb) (Declining) was encountered throughout the grassland and ridges vegetation categories. The plant species *Hypoxis hemerocallidea* (Star Flower) (GDARD, Declining) was encountered in the grassland vegetation type. The protected species listed in Section 9.1.7, are expected to occur within the grassland habitat type and must be managed appropriately.

Mitigation measures include obtaining permits and translocating these plants if encountered.

With the clearing of vegetation, open areas will occur, here indigenous vegetation will be replaced by fast growing alien and weed vegetation. This impact can be greatly reduced with the correct implementation of alien vegetation management plan.

10.1.7.2 Management Objectives

Management objectives are to prevent the loss of important/protected species of vegetation (such as those with Red Data Status, National and Provincial), by firstly attempting to avoid destruction through not constructing in areas where these species are located thereafter applying for permits that will allow and prescribe relocation strategies.

The destruction of the vegetative cover must be limited; this can be achieved by restricting the removal and disturbance of vegetation to those areas absolutely essential for the infrastructure placements.

The ecosystem present must be preserved, this includes areas not directly affected by project activities, and can be achieved by limiting project activities to areas where they are essential. The risk of habitat fragmentation must be reduced through preservation of natural corridors. Rehabilitation plans must be initiated during construction to minimise disturbed areas. Habitat/vegetation degradation must be prevented through the implementation of an alien invasive plant management strategy.

10.1.7.3 Management Actions and Targets

Red Data Status plants located in areas of development *Boophone disticha* (Poison bulb) and *Hypoxis hemerocallidea* (Star Flower) should be marked prior to construction of any infrastructure and the necessary permits for relocations of these protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities (GDARD) prior to relocation to a safe place to avoid destruction and stipulations made by GDARD must be followed. A nursery should be developed on site for this purpose. No protected plant species can be disturbed without authorisation.

Three basic rules of conservation apply to populations of Red List Plant Species, as set out hereunder, according to Red List Plant Guidelines (2012).

- All populations of Near Threatened and Threatened plant taxa must be conserved *in situ*.
- All populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines.
- An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red List Plant Species, and such Ecological Management Plans must conform with the Guidelines set out for buffer zone widths.

An alien plant management strategy must be implemented to preserve natural habitat. Such a strategy will entail the identification of areas where such infestation occurs and what the extent of it is. Thereafter specific eradication measures can be prescribed for species present. The alien invasive plant strategy must reduce the number and are size (49 ha) of these plant species that occur in the project area, this can be measured against the number of plants that were identified in this and previous studies.

Illegal waste dumping, including building waste and rubble, should be prohibited. Such illegal dumping sites are prone to alien vegetation recruitment. The environmental manager must ensure that after each building site is rehabilitated, there are no rubble piles remaining.

Training should be given to onsite staff on which plants and animals have red data status and how they may be identified. Thereafter the Environmental Officer must initiate the red data management plan. The incidence of plant or animal red data removal or death must be quantified and records kept, this will ensure that management actions are adapted of they are not successful.

Rehabilitation of disturbed areas should take place within a week of construction, all bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly, and prevent erosion and alien vegetation establishing.

Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats.

The significance impact ratings associated with the construction phase of the project are detailed in Table 10-13 below.

Table 10-13: Potential impacts of construction of infrastructure

Activity and Interaction Construction of infrastructure in areas of medium and high sensitivity (pipelines) require vegetation clearing			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct loss of floral species/vegetation types and biodiversity			
Prior to mitigation/ management			
Duration	Long term (4)	Loss 17.2 ha of floral species/vegetation will occur.	Minor (negative) – 72
Extent	Local (3)	Species/habitat loss will only occur within and immediately around the Project site.	
Intensity x type of impact	High (-5)	Sensitive sites occur throughout the pipeline, such as ridges and grasslands.	
Probability	High (6)	It is likely that destruction of vegetation types will occur without management measures.	
Nature	Negative		
Mitigation/ Management actions			
▪ Limit degradation and destruction of natural environment ridges and grassland, to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Re-vegetate open areas to limit erosion. ▪ Avoid known areas of faunal and floral SSC, specifically the ridges and grassland. ▪ Avoid sensitive landscapes such as ridges and grassland areas that were encountered on site. ▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation are controlled so that no open areas occur. ▪ Applications for permits for removal of certain plants, where required.			
Post- mitigation			

Activity and Interaction Construction of infrastructure in areas of medium and high sensitivity (pipelines) require vegetation clearing			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium term (3)	With vegetation management including rehabilitation, vegetation can recover in 1-5 years.	Negligible (negative) – 21
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity x type of impact	Moderate (-3)	Vegetation types present are seen as sensitive, therefore limiting destruction is crucial.	
Probability	Unlikely (3)	It is unlikely that compaction will have an effect after rehabilitation.	
Nature	Negative		

10.1.8 Wetlands Impacts

The major impacts anticipated due to the proposed interactions are listed in the table below.

Table 10-14: Interactions and Impacts associated with Wetlands during the Construction Phase

Interaction	Impact
Activity around and in the wetlands with machinery for the construction of the pipelines from the Cooke TSF to Ezulwini under the N12 through a wetland.	Potential pollution and resultant negative impacts on wetlands with the building of the pipelines through wetlands.

10.1.8.1 Impact Description

The construction of pipeline route from the Cooke TSF to Ezulwini is to pass within a pan wetland as the pipeline crosses the N12. There is an existing culvert and built servitude running under the N12 that is to be used, which is within the wetland. Limited construction will be needed which will decrease the impact. The pipeline containing tailings slurry has the potential to impact the wetlands if an unplanned spill occurs.

10.1.8.2 Management Objectives

Management objectives are to inform SGL where there are wetland interactions with the proposed activities during the construction of the WRTRP infrastructure in the Cooke MRA. These objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.1.8.3 Management Actions and Targets

During the construction of the WRTRP infrastructure in the Cooke MRA, general mitigation and management actions provided in the following studies done by Digby Wells as part of this project should be used to guide the effective management of wetland ecological resources affected by the proposed project:

- Aquatic Ecology Report (Digby Wells, 2015b);
- Fauna and Flora Assessment Report (Digby Wells, 2015c);
- Groundwater Assessment Report (Digby Wells, 2015d);
- Rehabilitation Plan (Digby Wells, 2015e); and
- Surface Water Report (Digby Wells, 2015f).

The Wetland Management Plan detailed in the Wetlands Report (Appendix K) must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- The edge of the wetlands and at least a 30m buffer must be clearly demarcated in the field that will last for the duration of the construction phase.
- Minimise footprint area disturbed by construction activities.
- Rehabilitation Plan for disturbed wetland area must be in place.

The Significance impact ratings associated with the construction phase of the project are detailed in Table 10-15 below.

Table 10-15: Summary of Wetland Impact Ratings for the initial Construction Phase in the Cooke MRA

Activity and Interaction: Pipeline placement in and around wetland at N12			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Disturbance of wetland habitat.			
Prior to mitigation/ management			
Duration	Short Term (2)	Wetland habitat will be impacted by the construction of the pipeline according to the current placement but construction will be a short term impact.	-70 “Minor negative”

Extent	Limited (2)	The wetland will be impacted only to a limited extent due to planned mitigations and the small areas needed for the pipeline installation.	
Intensity	Moderate loss (3)	Loss of wetlands is a serious impact to sensitive environments.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		
Mitigation/ Management actions			
▪ Responsible construction to protect the surrounding environment will mitigate this impact. This should include aspects such as vehicles must be in good working order; construction should occur in the dry-season in the shortest time possible; and particular care must be taken when constructing in the wetland. ▪ In addition, the sections of pipe crossing wetlands should have no joints and must be fitted with HDPE sleeves.			
Post-mitigation			
Duration	Immediate (1)	Rehabilitation and mitigation could decrease the duration of the impact to occur within one month.	-35 "Negligible negative"
Extent	Limited (2)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Minor loss (2)	Mitigation of the impact will lead to a minor effect on a limited area of the pan.	
Probability	Definite (7)	This will occur according to the proposed infrastructure layout.	
Nature	Negative		

10.1.9 Topography Impacts

10.1.9.1 Pipeline Routes

Pipeline routes will be constructed within the Cooke MRA to transport water, slurry and tailings. These pipeline routes are expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-16 below.

Table 10-16: Interactions and Impacts of the Pipeline Routes on the Topography of the Cooke MRA (Construction Phase)

Interaction	Impact
Site clearance and vegetation removal	Site clearance and removal of vegetation will change the surface of the project area and therefore the topography.
Topsoil removal and stockpiling	Topsoil removal will change the topography. Stockpiling of topsoil will add features to the surface thereby changing the topography.
Infrastructure development	Construction of the pipeline infrastructure will add features to the topography thereby changing it.

10.1.9.1.1 Impact Description

Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the pipeline infrastructure will have a minor negative impact on the topography. Construction of the pipeline infrastructure will add features to the surface and is expected to have a moderate negative impact on the topography. These impacts will only occur within the pipeline servitudes.

10.1.9.1.2 Management Objectives

The management objectives are to minimise the topography change as a result of site clearance and vegetation removal; topsoil removal and stockpiling, and pipeline infrastructure development.

10.1.9.1.3 Management Actions

The following management actions are required for the pipeline routes in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible;
- Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure;
- Limit the footprint area of pipeline infrastructure where possible; and
- Where possible spread topsoil and re-vegetate the pipeline servitude areas when construction is complete.

The significance impact ratings associated with the construction phase of the project are detailed in Table 10-17 below.

Table 10-17: Potential Impacts of the Pipeline Routes on the Topography of the Cooke MRA

Activity and Interaction (Pipeline routes require site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Site clearance and vegetation removal will change the surface of the project area and therefore the topography. Vegetation should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary; and ▪ Where possible re-vegetate the pipeline servitude areas when construction is complete.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	

Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal will change the surface of the project area and therefore the topography. Topsoil stockpiles will add features to the surface thereby changing the topography. Topsoil should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated where possible;			

▪ Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure; and ▪ Where possible spread topsoil in the pipeline servitude areas when construction is complete.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Construction of the pipeline infrastructure will add features to the topography thereby changing.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-70)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that	

		the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the footprint area of pipeline infrastructure where possible.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-63)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.1.9.2 Cooke Thickener

The Cooke thickener will be constructed within the Cooke MRA. This infrastructure is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the Cooke thickener are indicated in Table 10-18

Table 10-18: Interactions and Impacts of the Cooke Thickener on the Topography of the Cooke MRA (Construction Phase)

Interaction	Impact
Site clearance and vegetation removal	Site clearance and removal of vegetation will change the surface of the project area and therefore the topography.

Interaction	Impact
Topsoil removal and stockpiling	Topsoil removal will change the topography. Stockpiling of topsoil will add features to the surface thereby changing the topography.
Infrastructure development	Construction of the Cooke thickener infrastructure will add features to the topography thereby changing it.

10.1.9.2.1 Impact Description

Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the Cooke thickener will have a minor negative impact on the topography. Construction of the Cooke thickener infrastructure will add features to the surface and is expected to have a moderate negative impact on the topography.

10.1.9.2.2 Management Objectives

The management objectives are to minimise the topography change as a result of site clearance and vegetation removal; topsoil removal and stockpiling, and infrastructure development.

10.1.9.2.3 Management Actions

The following management actions are required for the Cooke thickener in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible;
- Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure; and
- Limit the footprint area of Cooke thickener infrastructure where possible.

The significance impact ratings associated with the construction phase are detailed in Table 10-19 below.

Table 10-19: Potential Impacts of the Cooke Thickener on the Topography of the Cooke MRA

Activity and Interaction (Cooke thickener requires site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Site clearance and vegetation removal will change the surface of the project area and therefore the topography. Vegetation should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-49)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning.	

		Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal will change the surface of the project area and therefore the topography. Topsoil stockpiles will add features to the surface thereby changing the topography. Topsoil should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated where possible; and ▪ Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life	Minor negative (-

		span of the project and can be reversed with sufficient management.	49)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Construction of the Cooke thickener infrastructure will add features to the topography thereby changing.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			

▪ Limit the footprint area of Cooke thickener infrastructure where possible.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-49)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.1.9.3 Collection Sumps and Pump Stations

The collection sumps and pump stations at Cooke TSF will be constructed within the Cooke MRA. This infrastructure is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the collection sumps and pump stations are indicated in Table 10-20.

Table 10-20: Interactions and Impacts of the Collection Sumps and Pump Stations on the Topography of the Cooke MRA (Construction Phase)

Interaction	Impact
Site clearance and vegetation removal	Site clearance and removal of vegetation will change the surface of the project area and therefore the topography.
Topsoil removal and stockpiling	Topsoil removal will change the topography. Stockpiling of topsoil will add features to the surface thereby changing the topography.
Infrastructure development	Construction of the collection sump and pump station infrastructure will add features to the topography thereby changing it.

10.1.9.3.1 Impact Description

Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the collection sumps and pump stations will have a minor negative impact on the topography. Construction of the collection sumps and pump stations will add features to the surface and is expected to have a moderate negative impact on the topography.

10.1.9.3.2 Management Objectives

The management objectives are to minimise the topography change as a result of site clearance and vegetation removal; topsoil removal and stockpiling, and infrastructure development.

10.1.9.3.3 Management Actions

The following management actions are required for the collection sumps and pump stations in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible;
- Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure; and
- Limit the footprint area of collection sump and pump station infrastructure where possible.

The significance impact ratings associated with the construction phase of the project are detailed in Table 10-21 below.

Table 10-21: Potential Impacts of the Collection Sumps and Pump Stations on the Topography of the Cooke MRA

Activity and Interaction (Collection sumps and pump stations require site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Site clearance and vegetation removal will change the surface of the project area and therefore the topography. Vegetation should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)

Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal will change the surface of the project area and therefore the topography. Topsoil stockpiles will add features to the surface thereby changing the topography. Topsoil			

should only be removed when and where necessary to prevent unnecessary soil erosion.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated where possible; and ▪ Ensure topsoil stockpiles are contoured and not too steep (18° or less) to prevent slope failure.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur.	

		> 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Construction of the collection sump and pump station infrastructure will add features to the topography thereby changing.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Limit the footprint area of collection sump and pump station infrastructure where possible.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning.	

		Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.1.10 Visual Impacts

10.1.10.1 Pipeline Routes

Pipeline routes will be constructed within the Cooke MRA to transport water, slurry and thickened tailings. These pipeline routes are expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-22.

Table 10-22: Interactions and Impacts of the Pipeline Routes on the Visual Aspects of the Cooke MRA (Construction Phase)

Interaction	Impact
Change of land use from agriculture to industry / mining	Change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance.
Site clearance and vegetation removal	Site clearance and removal of vegetation will have a negative visual impact on the receiving environment. The project area will become noticeable to nearby receptors as it will contrast the surrounding areas.
Topsoil removal and stockpiling	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.
Infrastructure development	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place.

10.1.10.1.1 Impact Description

The pipelines will be constructed close to ground level and are only expected to be visible from the immediate vicinity. Change of land use from agriculture to industry / mining as a result of the pipeline routes will have a minor negative visual impact on the receiving environment. Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the pipeline infrastructure will have a minor negative visual impact on the receiving environment. Construction of the pipeline infrastructure will have a minor negative visual impact on the receiving environment.

10.1.10.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the change of land use from agriculture to industry / mining. The management objectives also aim to minimise the negative visual impact caused by site clearance and vegetation removal, topsoil removal and stockpiling and infrastructure development

10.1.10.1.3 Management Actions

The following management actions are required for the pipeline routes in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape;
- Limit the height of topsoil stockpiles to 3 metres;
- Apply dust suppression techniques to limit the dust dispersion from stockpiles;
- Limit the height and footprint area of pipeline infrastructure where possible;
- Use shade cloth / netting to screen the construction site;
- Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible;
- Metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the metal structures are painted, it is recommended that a neutral matt finish be used;
- If construction activities take place at night, down lighting must be implemented to minimise light pollution; and
- Where possible spread topsoil and re-vegetate the pipeline servitude areas when construction is complete.

The significance impact ratings associated with the construction phase of this project are detailed in Table 10-23 below.

Table 10-23: Potential Impacts of the Pipeline Routes on the Visual Aspects of the Cooke MRA

Activity and Interaction (Pipeline routes result in change of land use from agriculture to industry / mining)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance. This impact can potentially be reversed during the decommissioning phase if all the infrastructure is removed and the area is rehabilitated.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-49)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Where possible spread topsoil and re-vegetate the pipeline servitude areas when construction is complete; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	

Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The removal of vegetation for site clearing will have a negative visual impact on the receiving environment. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary; and			

▪ Where possible re-vegetate the pipeline servitude areas when construction is complete.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-30)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-63)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	

Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
- Topsoil should only be removed when and where necessary; - Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape; - Limit the height of topsoil stockpiles to 3 metres; - Apply dust suppression techniques to limit the dust dispersion from stockpiles; and - Where possible spread topsoil in the pipeline servitude areas when construction is complete.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also			

have a negative impact on the sense of place.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-63)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
- Limit the height and footprint area of pipeline infrastructure where possible; - Use shade cloth / netting to screen the construction site; - Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; - Metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the metal structures are painted, it is recommended that a neutral matt finish be used; and - If construction activities take place at night, down lighting must be implemented to minimise light pollution.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-54)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem	

		functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.1.10.2 Cooke Thickener

The Cooke thickener will be constructed within the Cooke MRA. This infrastructure is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the Cooke Thickener are indicated in Table 10-24.

Table 10-24: Interactions and Impacts of the Cooke Thickener on the Visual Aspects of the Cooke MRA (Construction Phase)

Interaction	Impact
Change of land use from agriculture to industry / mining	Change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance.
Site clearance and vegetation removal	Site clearance and removal of vegetation will have a negative visual impact on the receiving environment. The project area will become noticeable to nearby receptors as it will contrast the surrounding areas.
Topsoil removal and stockpiling	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.
Infrastructure development	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place.

10.1.10.2.1 Impact Description

The Cooke thickener is only expected to be visible from close proximity. Change of land use from agriculture to industry / mining as a result of the Cooke thickener will have a minor negative visual impact on the receiving environment. Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the Cooke thickener infrastructure will have a minor negative visual impact on the receiving environment. Construction of the Cooke thickener infrastructure will have a minor negative visual impact on the receiving environment.

10.1.10.2.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the change of land use from agriculture to industry / mining. The management objectives also aim to minimise the negative visual impact caused by site clearance and vegetation removal, topsoil removal and stockpiling and infrastructure development.

10.1.10.2.3 Management Actions

The following management actions are required for the Cooke thickener in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape;
- Limit the height of topsoil stockpiles to 3 metres;
- Apply dust suppression techniques to limit the dust dispersion from stockpiles;
- Limit the height and footprint area of Cooke thickener infrastructure where possible;
- Use shade cloth / netting to screen the construction site;
- Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and
- If construction activities take place at night, down lighting must be implemented to minimise light pollution.

The significance impact ratings associated with the construction phase of this project are detailed in Table 10-25 below.

Table 10-25: Potential Impacts of the Cooke Thickener on the Visual Aspects of the Cooke MRA

Activity and Interaction (Cooke thickener results in change of land use from agriculture to industry / mining)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance. This impact can potentially be reversed during the decommissioning phase if all the infrastructure is removed and the area is rehabilitated.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-63)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-48)

Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The removal of vegetation for site clearing will have a negative visual impact on the receiving environment. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Vegetation should only be removed when and where necessary.			

Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-42)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	

Nature	Negative		
Mitigation / Management Actions			
▪ Topsoil should only be removed when and where necessary; ▪ Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape; ▪ Limit the height of topsoil stockpiles to 3 metres; ▪ Apply dust suppression techniques to limit the dust dispersion from stockpiles.			
Post-Mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-42)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place.			
Prior to Mitigation / Management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-63)

Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

Mitigation / Management Actions

- Limit the height and footprint area of Cooke thickener infrastructure where possible;
- Use shade cloth / netting to screen the construction site;
- Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and
- If construction activities take place at night, down lighting must be implemented to minimise light pollution.

Post-Mitigation

Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Minor negative (-48)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	

Nature	Negative		

10.1.10.3 Collection Sumps and Pump Stations

The collection sumps and pump stations at Cooke TSF will be constructed within the Cooke MRA. This infrastructure is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the collection sumps and pump stations are indicated in Table 10-26.

Table 10-26: Interactions and Impacts of the Collection Sumps and Pump Stations on the Visual Aspects of the Cooke MRA (Construction Phase)

Interaction	Impact
Change of land use from agriculture to industry / mining	Change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance.
Site clearance and vegetation removal	Site clearance and removal of vegetation will have a negative visual impact on the receiving environment. The project area will become noticeable to nearby receptors as it will contrast the surrounding areas.
Topsoil removal and stockpiling	Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.
Infrastructure development	The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place. Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place.

10.1.10.3.1 Impact Description

The collection sumps and pump stations are only expected to be visible from close proximity. Change of land use from agriculture to industry / mining as a result of the collection sumps and pump stations will have a minor negative visual impact on the receiving environment. Site clearance and vegetation removal, and topsoil removal and stockpiling prior to the development of the collection sumps and pump stations will have a minor negative visual impact on the receiving environment. Construction of the collection sumps and pump stations will have a minor negative visual impact on the receiving environment.

10.1.10.3.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the change of land use from agriculture to industry / mining. The management objectives also aim to minimise the negative visual impact caused by site clearance and vegetation removal, topsoil removal and stockpiling and infrastructure development.

10.1.10.3.3 Management Actions

The following management actions are required for the collection sumps and pump stations in the Cooke MRA:

- Vegetation should only be removed when and where necessary;
- Topsoil should only be removed when and where necessary;
- Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape;
- Limit the height of topsoil stockpiles to 3 metres;
- Apply dust suppression techniques to limit the dust dispersion from stockpiles;
- Limit the height and footprint area of collection sump and pump station infrastructure where possible;
- Use shade cloth / netting to screen the construction site;
- Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible;
- Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and
- If construction activities take place at night, down lighting must be implemented to minimise light pollution.

The significance impact ratings associated with the construction phase of this project are detailed in Table 10-27 below.

Table 10-27: Potential Impacts of the Collection Sumps and Pump Stations on the Visual Aspects of the Cooke MRA

<table>
<tr><th colspan="4">Activity and Interaction (Collection sumps and pump stations result in change of land use from agriculture to industry / mining)</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Impact Description: The change of land use from agriculture to industry / mining will have a negative visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from a rural sense of place to an industrial / mining sense of place resulting in a loss of scenic character and increased visual disturbance.
This impact can potentially be reversed during the decommissioning phase if all the infrastructure is removed and the area is rehabilitated.</td></tr>
<tr><td colspan="4">Prior to Mitigation / Management</td></tr>
<tr><td>Duration</td><td>Medium Term (3)</td><td>The impact will occur for 1-5 years and the impact can be reversed with minimal management.</td><td rowspan="5">Minor negative (-42)</td></tr>
<tr><td>Extent</td><td>Very Limited / Isolated (1)</td><td>The impact is limited to specific isolated parts of the site.</td></tr>
<tr><td>Intensity</td><td>Minor (2)</td><td>Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning.
Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>There are sound scientific reasons to expect that the impact will definitely occur.
> 80% probability</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation / Management Actions</td></tr>
<tr><td colspan="4">Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Medium Term (3)</td><td>The impact will occur for 1-5 years and the impact can be reversed with minimal management.</td><td>Minor negative (-36)</td></tr>
</table>

Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require site clearance and vegetation removal)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The removal of vegetation for site clearing will have a negative visual impact on the receiving environment. The project area will become noticeable to the nearby receptors as it will contrast the surrounding areas.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	

Nature	Negative		
Mitigation / Management Actions			
Vegetation should only be removed when and where necessary.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-30)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require topsoil removal and stockpiling)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Topsoil removal and stockpiling will have a negative visual impact on the receiving environment. Dust from the stockpiles will also have a negative visual impact.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem	

		functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
Topsoil should only be removed when and where necessary; Topsoil stockpiles should be vegetated where possible so as to blend into the surrounding landscape; Limit the height of topsoil stockpiles to 3 metres; Apply dust suppression techniques to limit the dust dispersion from stockpiles.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-30)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require infrastructure development)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The construction of surface infrastructure will have a negative visual impact on the receiving environment. The surface infrastructure will change the sense of place of the project area from a rural sense of place to an industrial / mining sense of place.			

Construction area lighting at night will have a negative visual impact on the receiving environment. The construction area lighting will be visible from afar and will draw attention to the project area. This will also have a negative impact on the sense of place.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
Limit the height and footprint area of collection sump and pump station infrastructure where possible; Use shade cloth / netting to screen the construction site; Surface infrastructure should be painted natural hues so as to blend into the surrounding landscape where possible; Pylons and metal structures should be galvanised so as to weather to a matt grey finish rather than be painted silver. If the pylons and metal structures are painted, it is recommended that a neutral matt finish be used; and If construction activities take place at night, down lighting must be implemented to minimise light pollution.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-30)

Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.1.11 Heritage Impacts

A Heritage Impact Assessment (HIA) was initially completed for the Cooke Mining Right area during the running of the Gold One' CUP. At this time, Gold One had intended to reclaim historical TSFs in Westonaria, Randfontein, Mogale City and Johnnesburg regions as detailed in introduction of this report. No direct impacts to heritage resources were identified during the HIA. Only two built structures, generally protected under section 34 of the NHRA, were identified in proximity to the proposed pipeline routing.

SAHRA issued final comment on the Geluksdal TSF and Pipeline in January 2014. The SAHRA Archaeology, Palaeontology and Meteorites Unit had no objection to the development on condition that if any new evidence of archaeological sites or artefacts, palaeontological fossils, graves or other heritage resources are found during the implementation of the project, SAHRA or an archaeologist be informed immediately.

As this portion of the WRTRP was previously considered (Case ID 871), and final comment received, this portion of the WRTRP is **<u>not considered further</u>**.

10.1.12 Socio-economic Impacts

The potential socio-economic impacts are complex in nature as the potential impacts are multi-dimensional, interrelated and mutually reinforcing. In addition, the potential socio-economic impacts may not result from individual project activities, but due to the presence of the Ultimate Project as a whole; the driving factors behind potential socio-economic activities are not easily determined. For ease of reference throughout this report, the project activity "*Employment and Procurement*" will be used to refer to all potential socio-economic impacts and their related mitigation measures, although the potential impacts may result from a combination of activities. It should also be noted that majority of the socio-economic impacts are likely to occur throughout the project life, and have been rated as such, but are detailed during the construction phase only.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-28.

Table 10-28: Summary of the Potential Socio-Economic Impacts Resulting from the Construction Phase

Interaction	Impact
Employment and procurement for the construction and operation of the WRTRP.	Local employment and procurement of goods and services, as well as skills development, capacity building and economic development will have a positive impact. All these impacts will result in a positive contribution to the GDP.
	Disruption of movement and mobility for people and livestock.
	Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.

10.1.12.1 Employment and Procurement

10.1.12.1.1 Impact Description: Job creation, economy stimulation and development

It is expected that a large portion of the workforce required during the construction and operational phases will be derived from within the borders of the affected local municipalities, although this number is not yet known. It is estimated that approximately 2 000 employees will be required for the construction phase (for the WRTRP as a whole) and it is likely that construction activities will be undertaken through the appointment of contractors. The construction phase of the project will include activities such as engineering and design, infrastructure development, installation of machinery and equipment, civil engineering works, labour and capital and other construction related activities. It is anticipated that a total capital investment in excess of R 9 billion will be spent by SGL during the construction phase. This positive impact to local businesses and suppliers will have a further positive impact on the region through indirect and induced impacts on the economy.

In addition, SGL has a Social and Labour Plan with commitments that include skills development, basic education (literacy and numeracy) and capacity building of its employees, all of which contributes towards the improvement of the skills levels amongst the population in the region. It is anticipated that the Social and Labour Plan, and associated LED Plan, will provide benefits to the local economy by stimulating the growth of small businesses and contributing towards skills development.

10.1.12.1.2 Management Objectives

The communities in the vicinity of the project are likely to be affected the most by the project's activities. It is consistent with national legislation and international best practice standards that these host communities are given special consideration in terms of the project's benefits. To enhance the potential positive impacts associated with the project, the following enhancement measures have been proposed:

- Use labour-intensive construction methods, where feasible, to increase employment opportunities;
- Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities;
- Local labour, local construction contractors and local and small businesses should be prioritised;
- Reserve a percentage of, and promote employment opportunities for woman and the youth;
- Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments;
- Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies;
- Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited;
- Identify students from local schools to participate in company bursaries and internship programmes;
- Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured;
- Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate;
- Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL; and
- Support housing development through the promoting of house ownership for employees.

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-29.

Table 10-29: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct, indirect and induced positive impacts as a result of local employment, procurement of local goods and services and skills and training development.			
Prior to enhancement/ management			
Duration	Project life (5)	The impacts will last for the life of the project.	Minor (positive) 60
Extent	Local (3)	Employment and procurement will target the local municipal areas.	
Intensity	Moderately high (4)	The economy's output will increase by R9.1 billion through employment and procurement.	
Probability	Likely (5)	Without the appropriate enhancement measures, potential for local recruitment and procurement will not be realised.	
Nature	Positive		
Enhancement/ Management actions			
▪ Use labour-intensive construction methods, where feasible, to increase employment opportunities; ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.			
Post- enhancement			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive)

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	National (6)	The resultant impacts will have a significant impact on a national scale.	96
Intensity	High (5)	Enhancement will maximise local job creation and procurement which will result in significant multiplier affects.	
Probability	Highly probable (6)	Enhancement measures will ensure the local employment and procurement potential is realised.	
Nature	Positive		

10.1.12.1.3 Impact Description: Disruption of Movement Patterns

The construction activities may impact on the daily movement patterns and mobility of people and livestock, both in terms of movement between farms and the use of existing access routes. Temporary disruption may extend to provincial and regional roads. This impact is considered to be medium-low (negative) and the following mitigation measures are proposed:

- Inform and consult local communities regarding construction activities and potential road closures;
- Implement a grievance mechanism and procedures for surrounding communities to provide comments and issues relating to activities associated with the WRTRP;
- Erect suitable traffic and construction signage to raise awareness of construction and potential hazards; and
- Implement cattle corridors and access points during construction activities to ensure grazing areas are uninterrupted.

10.1.12.1.4 Impact Description: Population Influx

Expectations regarding possible employment opportunities may arise once activities commence on site. Consequently, the area surrounding the CPP and RTSF complex may experience an influx of job seekers as this has already occurred in these areas since mining has expanded in the region. The magnitude of this impact may be influenced by the severity of poverty and unemployment, as people will be more inclined to travel in search of better livelihoods through employment.

The regional and local socio-economic profile indicates that poverty and unemployment are major challenges in the surrounding communities. It can therefore be anticipated that many job seekers (and sometimes whole families), as well as entrepreneurs and opportunists, will move to the broader Project area. In the event that a portion of the workforce is recruited from outside the local area, their presence will constitute an additional influx of people. Furthermore unsuccessful job seekers from outside the Project area may decide to settle in the Project area. This impact may commence prior to construction, and is likely to continue after construction has been completed.

The limited influx of construction workers, job-seekers and others is expected to have some social consequences. These include increased pressure on local services, resources and facilities, establishment and growth of informal settlements, conflict amongst communities and an increase in social pathologies and communicable diseases.

10.1.12.1.5 Management Objectives

Management objectives will be to minimise and manage the potential negative impacts associated with population influx.

The significance of the potential socio-economic impacts associated with the construction phase of the project are outlined in Table 10-30.

Table 10-30: Pre-Mitigation and Post-Mitigation Potential Impacts on the Socio-Economic Environment

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Resultant negative impacts associated with population influx.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	Influx may commence when information about the project becomes known. The impact will gain momentum during construction. Influx may seize during operation but some impacts will continue (e.g. HIV/Aids)	Medium high (negative) - 84
Extent	Municipal Area (4)	In vicinity of some project sites and at surrounding settlements	
Intensity	Moderately high (4)	Intensity will vary for different individuals and groups. Residents near project sites will be most severely impacted	
Probability	Highly Probable (5)	Pressure on services and growth of informal settlements is already a problem	
Nature	Highly probable (6)	The impact will likely occur	
Mitigation/ Management actions			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Involve community structures to assist in communicating labour requirements and other mine related aspects to the communities; ▪ SGL must liaise with the municipalities to ensure expected population influx is taken into account for infrastructure development and planning; ▪ Promote development projects, such as low cost housing, by including such developments in the Social and Labour Plan and LED programmes; ▪ Implement an HIV/AIDS and alcohol abuse awareness campaigns in the communities and include such campaigns as a condition of contract for suppliers and sub-contractors; ▪ A voluntary counselling and testing (VCT) programme must be introduced for all employees for the WRTRP; ▪ Access control to operational areas must be implemented to prevent sex workers and petty traders from loitering near construction camps and operational areas; ▪ Construction and operational personnel must be dressed in uniform to clearly identify non-employed personnel from entering restricted areas; ▪ Liaison structures and forums must be established with the local police to monitor social changes in crime patterns; and ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities.			
Post- mitigation			
Duration	Beyond project life (6)	Influx may commence when information about the project becomes known. The impact will gain momentum during construction. Influx may seize during operation but some impacts will continue (e.g. HIV/Aids)	Medium low (negative) - 55
Extent	Local (3)	In vicinity of some project sites and at surrounding settlements	
Intensity	Moderate (3)	Mitigation will reduce the scope and intensity of the impact, minimise construction camp impacts and assist local structures	
Probability	Likely (5)	The impact my still occur, even with mitigation	
Nature	Negative		

10.2 Operational Phase

The activities proposed to occur during the operational phase of the project, and from which potential impacts may emanate include the following:

- The reclamation of the Cooke and C4S TSFs, which includes the temporary storage of the slurry in a sump;
- Abstraction of water from the Cooke 1 and Cooke 4 shafts;
- Pumping of water from the Cooke 1 and the Cooke 4 shafts for use during reclamation activities at the Cooke and C4S TSFs respectively;
- Pumping 500 kt/m of tailings from the Cooke TSF to the Cooke Thickener; and
- Pumping tailings from the Cooke thickener to the CPP via Ezulwini.

10.2.1 Air Quality Impacts

During the operational phase, the reclamation of the Cooke and C4S TSFs may have an impact on the ambient air quality. The impacts imposed onto the environment as a result of the proposed interactions are described in the table below.

Table 10-31: Interactions and Impacts associated with Air Quality during the Operational Phase

Interaction	Impact
Wind erosion	Reduction in the quality of ambient air due to fugitive dust emissions

10.2.1.1 Impact Description

Hydraulic reclamation is a wet process; as such impact on ambient air quality will be minimal. For Cooke TSF, model predication showed that the maximum ground level concentrations of PM_{10}, daily and annual were in exceedance of the standard of 75 µg/m3 and 40 µg/m3 respectively. However, these exceedances were confined to the centre of the Cooke TSF. The predicted daily and annual $PM_{2.5}$ concentrations were within regulatory limit of 65 µg/3 and 25 µg/m3 respectively. The maximum predicted dust deposition rates were within the standard of 600 mg/m2/day.

For C4S, model simulation showed daily PM_{10} maximum predicted above the limit of 75 µg/m^3, while the annual concentration was within the limit of 40 µg/m^3. The predicted daily and annual $PM_{2.5}$ concentrations were within regulatory limit of 65 µg/m^3 and 25 µg/m^3 respectively. The maximum predicted dust deposition rate was within the standard of 600 mg/m^2/day.

10.2.1.2 Management Objectives

The management objective is to ensure that emissions on-site and of-site from the reclamation activity comply with the relevant regulatory standards for the protection of the environment, human health and wellbeing.

10.2.1.3 Management Actions and Targets

Application of dust suppressants and implementation of emissions management programme to assess performance and compliance to regulatory standards. Monitoring dust levels on site, at upwind and downwind locations preferably at discrete receptors to assess public exposure.

The air quality significance impact ratings associated with the operational phase of this project are detailed in Table 10-32 below.

Table 10-32: Potential impacts of Reclamation of Cooke TSF and C4S TSF

Activity and Interaction: Reclamation of Cooke TSF will result in fugitive dust emissions			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in air quality from wind erosion			
Prior to mitigation/ management			
Duration	Medium term (3)	Dust will be produced in the medium term	Negligible (negative) – 10
Extent	Very Limited (1)	Dust generated will be limited to the site and the immediate surroundings	
Intensity	Limited - negative (-1)	Limited impact on ambient air quality during operational phase	
Probability	Rare (2)	Possibility of dust generation is very low.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on exposed areas; and ▪ Set maximum speed limits and have these limits enforced.			
Post- mitigation			
Duration	Medium term (3)	Dust will be produced in the medium term	Negligible (negative) – 10
Extent	Very limited (1)	After mitigation measures are implemented, it is expected that dust impacts will be limited to isolated parts of the site.	
Intensity	Limited - negative (-1)	Limited impact on ambient air quality during operational phase	
Probability	Rare (2)	Possibility of dust generation is very low	

Activity and Interaction: Reclamation of Cooke TSF will result in fugitive dust emissions			
Nature	Negative		

10.2.2 Noise Impacts

During the operational phase of the project, the anticipated impacts are likely to result from reclamation activities and the operation of the pump station and Thickeners. The table below details the potential impacts imposed onto the receiving environment as a result of the proposed activities during the operational phase.

Table 10-33: Interactions and Impacts associated with Noise during the Operational Phase

Interaction	Impact
Reclamation activities at Cooke and C4S TSFs	Noise will emanate from the reclamation activities and pump stations during the operational phase.
Operation of the pump station at Cooke and C4S TSFs and the Cooke Thickener	

10.2.2.1 *Impact Description*

The noise impacts associated with the operational phase will emanate from the reclamation activities and the operation of the pump stations and Cooke Thickener. The noise modelling results indicate that the expected noise will not measure above the SANS 10103:2008 daytime rating levels (50 dBA) as well as night time rating levels (40 dBA) at the surrounding suburban receptors and therefore not impact on the surrounding receptors. Based on the definition of disturbing noise in the Gauteng Noise Control Regulations there will be no disturbance although certain noise sources may still be audible and therefore rated as a negligible impact on the surrounding receptors.

The mitigation or management actions proposed for the abovementioned impacts include the following:

- If complaints are received about the noise from the pump stations then noise barriers should be installed between the pump station and the specific complainant, as close to the pump stations as possible;
- Regular service maintenance on the pumps and pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry, including design prevention appurtenances like rapture discs where warrented;
- Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
- Switching off equipment when not in use.

The noise significance impact ratings associated with the operational phase are detailed in Table 10-34 below.

Table 10-34: Pre-mitigation and Post-mitigation significance ratings for impacts on noise during the operational phase

Dimension	Rating	Motivation	Significance
Activity and Interaction (Reclamation activities and operation of the pump stations at Cooke TSF)			
Impact Description: Noise will emanate from the reclamation activities, water storage and pump stations during the operational phase.			
Prior to mitigation/ management			
Duration	Project Life (5)	Noise will be produced for the duration of life of mine	Negligible (negative) – 27
Extent	Local (3)	It is expected that during operation noise will be limited to site.	
Intensity x type of impact	Minor - negative (-1)	It is expected that during operational phase noise will have a minor social impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding communities as the locations of pump stations and pipe routes are largely remote..	
Nature	Negative		
Mitigation/ Management action			
▪ If complaints are received about the noise from the pump stations then noise barriers should be installed between the pump station and the specific complainant, as close to the pump stations as possible; ▪ Regular service maintenance on the pumps and pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry,include design prevention appurtenances like rupture discs where warranted; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Project Life (5)	Noise will be produced for the duration of life of mine	Negligible (negative) – 18
Extent	Local (3)	It is expected that the disturbing noise will be limited to the site area.	
Intensity x type of impact	Minimal - negative (-1)	It is expected that during operational phase noise will have a minor impact	

Dimension	Rating	Motivation	Significance
Probability	Unlikely (2)	It is unlikely that noise will impact on the surrounding receptors as the locations of pump stations and pipe routes are largely remote..	
Nature	Negative		

10.2.3 Groundwater Impacts

10.2.3.1 Impact Description

The impact on groundwater as a result of the reclamation is anticipated to be positive within the long term basis. This is due to the fact that the TSFs, which are sources of contamination, will be removed.

In the short term however, the hydraulic reclamation of the TSFs could result in the partial seepage through the TSFs. The table below describes the potential impact as a result of the proposed interaction with the environment.

Table 10-35: Interactions and Impacts associated with Noise during the Operational Phase

Interaction	Impact
Hydraulic reclamation	Seepage through the TSFs of the water to be used for hydraulic reclamation
Pump station and water and slurry pipelines	Water/slurry leakage from pump station and or pipelines
Tailings exposure to oxygen and water	Acid Mine Drainage

It is recommended that the monitoring of the groundwater quality and water levels should be used as a form of mitigation or management actions. The Cooke TSF is not lined and seepage is expected to drain into the underlying groundwater system. This seepage can impact the water quality negatively and increase the cost of pumping from the underground mine voids as shown in Table 10-36 below.

Table 10-36: Potential groundwater impacts during the operation phase

Dimension	Rating	Motivation	Significance
Impact Description: Groundwater contamination due to seepage during hydraulic re-mining			
Prior to mitigation/ management			
Duration	Project Life (5)	Seepage of contaminated water could occur during the operation phase	Minor (negative) – 44
Extent	Local (3)	The impact is expected to be local	

Dimension	Rating	Motivation	Significance
Intensity	Moderate (3)	The contamination will be moderate as it will be local and an area that is already contaminated	
Probability	Probable (4)	Seepage due to the water used during hydraulic re-mining is probable	
Nature	Negative		
Mitigation/ Management actions			
Monitoring of groundwater quality and water levels. Minimise ponding of water within the reclamation area.			
Post- mitigation			
Duration	Project Life (5)	Contamination due to the hydraulic reclamation will persist during the life of mine	Negligible (negative) – 24
Extent	Limited (2)	The seepage is expected to be limited to the TSF footprint area	
Intensity	Minimal (1)	Impact will be underneath the TSF only due to the dolomitic nature and vertical hydraulic gradient	
Probability	Unlikely (3)	Impact to the groundwater outside the TSF areas is unlikely	
Nature	Negative		
Impact Description: Acid mine drainage due to the TSF disturbance and exposure to oxygen and moisture			
Prior to mitigation/ management			
Duration	Project Life (5)	Acid mine drainage can be generated and heavy metals can be mobilised. This is likely to persist throughout the life of operation	Minor (negative) – 54
Extent	Local (3)	The pollution plume is expected to be local laterally, but with a potential of migrating vertically to the underground mines	
Intensity	Minor (2)	The area is already contaminated. The existence of dolomite is also beneficial to buffer the acid	

Dimension	Rating	Motivation	Significance
Probability	Almost certain (6)	AMD generation is during the reclamation process and tailings disturbance is almost certain	
Nature	Negative		
Mitigation/ Management actions [4]			
Monitoring of groundwater quality. Minimise area of disturbance to avoid AMD at multiple places.			
Post management			
Duration	Long-term (4)	AMD generation will stop once the TSFs have been reclaimed	Negligible (negative) – 21
Extent	Limited (2)	With the reclamation from one end of the TSF, instead of multiple areas is likely to render AMD generation at controlled sites only	
Intensity	Minimal (1)	Once the AMD generation is controlled, the environmental impact in the area that is already contaminated is expected to be minimal	
Probability	Unlikely (3)	AMD is unlikely to occur if the above recommended procedures are implemented	
Nature	Negative		

10.2.4 Soil Impacts

During the operational phase similar impacts will occur as these pipelines would need to be maintained via servitudes.

Table 10-37: Interactions and Impacts associated with Soils during the Operational Phase

Interaction	Impact
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction

[4] This shouldn't be long. it is a brief, bulleted description of the mitigation

Interaction	Impact
	Loss of Land capability

10.2.4.1 Impacts Description

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

The loss of topsoil as a resource will have a high negative impact, the natural regeneration of a few millimetres of topsoil takes hundreds of years

10.2.4.1 Management Objectives

The management objectives are to limit the impacts that could occur on the sites and the following has been recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading.
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil.
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

10.2.4.1 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement dust suppression measures; and

- Proper storm management design is to be implemented to minimise and control dirty water runoff.

The impact rating for the change in land use and land capability after reclamation activities is described in the table below

Table 10-38: Impact rating for change in land use and land capability after reclamation activities

Activity and Interaction: ■ Pipeline routes			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

10.2.5 Surface Water Impacts

The operational phase of the project will consist of the operation of mining machinery such as pumps, and the abstraction of water from the Cooke 1 and 2 shafts.

The interaction of the proposed activity with the environment and the potential impact which may result is detailed in Table 10-39 below.

Table 10-39: Interactions and Impacts associated with Surface Water during the Operational Phase

Interaction	Impact
Pump failure and the overflow of sumps	The contamination of downstream water quality

10.2.5.1 Impact Description

As a result of the operation of the sumps and pumps the following potential impacts are predicted:

- Overflow of sumps to the downstream surface water resources; and
- Failure of pumps resulting in slurry from sumps to overflow to the downstream environment.

10.2.5.2 Management objectives

The management objectives adopted during the construction phase relate specifically to GN 704, which was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

The two main conditions of GN 704 applicable to this project are:

- *Condition 6* describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.
- *Condition 7* describes the measures which must be taken to protect water resources. All dirty water or substances which may result in pollution should be prevented from entering a water resource (by spillage, seepage, erosion) and ensure that water used in any process is recycled as far as practicable.

10.2.5.3 Management Actions and Targets

In this section management actions relating to the activities envisaged during the operational phase are described together with the targets required to ensure mitigation of the impacts occur.

10.2.5.3.1 Pump Failure and Overflows from Sumps

To manage the impact of contamination of the surface water resources, the following targets are required.

The management of sumps and pumps are linked. The pumps located at each of the sumps should be installed within closed off areas to contain material spillages. During power failure, manual monitoring of the sump associated with the pump station should be carried out. This ensures that the reclamation activities can be slowed down or emergency procedures can be actioned. The emergency procedures in the event of power failure should at least include operational modifications and the use of a stand-by generator to operate the pump station should the sump be getting full.

During pump failure overflows from sumps to the downstream watercourse may occur. It is therefore recommended that overflow compartments be constructed so as to contain any spillages that do occur. The compartments should be monitored and cleaned whenever spillages do occur, to ensure that the adequate capacity is available to mitigate additional spillages.

The significance impact ratings associated with the operational phase of the project are detailed in Table 10-40 below.

Table 10-40: Operational phase impact ratings for activities taking place in the Cooke MRA

Dimension	Rating	Motivation	Significance
Activity and Interaction: Operation of sumps and pumps			
Impact Description: Pump failure and overflow from sumps to contaminate downstream water quality			
Prior to mitigation/ management			
Duration	Project Life (5)	The whole operational phase will see the use of the sumps and pumps	Minor - negative (56)
Extent	Municipal Area (4)	Should overflows occur the impacts will be felt in the immediate catchment and might not be felt at quaternary catchment scale	
Intensity	High - (5)	The management of sumps and pumps are linked	
Probability	Probable (4)	It is likely that compaction will occur during construction	
Nature	negative		
Mitigation/ Management actions			
▪ Construct, monitor and maintain overflow compartments downstream of the sump area. ▪ Ensure emergency procedures in the event of power failure such as operational modifications and the use of a stand-by generator to operate the pump station should the sump be getting full.			
Post- mitigation			

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	Same as the pre mining	Negligible - negative (27)
Extent	Limited (2)	The impacts will not be far reaching as long as emergency measures are in place to collect any overflow thus will be limited to the control measures	
Intensity	Low - (2)	Impacts will be contained with mitigation and control measures	
Probability	Unlikely (3)	With mitigation the impacts it is unlikely that impacts will occur	
Nature	negative		

10.2.6 Aquatic Impacts

The interaction of the proposed activities with the aquatic environment during the operational phase and the potential impact which may result is detailed in Table 10-41 below.

Table 10-41: Interactions and Impacts associated with Aquatics during the Operational Phase

Interaction	Impact
Reclamation activities	Potential persistent pollutant contamination with increased suspended and dissolved solids resulting in water and habitat quality modification and subsequent loss of sensitive aquatic biota and a reduction in overall aquatic biodiversity.

10.2.6.1 Impact Description

Potential water and habitat quality degradation causing resultant negative impacts on local aquatic ecology. Water quality impacts may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Habitat quality impacts may include sedimentation, bed, channel and flow modification.

10.2.6.2 Management Objectives

The objective is to preserve the Present Ecological Status (PES) and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

10.2.6.3 Management Actions

The management actions are detailed in Section 9.1.8 above. More management actions include:

- Establish riparian buffer up to 500m (minimum 100m);

- Silt traps placed within clean water return channels;
- The planting of indigenous trees around the TSF and pollution control facilities;
- Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used; and
- Groundwater management according to the ground water study (Digby Wells, 2015).

The significance impact ratings associated with the operational phase of the project are detailed in Table 10-42 below.

Table 10-42: Potential water and habitat quality impacts during the operation phase

Activity and Interaction: Reclamation activities			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately >15 years.	78 (Moderate)
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Very serious (-5)	Runoff from the exposed TSF material during the reclamation would likely enter and degrade local aquatic ecosystems.	
Probability	Almost certain (6)	The impact will almost certainly occur if activities are to occur within proximity to the river systems without mitigation actions.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used. ▪ Groundwater management according to the ground water study (Digby Wells, 2015).			
Post- mitigation			

Duration	Project life (5)	The impact will occur for the duration of the project which is approximately >15 years.	39 (Minor)
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Very serious (-5)	Runoff from the exposed TSF material during the reclamation would likely enter and degrade local aquatic ecosystems.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Activity and Interaction: Removal of water from the Wonderfonteinspruit			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Habitat quality modification			
Prior to mitigation/ management			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately >15 years.	60 (Minor)
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Minor (-2)	The removal of water from the Wonderfonteinspruit will likely reduce the overall available habitat. However, the flows at present are already artificial which has resulted in inundation of typically terrestrial regions. Therefore, the removal of water may result in a reduction of inundation.	
Probability	Almost certain (6)	The impact will almost certainly occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used.			
Post- mitigation			

Duration	Project life (5)	The impact will occur for the duration of the project which is approximately >15 years.	39 (Minor)
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Minor (-2)	The removal of water from the Wonderfonteinspruit will likely reduce the overall available habitat. However, the flows at present are already artificial which has resulted in inundation of typically terrestrial regions. Therefore, the removal of water may result in a reduction of inundation.	
Probability	Almost certain (6)	The impact will almost certainly occur.	

10.2.7 Fauna and Flora Impacts

Operational activities will not lead to direct impacts to fauna and flora.

10.2.8 Wetland Impacts

The major impacts anticipated due to the proposed interactions are listed in the table below.

Table 10-43: Interactions and Impacts associated with Wetlands during the Operational Phase

Interaction	Impact
Existence, operation and maintenance of the pipeline through the pan wetland, under the N12.	Minimal impact to wetlands as following existing servitude under the N12; however operation will still be recognised as an industrial negative impact to wetland integrity.

10.2.8.1 Impact Description

The existence and operation of the pipeline route from the Cooke TSF to Ezulwini will continue to be within the pan wetland as the pipeline crosses the N12. There is an existing culvert and built servitude running under the N12 that is to be used, which is within the wetland. The pipeline containing tailings slurry has the potential to impact the wetlands if an unplanned spill occurs.

10.2.8.2 Management objectives

Management objectives are to inform SGL where there are wetland interactions with the proposed activities during the construction of the WRTRP infrastructure in the Cooke MRA. These objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.2.8.3 Management Actions and Targets

During the operation of the WRTRP infrastructure in the Cooke MRA, general mitigation and management actions provided in the following studies done by Digby Wells as part of this project should be used to guide the effective management of wetland ecological resources affected by the proposed project:

- Aquatic Ecology Report (Digby Wells, 2015b);
- Fauna and Flora Assessment Report (Digby Wells, 2015c);
- Groundwater Assessment Report (Digby Wells, 2015d);
- Rehabilitation Plan (Digby Wells, 2015e); and
- Surface Water Report (Digby Wells, 2015f).

The Wetland Management Plan detailed in the Wetlands Report in Appendix K of this report must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- The edge of the wetlands and a 100m buffer should be managed as a no-go area.
- The wetlands in the general area of the WRTRP should be managed through a Land Management Plan to potentially increase their general functionality.
- Pipeline structures must be managed and maintained to ensure their safe functioning, especially over wetland crossings.

The significance impact ratings associated with the operational phase of this project are detailed in Table 10-44 below.

Table 10-44: Summary of Wetland Impact Ratings for the initial Operational Phase in the Cooke MRA

Activity and Interaction: Pipeline in and around wetland at N12			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Disturbance of wetland habitat as the pipeline is an industrial negative impact to wetland integrity.			
Prior to mitigation/ management			

Duration	Project Life (5)	Wetland habitat will be impacted by the pipeline for the duration of the project.	-70 "Minor negative"
Extent	Limited (2)	Only a limited extent of the pan wetland will be impacted.	
Intensity	Minor effect (3)	This constitutes a minor effect to the wetland.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		
Mitigation/ Management actions			
▪ Monitoring of the pipeline and continuous maintenance, especially over wetlands to include: ▪ Alien and Invasive flora management along the project area according to the Fauna and Flora Report (Digby Wells, 2015c) ▪ Erosion control and continuous rehabilitation as per the Rehabilitation Plan (Digby Wells, 2015e). ▪ Note: Demarcating the wetland and the buffer with rehabilitation interventions could have a positive impact.			
Post-mitigation			
Duration	Project Life (5)	Rehabilitation and mitigation will not decrease the duration of the pipeline being in situ.	-63 "Minor negative"
Extent	Very limited (2)	Only isolated parts of the pan wetland will be impacted.	
Intensity	Minor effect (2)	This constitutes a minor effect to the wetland.	
Probability	Definite (7)	This will occur according to the proposed infrastructure layout.	
Nature	Negative		

10.2.9 Topography Impacts

10.2.9.1 Hydraulic Reclamation

Hydraulic reclamation of Cooke TSF and Cooke 4 South TSF will occur within the Cooke MRA. This is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the hydraulic reclamation are indicated in Table 10-45.

Table 10-45: Interactions and Impacts of the Hydraulic Reclamation on the Topography of the Cooke MRA (Operational Phase)

Interaction	Impact

Interaction	Impact
Hydraulic reclamation	Hydraulic reclamation involves removing features from the surface and will thereby change the topography.

10.2.9.1.1 Impact Description

Hydraulic reclamation of Cooke TSF will have a moderate negative impact on the topography. Once the hydraulic reclamation is complete, there will be a neutral impact on the topography and it will be returned to a state similar to the pre-mining state.

10.2.9.1.2 Management Objectives

The management objectives are to return the topography to a state similar to the pre-mining state by means of hydraulic reclamation.

10.2.9.1.3 Management Actions

The following management actions are required for the hydraulic reclamation in the Cooke MRA:

- Ensure the slopes of the TSF are not too steep (18° or less) during reclamation to prevent slope failure.

The table below represents the impact ratings and mitigation / management measures for the hydraulic reclamation in the Cooke Mining Right area.

Table 10-46: Potential Impacts of the Hydraulic Reclamation on the Topography of the Cooke MRA (Operational Phase)

Activity and Interaction (Hydraulic Reclamation of Cooke TSF)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Hydraulic reclamation involves removing features from the surface and will thereby change the topography. Once the hydraulic reclamation is complete, there will be an overall neutral impact on the topography. This will help to reverse some of the changes that occurred as a result of previous mining.			
Prior to Mitigation / Management			
Duration	Long Term (4)	The impact will occur for 6-15 years and the impact can be reversed with management.	Moderate negative (-84)
Extent	Local (3)	The impact will extend only as far as the development site area.	

Intensity	Very Serious (5)	Serious loss and / or damage to biological or physical resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure the slopes of the TSF are not too steep (18° or less) during reclamation to prevent slope failure.			
Post-Mitigation			
Duration	Long Term (4)	The impact will occur for 6-15 years and the impact can be reversed with management.	Moderate negative (-77)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Serious (4)	Serious loss and / or damage to biological or physical resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.2.10 Visual Impacts

10.2.10.1 Hydraulic Reclamation

Hydraulic reclamation of Cooke TSF and Cooke 4 South TSF will occur within the Cooke MRA. This is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the hydraulic reclamation are indicated in Table 10-47.

Table 10-47: Interactions and Impacts of the Hydraulic Reclamation on the Visual Aspects of the Cooke MRA (Operational Phase)

Interaction	Impact
Hydraulic reclamation	Hydraulic reclamation will have a negative visual impact on the receiving environment. Dust from the hydraulic reclamation will also have a negative visual impact. Once the hydraulic reclamation is complete, there will be an overall neutral visual impact on the receiving environment.

10.2.10.1.1 Impact Description

Hydraulic reclamation of Cooke TSF will have a moderate negative visual impact on the receiving environment. Once the hydraulic reclamation is complete, there will be a neutral visual impact on the receiving environment and it will be returned to a state similar to the pre-mining state.

10.2.10.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the hydraulic reclamation of Cooke TSF.

10.2.10.1.3 Management Actions

The following management actions are required for the hydraulic reclamation in the Cooke MRA:

- Apply dust suppression techniques to limit the dust dispersion from reclamation.

The impact ratings and mitigation / management measures for the hydraulic reclamation are summarised in Table 10-48.

Table 10-48: Potential Impacts of the Hydraulic Reclamation on the Visual Aspects of the Cooke MRA

Activity and Interaction (Hydraulic Reclamation of Cooke TSF)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Hydraulic reclamation will have a negative visual impact on the receiving environment. Dust from the hydraulic reclamation will also have a negative visual impact. Once the hydraulic reclamation is complete, there will be an overall neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred as a result of previous mining.			
Prior to Mitigation / Management			
Duration	Long Term (4)	The impact will occur for 6-15 years and the	Moderate

		impact can be reversed with management.	negative (-77)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Serious (4)	Serious loss and / or damage to biological or physical resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Apply dust suppression techniques to limit the dust dispersion from reclamation.			
Post-Mitigation			
Duration	Long Term (4)	The impact will occur for 6-15 years and the impact can be reversed with management.	Minor negative (-60)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.2.11 Heritage Impacts

See Section 10.1.9.

10.2.12 Socio-economic Impacts

As detailed in Section 10.1.12, socio-economic impacts may arise from the construction phase and continue throughout the life of the project. As a result, although these impacts may continue to occur during the operational phase, these impacts have not been reassessed for the operational phase below. For ease of reference, all potential socio-economic impacts fall under the activity *Employment and Procurement*.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-49.

Table 10-49: Summary of the Potential Socio-Economic Impacts Resulting from the Operational Phase

Interaction	Impact
Employment and procurement during the operational phase of the WRTRP.	Local employment and procurement of goods specific to the operational phase of the WRTRP.
Production of gold and uranium.	Export of uranium and gold will contribute to South Africa's export earnings and allows the country to earn foreign exchange.

10.2.12.1 Employment and Procurement

10.2.12.1.1 Impact Description: Job Creati on and Economy Stimulation

The Overall WRTRP will provide an estimated 500 permanent job positions over the life of the operation. The project will also result in indirect employment opportunities in the formal and informal sectors following project expenditure in the local areas and through the creation and expansion of local businesses that may serve the project's workforce.

In 2013, the export of gold contributed almost R 50 billion to South African exports, accounting for 19.5% of the country's total exports (DMR, 2015). The WRTRP will contribute an estimated R 4.1 billion per annum should the gold and uranium product be exported. Such exports will bring stability to the country through the earning of foreign exchange which in turns allows a greater purchasing capacity in the international market that can be used to acquire goods and services necessary for the development of other industries within the nation.

10.2.12.1.2 Management Objectives

It is consistent with national legislation and international best practice standards that host communities are given special consideration in terms of the project's benefits. To enhance the potential positive impacts associated with the project, the following enhancement measures have been proposed:

- Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities;
- Local labour and local and small businesses should be prioritised;
- Reserve a percentage of, and promote employment opportunities for woman and the youth;
- Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments;
- Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies;
- Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited;
- Identify students from local schools to participate in company bursaries and internship programmes;
- Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured;
- Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate;
- Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL; and
- Support housing development through the promoting of house ownership for employees.

The significance of the potential positive socio-economic impacts associated with the operational phase of the project is outlined in Table 10-50.

Table 10-50: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct, indirect and induced positive impacts as a result of local employment, procurement of local goods and services.			
Prior to enhancement/ management			

<table>
<tr><th colspan="4">Employment and Procurement</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>The impacts will last for the life of the project.</td><td rowspan="5">Minor (positive)
60</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Employment and procurement will target the local municipal areas.</td></tr>
<tr><td>Intensity</td><td>Moderately high (4)</td><td>Approximately 500 jobs will be created during the operational phase, with additional indirect jobs created as a result.</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>Without the appropriate enhancement measures, potential for local recruitment and procurement will not be realised.</td></tr>
<tr><td>Nature</td><td>Positive</td><td></td></tr>
<tr><td colspan="4">Enhancement/ Management actions</td></tr>
<tr><td colspan="4">
▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities;
▪ Local labour and local and small businesses should be prioritised;
▪ Reserve a percentage of, and promote employment opportunities for woman and the youth;
▪ Ensure that contractors comply with SGL’s employment policies and Social and Labour Plan commitments;
▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies;
▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited;
▪ Identify students from local schools to participate in company bursaries and internship programmes ;and
▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.
</td></tr>
<tr><td colspan="4">Post- enhancement</td></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>The impacts will last for the life of the project.</td><td rowspan="3">Moderate (positive)
96</td></tr>
<tr><td>Extent</td><td>National (6)</td><td>The resultant impacts will have a significant impact on a national scale.</td></tr>
<tr><td>Intensity</td><td>High (5)</td><td>Enhancement will maximise local job creation and procurement which will result in significant multiplier affects.</td></tr>
</table>

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Highly probable (6)	Enhancement measures will ensure the local employment and procurement potential is realised.	
Nature	Positive		
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Exportation of uranium and gold product will contribute directly to the country's economy.			
Prior to enhancement/ management			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive) 96
Extent	National (7)	Exports will affect the balance of the national accounts.	
Intensity	Moderately high (4)	On-going positive benefits will be experienced.	
Probability	Highly probable (6)	It is expected that majority of the uranium and gold product will be exported.	
Nature	Positive		
Enhancement/ Management actions			
This is a positive impact and there are no enhancement measures associated with the export of the product.			

10.3 Decommissioning Phase

10.3.1 Air Quality Impacts

During the Cooke TSF and C4S TSF Decommissioning Phase, the following activities may have an impact on ambient air quality:

- Removal of the pipeline and pump stations; and
- Rehabilitation of old footprints.

The interactions of the proposed activities with the environment and the resulting impacts are detailed in the table below.

Table 10-51: Interactions and Impacts of old Infrastructure and Rehabilitation of Footprints

Interaction	Impact
Wind erosion	Fugitive dust emissions
	Improved air quality; availability of land for alternative uses

10.3.1.1 Impact Description

The dismantling of old infrastructure i.e. pipelines and pump stations and the rehabilitation of the Cooke and C4S TSF footprints will involve the use of heavy machinery and vehicles similar to the construction phase. The impacts on the atmospheric environment will be minimal since the phase will be short-term. Also, the movement of soil material during rehabilitation will result in fugitive emissions. After reclamation, the source of pollution will have been removed and land will be available for alternative land uses.

10.3.1.2 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the dismantling process and subsequent rehabilitation of the footprints are not in exceedance of the applicable standards for the protection of the environment, human health and wellbeing.

10.3.1.3 Management Actions and Targets

Use of dust suppressant to contain wind erosion, monitoring dust levels on site, at upwind and downwind locations preferably at discrete receptors to assess public exposure. Adoption of realistic emissions management programme to assess performance and compliance to applicable standards.

The air quality significance ratings associated with the decommissioning phase of this project are detailed in Table 10-52 below.

Table 10-52: Potential Impacts of Demolition of Old Infrastructure and Rehabilitation of TSF footprints

Activity and Interaction: Demolition of Old Infrastructure will result in dust generation			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Fugitive emissions			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration demolition	Negligible (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor - negative (-2)	The impact will be minor	

Activity and Interaction: Demolition of Old Infrastructure will result in dust generation			
Probability	Unlikely (3)	Possibility that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
• Application of wetting agents or dust suppressant on the dirt road and exposed areas; • The area of disturbance must be kept to a minimum; • Drop heights when loaders off load rubble should be minimised; and • Set maximum speed limits and have these limits enforced.			
Post- mitigation			
Duration	Short term (2)	Dust will be generated for the duration of the demolition	Negligible (negative) – 10
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minimal - negative (-1)	Minimal impact on ambient air quality during demolition	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Medium term (3)	Dust will be produced in the medium term	
Activity and Interaction: Rehabilitation of footprint will result in elimination of pollution source and make land available for alternative land uses			
Impact Description: Reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration rehabilitation	Negligible (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor - negative (-2)	The impact will be minor.	
Probability	Unlikely (3)	Possibility that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loaders rubbles and offloading rehabilitation materials should be minimised;			

Activity and Interaction: Demolition of Old Infrastructure will result in dust generation			
and ▪ Set maximum speed limits and have these limits enforce.			
Post management			
Duration	Short term (2)	Dust will be generated for the duration the rehabilitation	Negligible (negative) – 10
Extent	Limited (2)	Dust generated will be limited to the site and the immediate surroundings	
Intensity	Minimal - negative (-1)	Minimal impact on ambient air quality	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Negative		

Activity and Interaction: Rehabilitation of footprint will result in elimination of a pollution source and availability of land for alternative land uses			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Better air quality and availability of land for alternative land uses			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration demolition	Negligible (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor - negative (-2)	The impact will be minor	
Probability	Unlikely (3)	Possibility that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
• Application of wetting agents or dust suppressant on the dirt road and exposed areas; • The area of disturbance must be kept to a minimum; • Drop heights when loading and offloading rubble should be minimised; • Set maximum speed limits and have these limits enforced; • Vegetation of footprint			
Post- mitigation			
Duration	Long term (4)	Dust will be eliminated in the area on a long-term	Moderate (positive) 78

Activity and Interaction: Demolition of Old Infrastructure will result in dust generation			
Extent	Regional (5)	The site and the region will be exposed to good air quality	
Intensity	Average to intense air quality (+4)	Minimal impact on ambient air quality during demolition	
Probability	Almost Certain (6)	It is almost certain that the quality of air will improve	
Nature			

10.3.2 Noise Impacts

The decommissioning phase of the project will encompass the dismantling and removal of mining machinery and infrastructure. It will also include the rehabilitation of the TSF footprints. The table below details the interactions as a result of the proposed activities in the decommissioning phase and the impacts posed onto the environment.

Table 10-53: Interactions and Noise Impacts of old Infrastructure and Rehabilitation of Footprints

Interaction	Impact
Dismantling and removal of the pump stations and pipeline infrastructure	Noise will emanate from the machinery and vehicles operating during the decommissioning activities.
Rehabilitation of Cooke 4 and C4S TSF footprints	

10.3.2.1 Impact Description

With the decommissioning activities using similar machinery and vehicles than the construction phase, it is expected that the significance of the noise impact during this phase will be similar.

The mitigation measures proposed to manage the potential impacts during the decommissioning phase include:

- Restricting decommissioning activities to daylight hours;
- Reversing alarms on mobile equipment should be broadband reversing alarms which emit directional, lower, less intrusive sound
- Mining related machines and vehicles to be serviced according to service plan to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
- Switching off equipment when not in use

The construction, operational and decommissioning activities will have ceased and the subsequent noise levels from the activities will have ceased, therefore no post closure impacts expected and also no post closure monitoring programme is recommended.

The noise significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-54 below.

Table 10-54: Pre-mitigation and post-mitigation significance ratings for impacts on noise during the decommissioning phase

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Activity and Interaction (Dismantling and removal of the pump stations and pipeline infrastructure)</td></tr>
<tr><td colspan="4">Impact Description: Noise will emanate from the machinery and vehicles operating during the decommissioning activities.</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Duration</td><td>immediate (1)</td><td>Noise will be produced for the duration of the decommissioning phase</td><td rowspan="5">Negligible (negative) – 15</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>It is expected that during decommissioning noise will extend as far as development site area.</td></tr>
<tr><td>Intensity x type of impact</td><td>Minimal - negative (-1)</td><td>It is expected that during decommissioning noise will have a minimal impact</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>It is unlikely that noise will impact on the surrounding receptors as the locations of pump stations and pipe routes are largely remote.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/ Management action</td></tr>
<tr><td colspan="4">Restricting decommissioning activities to daylight hours;
Reversing alarms on mobile equipment should be broadband reversing alarms which emit directional, lower, less intrusive sound
Mining related machines and vehicles to be serviced according to service plan to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
Switching off equipment when not in use.</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Duration</td><td>Short term (2)</td><td>Noise will be produced for the duration of the decommissioning phase</td><td rowspan="2">Negligible (negative) – 12</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>It is expected that during decommissioning noise will be limited to site if mitigation measures are implemented.</td></tr>
</table>

Intensity x type of impact	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal social impact	
Probability	Rare (2)	It is improbable that noise will impact on the surrounding receptor as the locations of pump stations and pipe routes are largely remote.	
Nature	Negative		

10.3.3 Groundwater Impacts

The impact as a result of the reclamation is anticipated to be positive after closure. This is due to the removal of the TSFs which are sources of contamination, will be removed.

The Cooke and C4S TSFs are not lined and seepage is expected to drain into the underlying groundwater system. Seepage from the TSFs, which are directly over the dolomites, is increasing the cost of pumping from the underground mine voids and impact the water quality negatively. The pumping cost would be reduced if the TSFs are removed since the seepage portion is eliminated. This implies that if infiltration of tailings seepage can be reduced, the contaminant loads will be less from a pollution perspective and pumping costs will be less. At present, the presence of the TSFs and the continued dewatering activities in these compartments will encourage continued infiltration of TSF seepage to the deeper aquifer units and mining areas, the consequent deterioration of water quality and increased volumes of water to be pumped from the underground chambers. These impacts can be managed by monitoring groundwater quality and water levels.

Table 10-55: Potential impacts due the re-mining of the historical TSFs

Dimension	Rating	Motivation	Significance
Impact Description: Impact on groundwater contamination due to re-mining of historical TSFs			
Prior to mitigation/ management			
Duration	Permanent (7)	Seepage of contaminated water will permanently be removed	Moderate (positive) – 105
Extent	Local (3)	The impact is expected to be local	
Intensity	Serious (5)	The contamination from the existing historical TSFs is serious	
Probability	Definite (7)	Seepage from the RTSF will definitely impact the groundwater	
Nature	positive		
Mitigation/ Management actions			

Dimension	Rating	Motivation	Significance
▪Monitoring of groundwater quality and water levels; ▪Rehabilitation of old TSF footprints			
Post- mitigation			
Duration	Permanent (7)	The contamination plume will be permanent	Moderate (positive) – 105
Extent	Limited (2)	The blast curtain with intercept any pollution plumes to within the footprint area	
Intensity	Minimal (1)	Impact will be underneath the TSF only	
Probability	unlikely (3)	Impact to the groundwater outside the RTSF area is unlikely	
Nature	negative		

10.3.4 Soil Impacts

The major impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

During this phase the tailings will be removed and pumped to the RTSF site. The current status of the soils under the dump is unknown and the land capability is non-existent, the land use is mining at presently.

The interactions as a result of the proposed activities during the decommissioning and closure phases of this project, as well as the associated soil impacts have been detailed in the table below.

Table 10-56: Interactions and Soil Impacts of old Infrastructure and Rehabilitation of Footprints

Interaction	Impact
Dismantling and removal of the pump stations and pipeline infrastructure	The removal of the pipeline route will cause a loss of topsoil as a resource as a result of compaction and erosion.
Reclamation of the Cooke TSF and Cooke 4 South sites	The removal of the tailings will result in positive impacts with regards to the recovery of the land use and land capability

10.3.4.1 Impacts Description

The impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

The reclamation of the TSF sites will improve the soil quality by reducing the impacts on the surrounding soils by removing the contaminant source. The TSF footprint area will also be remediated and the land use and capability can be improved

10.3.4.2 Management Objectives

The following management objectives are recommended:

- Management of areas that have been rehabilitated;
- Assessment of areas of compaction and erosion after pipelines have been removed;
- Monitoring of the soil placed and vegetation establishment;
- After the TSF sites have been reclaimed the footprint area must undergo a land contamination assessment to assess the extent of the contamination, before an alternative land use is decided upon;
- A remediation feasibility study must be conducted to assess phytoremediation options or complete removal and replacement of the topsoil on the footprint; and
- All parties involved must then decide on the most appropriate land use.

10.3.4.3 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement land rehabilitation measures as defined in rehabilitation report.
- Follow rehabilitation guidelines;

- The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil is to be moved when the soil is dry, as to reduce compaction;
- After the completion of the project the area is to be cleared of all infrastructure;
- The foundations to be removed;
- Topsoil to be replaced for rehabilitation purposes;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Stockpiles should only be used for their designated final purposes;
- A land contamination study must be done on the soils after reclamation has been completed;
- If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and
- Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.

The significance impacts ratings associated with the decommissioning phase of the project are detailed in Table 10-57 and Table 10-58 below.

Table 10-57: Impact rating for loss of topsoil as a resource during decommissioning and rehabilitation phase of the pipelines in the Cooke mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on	

		existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur.	
Nature	Negative		

Table 10-58: Impact rating for change in land use and land capability after reclamation activities

Activity and Interaction: ▪ **Change in land use after reclamation has been undertaken**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Potential change in land use and land capability from mining to another determined land use – positive impact.			
Prior to mitigation/ management			
Duration	Permanent (7)	Land use change will be permanent	Moderate (positive) – 105
Extent	Limited (2)	The impact will only occur on the project infrastructure area (TSF Footprints).	
Intensity	Great Improvement (6)	Improvement in land capability.	
Probability	Certain (7)	Certain that there will be a change in	

		land capability.	
Nature	Positive		
Mitigation/ Management actions			
Land reclamation, land contamination assessments and land use identification			

10.3.5 Surface Water Impacts

Decommissioning activities proposed during this phase of the project include the demolition of infrastructure such as pipelines and pumps. The anticipated impacts as a result of these activities are detailed in the table below.

Table 10-59: Interactions and Surface Water Impacts of old Infrastructure and Rehabilitation of Footprints

Interaction	Impact
Dismantling and removal of the pump stations and pipeline infrastructure	Water pollution could result from accidental spillages during decommissioning of infrastructures

10.3.5.1 Impact Description

The decommissioning phase of the project will cover the decommissioning activities, which must be focused on ensuring that spillages unto the clean water environment area is minimised.

As a result of the decommissioning activities the following potential impact has been predicted:

- Water pollution could result from accidental spillages during decommissioning of infrastructures.

10.3.5.2 Management Objectives

The three main conditions of GN 704 applicable to this project are:

- *Condition 6* describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.
- *Condition 7* describes the measures which must be taken to protect water resources. All dirty water or substances which may result in pollution should be prevented from

entering a water resource (by spillage, seepage, erosion) and ensure that water used in any process is recycled as far as practicable.

- *Condition* 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations. The in stream and riparian habitat of any water resource, which may have been affected or altered by a mine or activity, should be remedied so as to comply with these regulations.

10.3.5.3 Management Actions and Targets

In this section management actions relating to the activities envisaged during the decommissioning phase are described together with the targets required to ensure mitigation of the impacts occur.

10.3.5.3.1 Spillages from Decommissioned Infrastructure

To manage the impact of spillages unto the downstream watercourse, the following targets are required:

- Ensure that the pipelines are emptied of all residual material before decommissioning; and
- Ensure the consideration of the durability and longevity of water management designs, e.g. provision of erosion protection for long-term control of erosion and potential pollution to water resources during decommissioning.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-60 below.

Table 10-60: Decommissioning phase impact ratings for activities taking place in the Cooke MRA

Dimension	Rating	Motivation	Significance
Activity and Interaction (Decommissioning activities)			
Impact Description: Water pollution from accidental spillages of decommissioned infrastructure			
Prior to mitigation/ management			
Duration	Short term (2)	Equals to the duration of the actual removal of the infrastructure, thus a short duration	Negligible - negative (21)
Extent	Limited (2)	The impact's will be localized to the nearby water resources closest to the spillages	
Intensity	Moderate - negative (3)	This will limit the ecosystem functionality in the vicinity especially if runoff occurs	
Probability	Unlikely (3)	Without due care , spillages may occur	
Mitigation/ Management actions			

Dimension	Rating	Motivation	Significance
▪ Empty infrastructure before removal. ▪ The durability and longevity of water management designs, e.g. provision of erosion protection for long-term control of erosion and potential pollution to water resources during decommissioning.			
Post-Mitigation			
Duration	Short term (2)	As for pre-mitigation	Negligible - negative (12)
Extent	Limited (2)	As for pre-mitigation	
Intensity	Low - negative (2)	The scale of ecosystem Damage will be limited as long as mitigation occurs and the spillage volumes are decreased considerably	
Probability	Improbable (2)	If small volumes are handled and if empty infrastructure is handles, the probability of impacts will be almost diminished	

10.3.6 Aquatic Impacts

Activities within this mining right area will potentially impact the main stem of the Wonderfonteinspruit (C23D-01313; C23D-01365; C23D-01384). As described above these systems are currently in a largely/seriously modified state (class D/E). The potential impacts of the proposed project will be viewed in light of this classification.

This impact assessment does not take into consideration the potential risk and impacts of unplanned events.

Table 10-61: Interactions and impacts of the Cooke Mining Right Area Infrastructure

Interaction	Impact
Removal of infrastructure	Water and habitat quality modification
Removal of the TSF material	

10.3.6.1 Impact Description

Due to the activities proposed to occur during the decommissioning phase of the project, the anticipated aquatic impacts include water and habitat quality modification. Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.

10.3.6.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts as listed in the section below.

10.3.6.3 Management Actions and Targets

Management actions are provided in Section 9.1.8 above. Further to this, the management actions proposed for the abovementioned impacts include the following:

- Establish riparian buffer up to 500m (minimum 100m).
- Silt traps placed within clean water return channels.
- Re-vegetation of construction footprint and unpaved roads as soon as possible.
- Construction sequencing is proposed.
- Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.
- Unobtrusive infrastructure design over river systems.
- The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation;
- Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation.
- Soils adjacent the river that has been compacted must be loosened to allow for germination.
- Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river.
- No crossings should take place over riffle/rapid habitats as these are the most sensitive.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-62 below.

Table 10-62: Potential water and habitat quality impacts during the decommissioning phase

Activity and Interaction: Removal of infrastructure			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Medium term (3)	The site clearing and infrastructure placement will occur and potentially recover within a three-five year period	60 (Moderate)
Extent	Limited (2)	The impacts are anticipated to occur around the activities which are located in proximity to the Wonderfonteinspruit	
Intensity	Minor natural impacts (-2)	Water and habitat quality deterioration will be expected to occur downstream of the various activities. Although these impacts are limited due to the small size of the infrastructure (limited clearing required)	
Probability	Almost certain (6)	Pollution from the proposed activities is almost certainly going to occur as the activities, especially without mitigation, are located within proximity to various river systems.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Construction sequencing is proposed. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ▪ Unobtrusive infrastructure design over river systems. ▪ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ▪ Soils adjacent the river that has been compacted must be loosened to allow for germination. ▪ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive.			
Post- mitigation			

Duration	Short term (2)	The impact will only occur during the construction and decommissioning phase.	30 (Negligible)
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Very serious (-5)	The habitat and water quality within the local extent can be a very serious impact. Especially to aquatic habitat which is difficult to rehabilitate.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		
Activity and Interaction: Removal of the TSF material			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Duration	Beyond Project Life (6)	The impact will remain for some time after the project has been completed.	60 (Moderate)
Extent	Local (3)	The impacts, especially habitat impacts, will only occur within the local area. Water quality impacts will also most likely only impact a local area.	
Intensity	Discernible changes (3)	Water quality will likely improve and thus more sensitive aquatic biota will return..	
Probability	Likely (5)	The impact will likely occur after the completion of the project.	
Nature	Positive		

10.3.7 Fauna and Flora Impacts]

The decommissioning phase will involve the removal of the Cooke TSF infrastructure and rehabilitation of its impacted footprint. The pipelines will be left in situ.

Table 10-63: Interactions and Fauna & Flora Impacts of the WRTRP Cooke MRA decommissioning phase

Interaction	Impact
Decommissioning of the reclaimed Cooke TSF and Cooke 4 TSF footprints.	With rehabilitation of the footprints, this will have a positive impact to vegetation and habitat types present.

10.3.7.1 Management Objectives

The objective for this phase will be to maximise the success of the rehabilitation that will happen after infrastructure is removed, and to furthermore reduce any impacts that may occur during this phase.

10.3.7.2 Management Actions and Targets

Decommissioning of the WRTRP infrastructure in the Cooke MRA will be predominantly a rehabilitation activity of footprint area. In order for this to be a positive impact the removal of the infrastructure must be completed so as to not harm or negatively impact surrounding vegetation. Furthermore the rehabilitation must be conducted in such a manner to achieve aims for the process. These aims will be to ensure the footprint areas are vegetated and that erosion through runoff and wind does not occur. Efforts will be maximised if rehabilitation is completed in the before the first rains fall so as to make use of the rainfall to assist in plant recruitment.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-64 below.

Table 10-64: Fauna and Flora Impact Assessment Rating during the Decommissioning Phase

Activity and Interaction: Rehabilitation of infrastructure footprint areas			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Restoration of vegetation and habitat types.			
Duration	Short term (2)	If rehabilitation is not completed effectively it will not last .	18 “Small Positive”
Extent	Very Limited (1)	Only certain parts of the site will have revegetated cover.	
Intensity	Moderate (3)	The effectiveness of the rehab will determine the intensity	
Probability	Unlikely (3)	It’s unlikely that the rehabilitation will be effective	
Nature	Positive		
Impact Description: Rehabilitation of infrastructure footprint areas			

Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	84 “Moderate positive”
Extent	Local (3)	The general area beyond the project site will be positively impacted on.	
Intensity	Positive (4)	Vegetation will be restored.	
Probability	Almost certain (6)	With correct implementation this impact has a high probability of occurring	
Nature	Positive		

10.3.8 Wetlands

10.3.8.1 Impact Description

The decommissioning phase will involve the rehabilitation of the reclaimed TSF footprints. The major impacts anticipated due to the proposed interactions are listed in the table below.

Table 10-65: Interactions and Wetland Impacts of the WRTRP Cooke MRA decommissioning phase

Interaction	Impact
Decommissioning of the reclaimed TSF footprints.	With rehabilitation of the footprints, this will have a positive impact to surrounding wetlands as a significant negative impact is being removed and rehabilitated.

10.3.8.2 Management Objectives

Management objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.3.8.3 Management Actions and Targets

Decommissioning of the WRTRP infrastructure in the Cooke MRA will be predominantly a rehabilitation activity. General mitigation and management actions provided in the other studies done by Digby Wells as part of this project should still be used to guide the effective management of wetland ecological resources, most particularly the Rehabilitation Report (Digby Wells, 2015e). However, it is recommended that this be updated regularly, especially immmediately prior to the decommissioning phase.

The Wetland Management Plan detailed in the Wetland Report in Appendix K of this report must be used as a guide to inform management actions. However, specific important management actions are briefly discussed below:

- Rehabilitation of the reclaimed TSF footprints must be done according to the Rehabilitation Plan (Digby Wells, 2015e).
- The edge of the wetlands and a 100m buffer must be managed as a no-go area.
- Pipelines must be flushed clean and rendered safe for decommissioning.
- Decommissioning and rehabilitation should be done in the dry season.

The significance impact ratings associated with the decommissioning phase of this project are detailed in Table 10-66 below.

Table 10-66: Summary of wetland impact ratings for the Decommissioning phase in the Cooke MRA

Activity and Interaction: Decommissioning of the mined Cooke and Cooke 4 South TSF footprints.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: This may have a positive impact on the surrounding wetlands if rehabilitation occurs as this is removing a current highly significant negative impact to the wetlands. If rehabilitation of the footprint is not done, a negative impact will be realised.			
Prior to mitigation/ management			
Duration	Beyond project Life (6)	Impact will have long-lasting negative impacts on the wetlands beyond the project life.	-105 "Moderate negative"
Extent	Municipal (4)	The wetland catchments within the municipal boundaries could be impacted as the footprint may impact upon the Wonderfonteinspruit (Cooke) and Leeuspruit (Cooke 4 South)	
Intensity	Serious (5)	This represents serious damage to highly sensitive environments.	
Probability	Definite (7)	The wetland will certainly be impacted if the footprint is not remediated as this represents a significant pollution source.	
Nature	Negative		
Mitigation/ Management actions			
▪ Remediation and rehabilitation of the TSF footprints according to the rehabilitation plan will aim to remove this pollution source. This will have a positive impact on the wetlands as a very significant pollutant source will be removed from the catchment.			
Post- mitigation			
Duration	Beyond project Life (6)	Remediation will have a long lasting positive impact beyond the project life.	+105 "Moderate

Extent	Municipal (4)	Removal of these pollutant sources will have a positive impact in the municipal catchment	positive”
Intensity	Average (5)	Rehabilitation will allow a positive impact but will only remediate a small part of the existing impacts.	
Probability	Definite (7)	Rehabilitation is will result in a positive impact.	
Nature	Positive		

10.3.9 Topography Impacts

10.3.9.1 Pipeline Routes

The pipeline routes will be decommissioned within the Cooke MRA. This is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-67.

Table 10-67: Interactions and Impacts of the Pipeline Routes on the Topography of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will remove features from the surface and thereby change the topography.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will change the topography.

10.3.9.1.1 Impact Description

Demolition and removal of infrastructure will have a minor negative impact on the topography. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative impact on the topography. Once the infrastructure is removed and the rehabilitation is complete, there will be a neutral impact on the topography and it will be returned to a state similar to the pre-development state.

10.3.9.1.2 Management Objectives

The management objectives are to rehabilitate the topography by demolition and removal of infrastructure and rehabilitation of disturbed areas.

10.3.9.1.3 Management Actions

The following management actions are required for the pipeline routes in the Cooke MRA:

- Ensure that all unnecessary infrastructure is demolished;
- Ensure that all demolished infrastructure is removed from the project area;
- Rehabilitate all areas where infrastructure has been removed;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The significance impact ratings associated with the decommissioning phase of the project is detailed in Table 10-68 below.

Table 10-68: Potential Impacts of the Pipeline Routes on the Topography of the Cooke MRA

<table>
<tr><th colspan="4">Activity and Interaction (Pipeline routes require demolition and removal of infrastructure)</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Impact Description: Demolition and removal of infrastructure will remove features from the surface and thereby change the topography. Once the infrastructure is removed, there will be an overall neutral impact on the topography. This will help to reverse some of the changes that occurred when the infrastructure was constructed.</td></tr>
<tr><td colspan="4">Prior to Mitigation / Management</td></tr>
<tr><td>Duration</td><td>Short Term (2)</td><td>The impact will occur for less than 1 year and is reversible.</td><td rowspan="3">Minor negative (-42)</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>The impact is limited to the site and its immediate surroundings.</td></tr>
<tr><td>Intensity</td><td>Minor (2)</td><td>Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning.
Minor medium-term social impacts on local</td></tr>
</table>

		population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that all unnecessary infrastructure is demolished; ▪ Ensure that all demolished infrastructure is removed from the project area; and ▪ Rehabilitate all areas where infrastructure has been removed.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will change the topography. Once the rehabilitation is complete, there will be an overall neutral impact on the topography. The aim of rehabilitation is to create a free-draining topography. Spreading topsoil, and profiling and contouring will change the topography and assist to restore surface water flow and drainage lines to create a free-draining topography and assist to prevent soil erosion.			
Prior to Mitigation / Management			

Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-56)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-49)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	

Nature	Negative		

10.3.9.2 Cooke Thickener

The Cooke thickener will be decommissioned within the Cooke MRA. This is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the Cooke thickener are indicated in Table 10-69.

Table 10-69: Interactions and Impacts of the Cooke Thickener on the Topography of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will remove features from the surface and thereby change the topography.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will change the topography.

10.3.9.2.1 Impact Description

Demolition and removal of infrastructure will have a minor negative impact on the topography. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative impact on the topography. Once the infrastructure is removed and the rehabilitation is complete, there will be a neutral impact on the topography and it will be returned to a state similar to the pre-development state.

10.3.9.2.2 Management Objectives

The management objectives are to rehabilitate the topography by demolition and removal of infrastructure and rehabilitation of disturbed areas.

10.3.9.2.3 Management Actions

The following management actions are required for the Cooke thickener in the Cooke MRA:

- Ensure that all unnecessary infrastructure is demolished;
- Ensure that all demolished infrastructure is removed from the project area;
- Rehabilitate all areas where infrastructure has been removed;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography;

- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-70 below.

Table 10-70: Potential Impacts of the Cooke Thickener on the Topography of the Cooke MRA

Activity and Interaction (Cooke thickener requires demolition and removal of infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and removal of infrastructure will remove features from the surface and thereby change the topography. Once the infrastructure is removed, there will be an overall neutral impact on the topography. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that all unnecessary infrastructure is demolished; ▪ Ensure that all demolished infrastructure is removed from the project area; and			

▪ Rehabilitate all areas where infrastructure has been removed.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-28)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will change the topography. Once the rehabilitation is complete, there will be an overall neutral impact on the topography. The aim of rehabilitation is to create a free-draining topography. Spreading topsoil, and profiling and contouring will change the topography and assist to restore surface water flow and drainage lines to create a free-draining topography and assist to prevent soil erosion.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	

Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			

- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.3.9.3 Collection Sumps and Pump Stations

The collection sumps and pump stations will be decommissioned within the Cooke MRA. This is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of the collection sumps and pump stations are indicated in Table 10-71.

Table 10-71: Interactions and Impacts of the Collection Sumps and Pump Stations on the Topography of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will remove features from the surface and thereby change the topography.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will change the topography.

10.3.9.3.1 Impact Description

Demolition and removal of infrastructure will have a minor negative impact on the topography. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative impact on the topography. Once the infrastructure is removed and the rehabilitation is complete, there will be a neutral impact on the topography and it will be returned to a state similar to the pre-development state.

10.3.9.3.2 Management Objectives

The management objectives are to rehabilitate the topography by demolition and removal of infrastructure and rehabilitation of disturbed areas.

10.3.9.3.3 Management Actions

The following management actions are required for the collection sumps and pump stations in the Cooke MRA:

- Ensure that all unnecessary infrastructure is demolished;
- Ensure that all demolished infrastructure is removed from the project area;
- Rehabilitate all areas where infrastructure has been removed;
- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and

- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-72 below.

Table 10-72: Potential Impacts of the Collection Sumps and Pump Stations on the Topography of the Cooke MRA

Activity and Interaction (Collection sumps and pump stations require demolition and removal of infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and removal of infrastructure will remove features from the surface and thereby change the topography. Once the infrastructure is removed, there will be an overall neutral impact on the topography. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that all unnecessary infrastructure is demolished; ▪ Ensure that all demolished infrastructure is removed from the project area; and ▪ Rehabilitate all areas where infrastructure has been removed.			
Post-Mitigation			

Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-28)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will change the topography. Once the rehabilitation is complete, there will be an overall neutral impact on the topography. The aim of rehabilitation is to create a free-draining topography. Spreading topsoil, and profiling and contouring will change the topography and assist to restore surface water flow and drainage lines to create a free-draining topography and assist to prevent soil erosion.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur.	

		> 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.3.9.4 Cooke TSF and Cooke 4 South TSF

The footprint of Cooke TSF will be rehabilitated within the Cooke MRA. This is expected to have a negative impact on the topography of the Cooke MRA. The interactions and resultant impacts of Cooke TSF and Cooke 4 South TSF are indicated in Table 10-73.

Table 10-73: Interactions and Impacts of Cooke TSF and Cooke 4 South TSF on the Topography of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will change the topography.

10.3.9.4.1 Impact Description

Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative impact on the topography. Once the infrastructure is removed and the rehabilitation is complete, there will be a neutral impact on the topography and it will be returned to a state similar to the pre-mining state.

10.3.9.4.2 Management Objectives

The management objectives are to rehabilitate the topography by rehabilitation of disturbed areas.

10.3.9.4.3 Management Actions

The following management actions are required for Cooke TSF and Cooke 4 South TSF in the Cooke MRA:

- Rehabilitate all disturbed areas;
- Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The significance impact ratings associated with the decommissioning phase of the project are detailed in Table 10-74 below.

Table 10-74: Potential Impacts of Cooke TSF and Cooke 4 South TSF on the Topography of the Cooke MRA

Activity and Interaction (Cooke TSF requires rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will change the topography. Once the rehabilitation is complete, there will be an overall neutral impact on the topography. The aim of rehabilitation is to create a free-draining topography. Spreading topsoil, and profiling and contouring will change the topography and assist to restore surface water flow and drainage lines to create a free-draining topography and assist to prevent soil erosion.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-63)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Rehabilitate all disturbed areas; ▪ Ensure that the rehabilitated area is contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-56)

Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		

10.3.10 Visual Impacts

10.3.10.1 Pipeline Routes

The pipeline routes will be decommissioned within the Cooke MRA. This is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-75.

Table 10-75: Interactions and Impacts of the Pipeline Routes on the Visual Aspects of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will have a negative visual impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will have a negative visual impact on the receiving environment. Once rehabilitation is complete, there will be a neutral visual impact on the receiving environment.

10.3.10.1.1 Impact Description

Demolition and removal of infrastructure will have a minor negative visual impact on the receiving environment. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative visual impact on the receiving environment. Once the infrastructure is removed and the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and it will be returned to a state similar to the pre-development state.

10.3.10.1.2 Management Objectives

The management objectives are to increase the neutral visual impact caused by the demolition and removal of infrastructure and the rehabilitation of disturbed areas.

10.3.10.1.3 Management Actions

The following management actions are required for the pipeline routes in the Cooke MRA:

- Apply dust suppression techniques to limit the dust from the demolition area;
- Use shade cloth / netting to screen the demolition area;
- Limit the quantity and time of rubble stored on site;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The impact ratings and mitigation / management measures for the pipeline routes are summarised in Table 10-76.

Table 10-76: Potential Impacts of the Pipeline Routes on the Visual Aspects of the Cooke MRA

Activity and Interaction (Pipeline routes require demolition and removal of infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and removal of infrastructure will have a minor negative impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or	

		physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth / netting to screen the demolition area; and ▪ Limit the quantity and time of rubble stored on site.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-30)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Pipeline routes require rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will have a minor negative visual impact on the receiving environment. Once the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-development state.			

Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-49)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions	

		and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.3.10.2 Cooke Thickener

The Cooke thickener will be decommissioned within the Cooke MRA. This is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-77.

Table 10-77: Interactions and Impacts of the Cooke Thickener on the Visual Aspects of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will have a negative visual impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will have a negative visual impact on the receiving environment. Once rehabilitation is complete, there will be a neutral visual impact on the receiving environment.

10.3.10.2.1 Impact Description

Demolition and removal of infrastructure will have a minor negative visual impact on the receiving environment. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative visual impact on the receiving environment. Once the infrastructure is removed and the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and it will be returned to a state similar to the pre-development state.

10.3.10.2.2 Management Objectives

The management objectives are to increase the neutral visual impact caused by the demolition and removal of infrastructure and the rehabilitation of disturbed areas.

10.3.10.2.3 Management Actions

The following management actions are required for the Cooke thickener in the Cooke MRA:

- Apply dust suppression techniques to limit the dust from the demolition area;
- Use shade cloth / netting to screen the demolition area;
- Limit the quantity and time of rubble stored on site;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The impact ratings and mitigation / management measures for the Cooke thickener are summarised in Table 10-78.

Table 10-78: Potential Impacts of the Cooke Thickener on the Visual Aspects of the Cooke MRA

Activity and Interaction (Cooke thickener requires demolition and removal of infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and removal of infrastructure will have a minor negative impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-35)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur.	

		> 80% probability	
Nature	Negative		
Mitigation / Management Actions			
- Apply dust suppression techniques to limit the dust from the demolition area; - Use shade cloth / netting to screen the demolition area; and - Limit the quantity and time of rubble stored on site.			
Post-Mitigation			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-24)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Cooke thickener requires rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will have a minor negative visual impact on the receiving environment. Once the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-development state.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-42)
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	

Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-30)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.3.10.3 Collection Sumps and Pump Stations

The collection sumps and pump stations will be decommissioned within the Cooke MRA. This is expected to have a negative visual impact on the receiving environment of the Cooke

MRA. The interactions and resultant impacts of the pipeline routes are indicated in Table 10-79.

Table 10-79: Interactions and Impacts of the Collection Sumps and Pump Stations on the Visual Aspects of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Demolition and removal of infrastructure	Demolition and removal of infrastructure will have a negative visual impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment.
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will have a negative visual impact on the receiving environment. Once rehabilitation is complete, there will be a neutral visual impact on the receiving environment.

10.3.10.3.1 Impact Description

Demolition and removal of infrastructure will have a minor negative visual impact on the receiving environment. Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative visual impact on the receiving environment. Once the infrastructure is removed and the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and it will be returned to a state similar to the pre-development state.

10.3.10.3.2 Management Objectives

The management objectives are to increase the neutral visual impact caused by the demolition and removal of infrastructure and the rehabilitation of disturbed areas.

10.3.10.3.3 Management Actions

The following management actions are required for the collection sumps and pump stations in the Cooke MRA:

- Apply dust suppression techniques to limit the dust from the demolition area;
- Use shade cloth / netting to screen the demolition area;
- Limit the quantity and time of rubble stored on site;
- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;

- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The impact ratings and mitigation / management measures for the collection sumps and pump stations are summarised in Table 10-80.

Table 10-80: Potential Impacts of the Collection Sumps and Pump Stations on the Visual Aspects of the Cooke MRA

Activity and Interaction (Collection sumps and pump stations require demolition and removal of infrastructure)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and removal of infrastructure will have a minor negative impact on the receiving environment. Once the infrastructure is removed, there will be an overall neutral visual impact on the receiving environment. This will help to reverse some of the changes that occurred when the infrastructure was constructed.			
Prior to Mitigation / Management			
Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-28)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Apply dust suppression techniques to limit the dust from the demolition area; ▪ Use shade cloth / netting to screen the demolition area; and ▪ Limit the quantity and time of rubble stored on site.			
Post-Mitigation			

Duration	Short Term (2)	The impact will occur for less than 1 year and is reversible.	Negligible negative (-24)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		
Activity and Interaction (Collection sumps and pump stations require rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will have a minor negative visual impact on the receiving environment. Once the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-development state.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-35)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	

Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Negligible negative (-30)
Extent	Very Limited / Isolated (1)	The impact is limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal to no loss and / or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.3.10.4 Cooke TSF and Cooke 4 South

The footprint of Cooke TSF will be rehabilitated within the Cooke MRA. This is expected to have a negative visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of Cooke TSF and Cooke 4 South TSF are indicated in Table 10-81.

Table 10-81: Interactions and Impacts of Cooke TSF and Cooke 4 South TSF on the Visual Aspects of the Cooke MRA (Decommissioning Phase)

Interaction	Impact
Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation	Rehabilitation of disturbed areas will have a negative visual impact on the receiving environment. Once rehabilitation is complete, there will be a neutral visual impact on the receiving environment.

10.3.10.4.1 Impact Description

Rehabilitation of disturbed areas by spreading topsoil, profiling and contouring, and re-vegetation is expected to have a minor negative visual impact on the receiving environment. Once the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and it will be returned to a state similar to the pre-development state.

10.3.10.4.2 Management Objectives

The management objectives are to increase the neutral visual impact caused by the rehabilitation of disturbed areas.

10.3.10.4.3 Management Actions

The following management actions are required for Cooke TSF and Cooke 4 South TSF in the Cooke MRA:

- Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography;
- Spread topsoil over the rehabilitated area;
- Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography;
- Re-vegetate the rehabilitated areas; and
- Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.

The impact ratings and mitigation / management measures for Cooke TSF and Cooke 4 South TSF are summarised in Table 10-82.

Table 10-82: Potential Impacts of Cooke TSF and Cooke 4 South TSF on the Visual Aspects of the Cooke MRA

Activity and Interaction (Cooke TSF requires rehabilitation of disturbed areas)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will have a minor negative visual impact on the receiving environment. Once the rehabilitation is complete, there will be an overall neutral visual impact on the receiving environment and will assist to return the project area to a state similar to the pre-development state.			
Prior to Mitigation / Management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-63)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Negative		
Mitigation / Management Actions			
▪ Ensure that the rehabilitated area is re-contoured and profiled to create a free-draining topography; ▪ Spread topsoil over the rehabilitated area; ▪ Ensure that surface water and drainage lines are rehabilitated to create a free-draining topography; ▪ Re-vegetate the rehabilitated areas; and ▪ Ensure all mitigation measures outlined in the closure and rehabilitation reports are conducted.			
Post-Mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Minor negative (-48)
Extent	Local (3)	The impact will extend only as far as the	

		development site area.	
Intensity	Minor (2)	Minor loss and / or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	
Probability	Almost Certain / Highly Probable (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.3.11 Heritage Impacts

See Section 10.1.9.

10.3.12 Socio-economic Impacts

As detailed in Section 10.1.12 for ease of reference, all potential socio-economic impacts fall under the activity *Employment and Procurement*.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-83.

Table 10-83: Summary of the Potential Socio-Economic Impacts Resulting from the Decommissioning Phase

Interaction	Impact
Decommissioning of the WRTRP operations.	Retrenchments of mine employees will take place as operations close. The local economy will likely be dependent on the WRTRP to an extent which will be impacted once operations cease.

10.3.12.1 Employment and Procurement

10.3.12.1.1 Impact Description

Any impact predictions concerning the characteristics of the socio-economic environment at the time of eventual project decommissioning are subject to a large margin of error which will significantly reduce the accuracy of the impact assessment. Several socio-economic impacts may arise when the operation is decommissioned and should be investigated prior to decommissioning. The issues that may arise include psychological impacts on the workforce due to personal and family income issues, dependency from the local economy on the project through multiplier effects, tax and royalties and Social and Labour initiatives and impacts on land uses following closure.

The closure of the project will result in the reduction in the economic stimulus to maintain the current state of the local economy and for further growth. This impact will be cumulative with regard to job losses, the closing down of businesses and the decrease on local investment and spending, all resulting in an overall economic slow-down.

10.3.12.1.2 Management Objectives

An important approach to mitigating economic dependency on the Project is to develop alternative and sustainable livelihoods so that local communities and businesses are able to support themselves through other economic sectors at the time of project closure. SGL must collaborate with the local municipalities and relevant government agencies to support the diversification of the local economy to reduce the economies dependency on the project and mining in general.

The MPRDA requires that the Social and Labour Plan provides strategies and measures that could prevent job loss; these include the establishment of Future Forums to manage downscaling and retrenchments. The alternatives to save jobs must be investigated before decommissioning.

In addition, a Closure Plan will be developed and must include socio-economic impacts and a stakeholder consultation process for the operations. The Closure Plan must be compiled 15 years prior to the expected closure, and reviewed every 5 years.

The significance of the potential positive socio-economic impacts associated with the decommissioning of the project is outlined in Table 10-84.

Table 10-84: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Decommissioning of the project will have a direct negative impact through the retrenchment of the mine workforce, as well as a cumulative impact on the local economy due to its dependency on mining.			
Prior to migitation/ management			
Duration	Beyond project life (6)	Some impacts (e.g. retrenchments) may occur during operation. However, most impacts will be felt after closure	Medium-high (negative) - 84
Extent	Municipal Area (4)	Impact will affect workers as well as local municipalities and communities	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Moderately high (4)	Without appropriate mitigation, impact will undermine many of benefits achieved under LED. Retrenched workers and their families will be severely impacted	
Probability	Highly probable (6)	The impact will most likely occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Develop a Closure Plan 15 years prior to planned closure and review the Closure Plan every 5 years; ▪ Establish a Future Forum to promote on-going discussions between SGL and the mine's workforce; ▪ Liaise with the Department of Labour for the utilisation of its resources and support services once retrenchments take place; ▪ Provide financial life skills to employees and ensure employees are trained in alternative skills; and ▪ Inform affected areas, such as the local municipality and labour sending areas, of planned retrenchments.			
Post- mitigation			
Duration	Beyond project life (6)	Some impacts (e.g. retrenchments) may occur during operation. However, most impacts will be felt after closure	Medium-low (negative) - 60
Extent	Municipal Area (4)	Impact will affect workers as well as local municipalities and communities	
Intensity	Low (2)	Mitigation will soften impacts on individuals/households and will capacitate local municipalities to sustain benefits	
Probability	Likely (5)	The impact will most likely occur, albeit not all negative components	
Nature	Negative		

10.4 Post-Closure Phase

10.4.1 Surface Water Impacts

The post closure phase of the project will entail the assessment of the concurrent rehabilitation of the footprint areas by monitoring, and will address any further rehabilitation requirements.

10.4.1.1 Impact Description

There will be no major impacts that will directly impact the surface water resources as rehabilitation is already carried out in the decommissioning phase. In this phase monitoring should continue for residual surface water impacts, as well as identification of ineffective rehabilitation work and ensuring that these are attended to.

Restoration of the natural drainage patterns will result in an increase of the runoff that reports to the natural water bodies thereby increasing the catchment yield. This will be a positive impact on the on the water resources.

10.4.1.2 Management Objectives

The management objectives adopted during the post closure phase relate specifically to GN 704, which was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources:

- Design of sustainable water management measures for closure and the maintenance of water quantity and quality monitoring should persist; and
- The likelihood and position of future seepage points, and the impact of these on the receiving water.

10.4.1.3 Management Actions and Targets

In this section management actions relating to the activities envisaged during the decommissioning phase are described together with the targets required to ensure mitigation of the impacts occur:

- Ensure that the surface inspection is continuously undertaken to allow clean water runoff to drain onto the natural water bodies;
- Ensure that monitoring is in place for at least two to three years post closure, after rehabilitation and that the land remains free draining post closure, post rehabilitation;
- Monitor the parameters such as pH, EC, Sulfate, and Metals to enable detection of surface water impacts and determine the trend or fluctuation of the water quality compared to the baseline water quality detailed in section 9.1 of this report;
- Potential future impacts from the mine should be covered in the closure plan and the closure financial provisions. If post closure impacts are identified, methods of withholding and treating the water should be further investigated depending on parameters of concern; and
- The post-closure water management plan should take cognisance of the likelihood that the water table will rebound in the rehabilitated footprints and that runoff of residual contaminants could impact the runoff water to the streams.

The significance impact ratings associated with the post-closure phase of the project are detailed in Table 10-85 below.

Table 10-85: Post-closure phase impact ratings for activities taking place in the Cooke MRA

Dimension	Rating	Motivation	Significance
Activity and Interaction: (Post closure Impacts)			
Impact Description: Residual water pollution from rehabilitated infrastructure footprints post closure			
Prior to mitigation/ management			
Duration	Medium term (3)	The time of impact varies depending on the residual impacts anticipated, but could last for some years	Minor - negative (40)
Extent	Local (3)	The Impacts will travel as far as the runoff goes, into nearby streams	
Intensity	Moderately high - negative (4)	The impact s negative with moderate intensity as the impacts could add to the existing poor water quality in the streams	
Probability	Probable (4)	Without appropriate mitigation and capping the rehabilitated area residual impacts could , result in contamination	
Mitigation/ Management Actions			
▪ Potential future impacts from the mine should have been identified and mitigated accordingly. ▪ The final mine topography should be free-draining as far as possible.			
Post-Mitigation			
Duration	Medium term (3)	As mitigation is implemented, the erosion will be limited to the times of operation of each small site	Negligible - negative (27)
Extent	Local (3)	Impact limited to the smaller areas cleared and un-rehabilitated each time	
Intensity	Moderate - negative (3)	Mitigation will reduce the intensities of the potential erosion	
Probability	Unlikely (3)	Mitigation will not completely stop erosion but will significantly reduce	
Activity and Interaction: Post closure (Rehabilitated area)			
Impact Description: Improvement in catchment yield			
Prior to mitigation/ management			
Duration	Project Life (7)	This will continue permanently after the closure of the project	Moderate - positive (91)
Extent	Local (3)	The Dams and rivers downstream of the project area catchment could be positively impacted	
Intensity	Moderately high (3)	Rivers around the project area will receive moderately increased runoff and this could benefit the downstream users and the aquatic life as well	
Probability	Certain (7)	The increased catchment yield will occur as long as the drainage patterns are restored	
Nature	Positive		

Dimension	Rating	Motivation	Significance
Mitigation/ Management actions			
▪ Ensure that the surface inspection is continuously undertaken to allow runoff to drain onto the natural water bodies.			
Post- mitigation			
Duration	Project Life (7)	This will continue permanently after the closure of the project	Moderate - positive (91)
Extent	Local (3)	The Dams and rivers downstream of the project area catchment could be positively impacted	
Intensity	Moderately high (3)	Rivers around the project area will receive moderately increased runoff and this could benefit the downstream users and the aquatic life as well	
Probability	Certain (7)	The increased catchment yield will occur as long as the drainage patterns are restored	
Nature	Positive		

10.4.2 Visual Impacts

10.4.2.1 Cooke TSF and Cooke 4 South TSF

The change in land use after the hydraulic reclamation and rehabilitation of Cooke TSF and Cooke 4 South TSF from mining to a suitable end land use is expected to have a positive visual impact on the receiving environment of the Cooke MRA. The interactions and resultant impacts of Cooke TSF and Cooke 4 South TSF are indicated in Table 10-86.

Table 10-86: Interactions and Impacts of Cooke TSF and Cooke 4 South TSF on the Visual Aspects of the Cooke MRA (Post-Closure Phase)

Interaction	Impact
Change of land use from mining to a suitable end land use	Change of land use from mining to a suitable end land use will have a positive visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from an industrial / mining sense of place resulting in increased scenic character and decreased visual disturbance.

The impact ratings and mitigation / management measures for Cooke TSF and Cooke 4 South TSF are summarised in Table 10-87

Table 10-87: Potential Impacts of Cooke TSF and Cooke 4 South TSF on the Visual Aspects of the Cooke MRA (Post-Closure Phase)

Activity and Interaction (Hydraulic reclamation and rehabilitation of Cooke TSF and Cooke 4 South TSF result in change of land use from mining to a suitable end land use)			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The change of land use from mining to a suitable end land use will have a positive visual impact on the receiving environment. This change in land-use will change the sense of place of the project area and surrounds from an industrial / mining sense of place resulting in increased scenic character and decreased visual disturbance.			
Prior to Mitigation / Management			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	Moderate positive (105)
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Very Serious (5)	Moderate loss and / or damage to biological or On-going and widespread benefits to local communities and natural features of the landscape.	
Probability	Definite (7)	There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability	
Nature	Positive		

10.5 Cumulative Impacts

Cumulative impacts are defined as impacts arising from the combined effects of two or more projects or actions. The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of its parts, implying that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation. Cumulative impacts usually relate to large-scale rather than site-specific impacts and have a tendency to increase the intensity of impacts already predicted for the proposed project.

The potential cumulative impacts as a result of the WRTRP are discussed in Table 10-88

Table 10-88: Potential Cumulative Impacts

Environmental Aspect	Cumulative Impacts
Air Quality	Air quality data from the existing dust monitoring network: Kloof, Driefontein, Cooke and Ezulwini show deposition rates that are representative of background. Few exceedance of the residential limit (600 mg/m2/day), and sometimes industrial limit (1200 mg/m^2/day) were observed across the MRAs. In general, monthly dust deposition rates are within limit. The analysed PM_{10} data for 2013 and 2014 collected at the Driefontein Monitoring Station were within the daily limit of 75 µg/m^3 for most of the time. This is not to say there were no exceedances, but rather a general statement. Ambient levels in the vicinity of the RTSF will be influence by other TSFs in the area i.e. South Deep TSF and the Gold Fields TSF. The operational phase of the Project at the different MRAs will have localised impacts in the immediate vicinity. It is not envisaged that the proposed project will compromise the current ambient air quality scenario.
Groundwater	There are no industrial or mining activities in the vicinity of the proposed RTSF other than Gold Fields' Doornpoort TSF. Sources of future groundwater impacts around the proposed RTSF area will therefore be from the RTSF and Gold Fields' Doornpoort TSF. The Gold Fields TSF is approximately 1 km northeast of the proposed RTSF. The Leeuspruit flows between the two. The river is generally fed by groundwater and therefore any pollution from the Gold Fields TSF is expected to be intercepted by the river as baseflow. However, the closeness of the two TSFs means that if any local fractures exist (that were not identified during this study) connecting the two TSFs, pollution plumes from the Gold Fields TSF can possibly migrate beyond the river towards the proposed RTSF. Groundwater monitoring along a set of boreholes on both sides of the river is recommended to detect the sources of any contamination plume reaching the river. The hydrocensus conducted by Digby Wells in the vicinity of the RTSF (2015) showed that irrigation (fertiliser) related, site-specific pollution exists in some boreholes which are usually manifested by the elevated nitrate or ammonia concentrations. The current groundwater quality is good, with current sulfate concentrations recorded as 32 mg/L (note: a sulfate concentration up to 400 mg/L is considered to be of good quality). This could accordingly serve as the baseline for future monitoring.

Environmental Aspect	Cumulative Impacts
Soils	The major impacts associated with mining are the disturbance of natural occurring soil profiles consisting of layers or soil horizons. Rehabilitation of disturbed areas aims to restore land capability but the South African experience is that post mining land capability usually decreases compared to pre-mining land capability. Soil formation is determined by a combination of five interacting main soil formation factors. These factors are time, climate, slope, organisms and parent material. Soil formation is an extremely slow process and soil can therefore be considered as a non-renewable resource. Soil quality deteriorates during stockpiling and replacement of these soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. Depth however can be imitated but the combined soil quality deterioration and resultant compaction by the machines used in rehabilitation, leads to a net loss of land capability. A change in land capability then forces a change in land use. The impact on soil is high because natural soil layers are stripped and stockpiled for later use in rehabilitation. In addition, soil fertility is impacted because stripped soil layers are usually thicker than the defined topsoil layer. The topsoil layer is the layer where most plant roots are found and is generally 0.30 m thick. Although a significant portion of arable land will be lost at the RTSF site. The reclaimed sites will have an increase in land use and land capability. This will not be at the same level of the land capability and land use of the RTSF site.
Surface Water	The baseline water quality data indicated elevated concentrations of sulphate, nitrate, fluoride, manganese and ammonia in a number of streams in the project area. This indicates that rivers within the region are already impacted. The area comprises of various land uses which includes mining, industrial areas, residential areas and agricultural activities. All these land uses could possibly have contributed to this water quality status. The reclamation of the gold dumps could mobilise and expose sulphide minerals, such a pyrite (FeS_2), that will oxidise when exposed to water and air and release large quantities of iron and sulphate into solution which is very acidic and thereby referred to as AMD. Therefore, without adequate and effective mitigation measures, the proposed project may further deteriorate the quality of water in the natural water courses during the operational phase of the project.

Environmental Aspect	Cumulative Impacts
	It is anticipated in the long term, however, that the surface water environment will benefit by eliminating a permanent source of contaminants due to the presence of the TSFs. The reclamation of the historical TSFs and removal of sulphides from the tailings will have a positive impact on the environment .This project would therefore contribute to a regional closure strategy that talks to a sustainable solution for both water issues and management of a multitude of poorly sited historical TSFs.
Fauna and Flora	The only construction and subsequent removal of vegetation that will occur is within the footprint of the CPP and the RTSF complex, with negligible (after mitigation) impacts occurring from the pipeline. These two pose the greatest cumulative impacts to the general area. It is expected that 346 ha of natural grassland and 12 ha of wetlands will be removed to facilitate construction. Total cumulative impact to loss of vegetation and habitat will be 358 ha.
Aquatics	The aquatic habitat PES of the Leeuspruit is currently largely modified as a result of poor water quality compounded by habitat modification. The proposed project, through the creation of the RTSF, would potentially contribute toward increasing the dissolved solid component of the downstream aquatic regions. Thus, the proposed project would potentially contribute toward further water quality degradation (should no mitigation be implemented) within the Leeuspruit over the long term. The Leeuspruit will also be traversed by pipelines in three separate regions. The placement of these pipelines could degrade marginal aquatic habitat. However, on a large scale the impacts would be negligible. The Loopspruit is also currently in a largely modified state due to critical water and large habitat modification. No reclamation activities will be taking place within he Loopspruit catchment area. However, several pipeline crossings will be constructed and therefore could degrade marginal aquatic habitat. This impact was assessed to be on a local scale and therefore would result in a negligible cumulative impact, specifically on the marginal aquatic habitat.
Wetlands	The activities associated with the Kloof Mining Right area will result in the loss of 11 ha of valley bottom wetlands within the CPP foorptint and 38.5 ha of pans and 4.4 ha of valley bottom wetlands within the RTSF footprint. SGL will

Environmental Aspect	Cumulative Impacts
	need to investigate an offset strategy for the loss of these wetlands. This will directly contribute to the cumulative loss of wetlands in the local area, municipality and province. This may result in reduced wetland functionality which is responsible for maintenance of water quality, toxicant assimilation, carbon storage, streamflow regulation and flood attenuation, as well as biodiversity maintenance
Visual	The proposed CPP is situated near the existing Kloof mining infrastructure. This existing infrastructure has impacts on the visual aesthetics / character of the receiving environment and the development of the proposed CPP will add to these existing visual impacts. The receiving environment of the proposed RTSF consists mainly of small holdings, agriculture and open land with some small residential areas. Only a small percentage of the receiving environment has been disturbed by mining and prior to the construction of the new Gold Fields Doornpoort TSF there was no mining activity within 3.5 km of the proposed RTSF site. The construction of the new Gold Fields Doornpoort TSF and the proposed RTSF will have significant negative visual impacts on the visual aesthetics / character of the receiving environment. The visibility of these large developments will alter the sense of place of the receiving environment from rural to industrial / mining and result in a loss of scenic character and increased visual disturbance. The proposed activities of the Driefontein, Cooke and Ezulwini MRAs will have a neutral visual impact on the receiving environment. The reclamation of the Driefontein 3, Driefontein 5, Cooke and Cooke 4 South TSFs will have a negative visual impact during the reclamation phase but ultimately after the rehabilitation phase there will be a positive visual impact because the negative visual impact of mining created by the TSFs will be removed. This positive visual impact will be increased as the number of reclaimed dumps increases.
Noise	Cumulative impacts should be considered for the overall improvement of ambient noise levels. The project is considered a causative source of noise pollution of negligible significance. The existing noise sources in the immediate surroundings of the project area are typical noise sources such as vehicle activity on the main roads (N12, R28, R500 and R501) as well as on surrounding gravel roads.

Environmental Aspect	Cumulative Impacts
	The existing Driefontein, Kloof, Ezulwini and Cooke Mining Right area are already impacting on the noise levels of their immediate surroundings in the respective Mining Right areas but are too far apart from one another to cumulatively impact on the region. As a result, the WRTRP is not expected to have a cumulative impact or exacerbate current noise levels. This is primarily due to noise propagation not measuring above the rating levels of the surrounding suburban and rural receptors.
Heritage	Cumulative impacts occur from in-combination effects of various impacts on heritage resources acting within a host of processes that result in an incremental effect. As detailed in the cultural heritage baseline in Section 9.1.11, the regional and local study area contribute to the historic mining landscape associated with the West Rand, and the mining history of Johannesburg at large. Visible tangible markers associated with this history are historic mining infrastructures, such as headgears, and more significantly, historical TSFs. The proposed WRTRP will have neutralising impact to the local and regional study area as the RTSF will replace the historical TSFs on the landscape. This will be manifested primarily through the alteration to the sense-of-place in so far as the historic mining landscape characterised by the numerous individual historical TSFs will be changed into a modernised mining landscape through the establishment of the proposed RTSF. The overall sense-of-place, however, will remain intrinsically associated with the mining landscape, which is a part of a living mining heritage and cannot therefore be “preserved” through keeping of the static *status quo*. The proposed reclamation activities associated with the Initial Implementation will result in an additive cumulative impact to the historic mining landscape, i.e. the sum of all the effects of the reclamation. Reclamation activities will decrease the number of remaining historical TSFs as tangible markers of historic mining activities on the West Rand. The removal of the historical TSF’s will subsequently gradually increase the significance of *in situ* resources. Through time, the remaining historical TSFs associated with the mining heritage of the greater Johannesburg region will have a high cultural significance regardless of the integrity of the resource.

Environmental Aspect	Cumulative Impacts
Socio-Economic	It is expected that the project will contribute towards improving environmental conditions in the project area and its surroundings due to the reclamation of historical TSFs. The cumulative contribution of this impact is, however, dependent on the impacts of other existing and future developments in the area, as well as the success of government programmes aimed at the protection of the environment, and the socio-economic development of historically disadvantaged local communities. Cooperating and partnering with government, mining companies and industries is therefore imperative. It is also expected that the project will contribute to employment, local procurement and the production of high value products; this will facilitate income growth, capacity development and national level economic benefits. The project may also contribute to infrastructure and service improvements in the affected districts, which will in themselves impact positively on the local and district socio-economic status. These positive impacts, in combination with those of other developments, could boost the overall development in the surrounding municipal districts. A highly significant cumulative impact relates to the fact that existing and new developments in the West Rand may accelerate population influx to the area with the associated increased pressure on land, resources and services, as well as the potential for informal settlement, encroachment and urban sprawl. The development of the project could exacerbate conditions such as the spread of HIV/AIDS and other communicable diseases following population influx, settlement densification and related factors (e.g. decreases in the quality and quantity of water). Health impacts must be addressed in the project's Community Health and Safety Management Plan. Moreover, the Project should collaborate with national, provincial and local government, as well as leading health-based NGOs to promote an integrated approach to combating HIV/AIDS.

10.6 Item 3(g)(vi): Methodology used in determining and ranking the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks

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

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

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

SIGNIFICANCE = CONSEQUENCE[5] x PROBABILITY[6] x NATURE[7]

The matrix (Table 10-90) calculates the rating out of 147 points, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 10-89. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation, and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 10-91).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

[5] Consequence = Intensity + Extent + Duration

[6] Probability = Likelihood of and impact occurring

[7] Nature = Positive (+1) or Negative (-1) impact

Table 10-89: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 10-90: Probability/Consequence Matrix

		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 10-91: Significance Rating Description

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

10.7 Item 3(g)(vii): The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected

The layout of the project has been designed to mitigate and prevent potential impacts as far as possible. The project activities associated with the Kloof Mining Right area are likely to result in negative impacts to the biophysical environment, while the reclamation activities associated with the remaining Mining Right areas, namely Driefontein, and Cooke (which includes the reclamation of the C4S TSF), are likely to result in positive impacts to the biophysical environment as a result of the removal of historical TSFs that are sources of pollution and contamination.

The infrastructure layout at the Ezulwini Mining Right area was structured in such a way that efficiency in operating the infrastructure would be guaranteed, while negative impacts onto the receiving environment would be minimised as far as possible. The pipeline routings (from the CPP to the Ezulwini Plant) have been proposed to be constructed on existing servitudes to minimise the footprint area being affected.

The reclamation activities proposed for the WRTRP are proposed to pose a positive impact onto the receiving environment. The removal of the historical TSFs essentially constitutes to the permanent pollution sources within the West Rand being eradicated, thus improving the quality of water resources, as well reducing the extent of land occupied by mining dumps throughout the West Rand. The resultant tailings to be deposited on the RTSF will be reduced in sulfate and uranium content, reducing the contamination potential. It is important to note that the reclamation of the C4S TSF will not be assessed as part of this application; however it will form part of the Cooke Mining Right EIA Report. In addition to this, the activities associated with the RTSF will be assessed as part of the Kloof Mining Right area EIA Report.

10.8 Item 3(g)(viii): The possible mitigation measures that could be applied and the level of risk

This section refers to the potential mitigation measures proposed for impacts associated with the project, with specific relation to concerns that I&APs have raised. The mitigation measures proposed in this Draft EIA and EMP were made available for public review and comment. Any further comments or issues raised will be recorded and responded to before the EIA and EMP is updated and submitted to the DMR provided they are submitted within a reasonable time.

Section 10.7 outlines the positive and negative impacts associated with the project, as identified by I&APs, as well as identified by the specialist studies. The predominant issues raised by I&APs relate to groundwater contamination, both existing and future potential contamination, as well as issues relating to the socio-economic development of the region.

The historical TSFs present throughout the landscape are located on sensitive dolomitic aquifers and seepage from the TSFs result in the contamination of groundwater. The WRTRP aims to remove these historical TSFs through the reclamation activities and rehabilitate the TSFs' footprints which will remove a permanent pollution source from the landscape. In addition, present mining activities can result in the groundwater becoming contaminated as it reacts with ore that increases the water's sulfate concentrations and pH values. The WRTRP will utilise this mine affected water to reclaim the historical TSFs, prevent discharge into the environment as well as preventing the use of clean water for mining activities, and this water will eventually be treated at the AWTF to potable standards (SANS 241:2011). The WRTRP is likely to improve the water quality of the region by removing the permanent pollution sources from the environment, using mine affected water to minimise discharge into the environment and to treat mine affected water to potable standards.

The development and presence of the RTSF will be a permanent pollution source on the environment once established. The tailings material to be deposited on the RTSF will not have the pollution potential of the current historical TSFs as large quantities of sulfate and uranium will be removed during the processing at the CPP. In addition, the water contained in the RTSF will be diverted and flow to a lined RWD which will prevent contamination of the groundwater resources. Contamination plumes are still expected from the RTSF due to seepage, however, and this contamination plume will be restricted to an area of approximately 1 600 ha through the implementation of a blast curtain. The blast curtain will be located along the periphery of the RTSF footprint. Groundwater monitoring will be undertaken throughout the life of the project and beyond to ensure that potential impacts to the environment due to the contamination plume are monitored.

The RTSF will also result in economic and physical displacement, the loss of wetlands and a visual intrusion on the environment. An exclusion zone will be implemented whereby purchase agreements will be concluded with the land owners affected by the RTSF. The responsibility for farm workers and land occupiers will be agreed upon in the purchase agreement to ensure any physical or economic displacement is compensated adequately. A wetland offset strategy will be implemented to compensate for the loss of wetland habitat.

The WRTRP will contribute significantly to the socio-economic environment. It is expected that the project will have a total capital investment of R 9 billion and will require 2 000 temporary employees during the construction phase and 500 permanent employees for the life of the operation over a period of 50 years. The WRTRP will contribute an estimated R4.1 billion per annum should the product be exported. To enhance the socio-economic impacts anticipated, enhancement and management measures have been provided to maximise the local benefits.

All mitigation measures and the significance ratings, prior to and post the implementation of the mitigation measures, have been provided in Sections 10.1 to 10.4.

10.9 Item 3(g)(ix): Motivation where no alternatives sites were considered

Alternatives were considered for the unauthorised pipelines as discussed in Section 8.1 of this report. The pipeline routes were determined based on existing servitudes, avoiding sensitive areas and wetlands, economic feasibility in terms of pumping costs and property ownership. Site alternatives were not considered since the reclamation activities are restricted to the Cooke Mining Right area.

10.10 Item 3(g)(x): Statement motivating the alternative development location within the overall site

10.10.1 Cooke and C4S Thickeners

The C4S thickener is conveniently located north of the C4S TSF along the new proposed pipeline route leading from the C4S to the CPP. This thickener is placed strategically in this specific location to minimise the footprint requirements considering that the entire reclamation infrastructure is located in this area including the C4S main reclamation pump station, the authorised Cooke 4 shaft from which water is abstracted for reclamation purposes and the proposed pipeline from the C4S TSF to the CPP.

The Cooke thickener is located west of the Cooke TSF along the authorised pipeline route leading to the CPP. It was found to be environmentally efficient to construct the Cooke thickener along this route as it reduces the environmental footprint with the entire reclamation related infrastructure concentrated into one area.

10.10.2 Pipelines

The pipeline alternatives chosen for each of the proposed pipelines took into consideration the distance, the avoidance of environmentally sensitive areas, capitalising on already existing routes where possible and crossing existing mine impacted land. The alternatives are described in Section 8.1 above.

11 Item 3(h): Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity

The proposed infrastructure layout for the Cooke Mining Right area was informed by various environmental, technical and engineering studies, and the location of already existing infrastructure and historical TSFs. The infrastructure location within the Cooke Mining Right area has been selected based on existing servitudes, proximity to the historical TSFs to be mined and economic feasibility. During the Scoping Phase of this project, various specialists identified the potential impacts which could result from the proposed activities within the preferred project site. a detailed plan of study for specialist studies to determine the sensitivities anticipated in relation to the project and the baseline environment of the project area.

Following the identification of potential impacts and detailed baseline environment, the impacts were assessed utilising the Digby Wells' methodology which assesses the nature of the impact, duration and extent, intensity including the aspects irreplaceability, and the probability of the impact occurring. The EIA methodology is detailed in Section 10.6. Following the assessment of the potential impacts, mitigation measures were provided and the potential impacts were assessed post-mitigation. The significance of the pre-mitigation impacts, the proposed mitigation measures and the post-mitigation significance ratings are detailed per environmental aspect per phase of the project in Section 10.6. The potential impacts assessed are based on the preferred site layout (Plan 4d).

12 Item 3(i): Assessment of each identified potentially significant impact and risk

The potential impacts per activity are detailed in Table 12-1. The discussion of the impacts are provided in Section 0, along with the impact ratings prior to and post the implementation of mitigation and management measures, as well as providing a list of the mitigation measures.

Table 12-1: Assessment of Each Identified Impact

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
Construction Phase						
Site Clearing for the construction of pipelines, Thickeners and pump stations	Reduction in the quality of ambient air due to dust generation;	Air Quality	Construction phase	Negligible (Negative)	▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ Limit activity to non-windy days; ▪ The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur; ▪ Drop heights when loaders and offloading material should be minimised; and ▪ Vehicle travel speed and distances should be minimised.	Negligible (Negative)
Site Clearing for the construction of pipelines, Thickeners and pump stations	Increased particulate matter load in the atmosphere leading to deteriorated air quality	Air Quality	Construction Phase	Negligible (Negative)	▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading and offloading construction materials should be minimised; ▪ Vehicle travel speed and distances should be minimised.	Negligible (Negative)
Site Clearing for the construction of pipelines, Thickeners and pump stations	Noise will emanate from the machinery and vehicles operating during the construction activities.	Noise	Construction Phase	Negligible (Negative)	▪ Restricting construction activities to daylight hours; ▪ machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective; and ▪ Switching off equipment when not in use.	Negligible (Negative)
Site clearing for the construction of pipelines, thickeners and pump stations	Loss of topsoil resource	Soil	Construction Phase	Minor (Negative)	▪ Effective storm water management, erosion protection and rehabilitation.	Negligible (Negative)
Site clearing for the Construction of Infrastructure	Increase in sedimentation due to exposed surfaces	Surface Water	Construction Phase	Minor (Negative)	▪ Construct temporary ditches and a temporary storage area along downstream boundary of cleared areas to capture sediment laden runoff. Water within temporary storage area can be used for construction and should be operated empty.	Negligible (Negative)
Site clearing for the Construction of Infrastructure	Mixing of upstream clean water runoff with dirty water runoff from cleared site areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Construction Phase	Moderate (Negative)	▪ Temporary surface water ditches are to be constructed on the upstream boundary of infrastructure areas to divert clean water into the downstream environment.	Negligible (Negative)
Construction of infrastructures	Flooding of pipeline	Surface Water	Construction Phase	Minor (Negative)	▪ Ensure that all pipelines are constructed above the 1:100 year flood elevation and/or	Minor (Negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
(pipelines, pump stations, NBT etc.).	crossings				designed to withstand exceptional rainfall events.	
Construction of infrastructures (pipelines, Thickeners and sumps).	Mixing of upstream clean water runoff with dirty water runoff from within infrastructure areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Construction Phase	Moderate (Negative)	▪ Clean water emanating from upstream of infrastructure areas will be diverted away and discharged to the nearby watercourse or environment. The clean water diversion will be sized to accommodate the 1:50 year storm event. ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	Minor (Negative)
Site clearing for infrastructure placement (Pipelines)	Water and habitat quality modification	Aquatics	Construction Phase	Minor (Negative)	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with construction sequencing is proposed. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.	Negligible (Negative)
Construction of infrastructure	Water and habitat quality modifications	Aquatics	Construction Phase	Minor (Negative)	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ▪ Construction sequencing is proposed.	Negligible (Negative)
Construction of infrastructure in areas of medium and high sensitivity (pipelines) require vegetation clearing	Direct loss of floral species/vegetation types and biodiversity	Fauna and Flora	Construction Phase	Minor (Negative)	▪ Limit degradation and destruction of natural environment ridges and grassland, to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Re-vegetate open areas to limit erosion. ▪ Avoid known areas of faunal and floral SSC, specifically the ridges and grassland. ▪ Avoid sensitive landscapes such as ridges and grassland areas that were encountered on site. ▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation are controlled so that no open areas occur. ▪ Applications for permits for removal of certain plants, where required.	Negligible (Negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
Construction of infrastructure (pipelines) which requires vegetation clearing	Loss of species of special concern (protected species)	Fauna and Flora	Construction Phase	Minor (Negative)	▪ Limit degradation and destruction of natural environment to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Re-vegetate open areas to limit erosion. ▪ Avoid known areas of faunal and floral SSC. ▪ Avoid sensitive landscapes such as riparian and ridge areas that were encountered on site. ▪ Applications for permits for removal of certain plants, where required	Negligible (Negative)
Construction of infrastructure (pipelines) which requires vegetation clearing	Alien vegetation establishment	Fauna and Flora	Construction Phase	Minor (Negative)	▪ Manage nationally restricted alien invasive plant species by ensuring the removal of vegetation during construction and operation is controlled so that no open areas occur. ▪ If alien vegetation is encountered, remove these plants, in the correct way and timeously, following the alien management plan.	Negligible (Negative)
Pipeline placement in and around wetland at N12	Disturbance of wetland. The pipeline containing tailings slurry has the potential to impact the wetlands if an unplanned spill occurs	Wetlands	Construction Phase	Minor (Negative)	▪ Responsible construction to protect the surrounding environment will mitigate this impact. This should include aspects such as vehicles must be in good working order; construction should occur in the dry-season in the shortest time possible; and particular care must be taken when constructing in the wetland. ▪ In addition, the sections of pipe crossing wetlands should have no joints and must be fitted with HDPE sleeves.	Negligible (Negative)
Employment and Procurement for the construction and operation of the WRTRP.	Local employment and procurement of goods and services, as well as skills development, capacity building and economic development will have a positive impact. All these impacts will result in a positive contribution to the GDP.	Socio-economic	Construction Phase	Minor (positive)	▪ Use labour-intensive construction methods, where feasible, to increase employment opportunities; ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.	Moderate (Positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
Employment and procurement for the construction and operation of the WRTRP.	Disruption of movement and mobility for people and livestock.	Socio-economic	Construction Phase	Moderate (Negative)	▪ Involve community structures to assist in communicating labour requirements and other mine related aspects to the communities; ▪ SGL must liaise with the municipalities to ensure expected population influx is taken into account for infrastructure development and planning; ▪ Promote development projects, such as low cost housing, by including such developments in the Social and Labour Plan and LED programmes; ▪ Implement an HIV/AIDS and alcohol abuse awareness campaigns in the communities and include such campaigns as a condition of contract for suppliers and sub-contractors; ▪ A voluntary counselling and testing (VCT) programme must be introduced for all employees for the WRTRP; ▪ Access control to operational areas must be implemented to prevent sex workers and petty traders from loitering near construction camps and operational areas; ▪ Construction and operational personnel must be dressed in uniform to clearly identify non-employed personnel from entering restricted areas; ▪ Liaison structures and forums must be established with the local police to monitor social changes in crime patterns; and ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities.	Minor (Negative)

Employment and procurement for the construction and operation of the WRTRP.	Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.	Socio-economic	Construction Phase	Minor (Negative)	▪ Implement suitable consultation procedures to ensure that local communities are:
					  ▪ Informed about pending construction activities;
					  ▪ Involved in the formulation of mitigation measures where appropriate; and
					  ▪ Implement appropriate grievance procedures and compensation measures.
					▪ Ensure that the alignment of construction roads, pipelines and power lines avoid loss of access to properties, livelihood resources and livestock infrastructure. Where this is unavoidable, alternative access must be provided. Any assets lost as a result must be compensated for in an appropriate manner;
					▪ Erect suitable traffic and construction signage to control traffic, raise awareness of potential risks/hazards and indicate alternative access routes;
					▪ Implement suitable measures to provide continued access to assets and livestock, and minimise traffic disruptions. These measures could include temporary pedestrian crossings (on main access roads), road diversions and cattle crossings;
					▪ Ensure that access to grazing areas are uninterrupted through providing alternative access routes and/or cattle corridors and access points during construction activities;
					▪ Ensure acceptable repair of road networks after construction activities are completed. Where this is not possible, alternative access roads should be constructed; and
					▪ Where the fencing of project facilities and infrastructure will be permanent, alternative access must be provided if access to properties is lost.
						Minor (Negative)

Operational Phase						
Reclamation of the	This will result in	Air Quality	Operational Phase	Negligible (Negative)	▪ Vehicle travel speed and distances should be minimised when transporting personnel	Negligible (Negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
Cooke and C4S TSFs	fugitive dust emissions which then reduce the quality of ambient air.				on and off site on dirt roads; ▪ Vegetation removal must be limited to the section to be reclaimed.	
Reclamation activities and the operation of the pump stations during the operational phase	Noise will emanate from the reclamation activities and pump stations during the operational phase.	Noise	Operational Phase	Negligible (Negative)	▪ Pump stations to be housed in noise attenuating enclosures; ▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry; ▪ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	Negligible (Negative)
Hydraulic reclamation of the historical TSFs	Seepage through the TSFs of the water to be used for hydraulic reclamation	Groundwater	Operational Phase	Minor (Negative)	▪ Monitoring of groundwater quality and water levels	Negligible (Negative)
Maintenance of the pipeline route during the operations of the mine.	The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.	Soil	Operational Phase	Minor (Negative)	▪ Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.	Negligible (Negative)
Operation of sumps and pumps	Pump failure and overflow from sumps to contaminate downstream water quality	Surface Water	Operational Phase	Minor (Negative)	▪ Construct, monitor and maintain overflow compartments downstream of the sump area. ▪ Ensure emergency procedures in the event of power failure such as operational modifications and the use of a stand-by generator to operate the pump station should the sump be getting full.	▪ Negligible (Negative)
Reclamation of the historical TSFs	Water and habitat quality modification	Aquatics	Operational Phase	Moderate (Negative)	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ The planting of indigenous trees around the TSF and pollution control facilities. ▪ Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used. ▪ Groundwater management according to the ground water study (Digby Wells, 2015).	▪ Minor (Negative)
Existence, operation and maintenance of the pipeline through the pan wetland,	The pipeline containing tailings slurry has the potential to impact the wetlands	Wetlands	Operational Phase	Minor (Negative)	▪ Monitoring of the pipeline and continuous maintenance, especially over wetlands to include: • Alien and Invasive flora management along the project area according to the	Minor (Negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
under the N12.	if an unplanned spill occurs. Disturbance of wetland habitat as the pipeline is an industrial negative impact to wetland integrity is anticipated				Fauna and Flora Report (Digby Wells, 2015c) • Erosion control and continuous rehabilitation as per the Rehabilitation Plan (Digby Wells, 2015e). ▪ Note: Demarcating the wetland and the buffer with rehabilitation interventions could have a positive impact.	
Employment and procurement during the operational phase of the WRTRP	Local employment and procurement of goods specific to the operational phase of the WRTRP.	Socio-economic	Operational Phase	Minor (Positive)	▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour and local and small businesses should be prioritised; ▪ Reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Identify students from local schools to participate in company bursaries and internship programmes ;and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.	Moderate (Positive)
Production of gold and uranium	Export of uranium and gold will contribute to South Africa's export earnings and allows the country to earn foreign exchange.	Socio-economic	Operational Phase	Moderate (Positive	▪ This is a positive impact and there are no enhancement measures associated with the export of the product.	N/A
Decommissioning Phase						
Removal of surface infrastructure such as pipelines and pump stations	Reduction in the quality of ambient air due to fugitive emissions from vehicle wheels and wind erosion	Air Quality	Decommissioning Phase	Negligible (negative)	▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loaders off load rubble should be minimised; ▪ Vehicle travel speed and distances should be minimised.	Negligible (Negative)
Rehabilitation of the old TSF footprint	This will result in the elimination of a pollution source and availability of land for	Air Quality	Decommissioning Phase	Negligible (Negative)	▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ The area of disturbance must be kept to a minimum;	Minor (Positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
	alternative land uses				▪ Drop heights when loaders off load rubble should be minimised; ▪ Vehicle travel speed and distances should be minimised. ▪ Vegetation of footprint	
Dismantling and removal of the pump stations and pipeline infrastructure	Noise will emanate from the machinery and vehicles operating during the decommissioning activities.	Noise	Decommissioning Phase	Negligible (Negative)	▪ Restricting decommissioning activities to daylight hours; ▪ machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	Negligible (Negative)
Removal of historical TSFs through hydraulic reclamation activities	Impact on groundwater contamination due to re-mining of historical TSFs	Groundwater	Decommissioning Phase	Moderate (Positive)	▪ Monitoring of groundwater quality and water levels	Moderate (Positive)
Removal of pipelines	The removal of the pipeline route will cause a loss of topsoil as a resource as a result of compaction and erosion.	Soil	Decommissioning Phase	Minor (Negative)	▪ The removal of the pipeline must be done on the existing roads to minimise compaction and erosion.	Negligible (Negative)
Reclamation of the historical TSFs	The removal of the tailings and the reclamation of the land use and land capability	Soil	Decommissioning Phase	Moderate (Negative)	▪ The TSF sites will be reclaimed and contamination studies must be undertaken as well as remediation feasibility studies.	Moderate (Positive)
Removal of surface infrastructure during the decommissioning phase	Water pollution from accidental spillages of decommissioned infrastructure	Surface Water	Decommissioning Phase	Negligible (Negative)	▪ Empty infrastructure before removal. ▪ The durability and longevity of water management designs, e.g. provision of erosion protection for long-term control of erosion and potential pollution to water resources during decommissioning.	Negligible (Negative)
Removal of infrastructure	Water and habitat quality modification	Aquatics	Decommissioning Phase	Moderate (Negative)	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Construction sequencing is proposed. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ▪ Unobtrusive infrastructure design over river systems. ▪ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all	Negligible (Negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
					structures to prevent instream sedimentation. ▪ Soils adjacent the river that has been compacted must be loosened to allow for germination. ▪ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	
Removal of TSF material	Water and habitat quality modification	Aquatics	Decommissioning Phase	Moderate (Positive)	▪ N/A	N/A
Rehabilitation of infrastructure footprint areas	Restoration of vegetation and habitat types.	Fauna and Flora	Decommissioning Phase	Small (Positive)	▪ N/A	N/A
Rehabilitation of infrastructure footprint areas	Rehabilitation of infrastructure footprint areas	Fauna and Flora	Decommissioning Phase	Moderate (Positive)	▪ N/A	N/A
Decommissioning of the mined Cooke and Cooke 4 South TSF footprints.	This may have a positive impact on the surrounding wetlands if rehabilitation occurs as this is removing a current highly significant negative impact to the wetlands. If rehabilitation of the footprint is not done, a negative impact will be realised.	Wetlands	Decommissioning Phase	Moderate (Negative)	▪ Remediation and rehabilitation of the TSF footprints according to the rehabilitation plan will aim to remove this pollution source. This will have a positive impact on the wetlands as a very significant pollutant source will be removed from the catchment.	Moderate (Positive)
Decommissioning of the WRTRP operations	Retrenchments of mine employees will take place as operations close. The local economy will likely be dependent on the WRTRP to an extent which will be impacted once operations cease.	Socio-economic	Decommissioning Phase	Moderate (Negative)	▪ Develop a Closure Plan 15 years prior to planned closure and review the Closure Plan every 5 years; ▪ Establish a Future Forum to promote on-going discussions between SGL and the mine's workforce; ▪ Liaise with the Department of Labour for the utilisation of its resources and support services once retrenchments take place; ▪ Provide financial life skills to employees and ensure employees are trained in alternative skills; and ▪ Inform affected areas, such as the local municipality and labour sending areas, of planned retrenchments.	Moderate (Positive)
Post-closure Phase						

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance
	Residual water pollution from rehabilitated infrastructure footprints post closure	Surface Water	Post-closure Phase	Minor (Negative)	▪ Potential future impacts from the mine should have been identified and mitigated accordingly. ▪ The final mine topography should be free-draining as far as possible.	Negligible (Negative)
Rehabilitation of footprint area	Improvement in catchment yield	Surface Water	Post-closure Phase	Moderate (Positive)	▪ Ensure that the surface inspection is continuously undertaken to allow runoff to drain onto the natural water bodies.	Moderate (Positive)

13 Item 3(j): Summary of specialist reports

The summary of the specialist impact assessment reports undertaken for the WRTRP is detailed in Table 13-1 below.

Table 13-1: Summary of Specialist Impact Assessments for the WRTRP

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Air Quality Impact Assessment	▪ Significance of impacts ▪ Mitigation measures ▪ Monitoring Programme	Yes	The Air Quality Impact Assessment has been included in Appendix E. All mitigation and management measures included in this report were recommended by the Air Quality Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.
Groundwater Impact Assessment	▪ Significance of impacts ▪ Mitigation measures ▪ Monitoring Programme	Yes	The Groundwater Impact Assessment has been included in Appendix F. All mitigation and management measures included in this report were recommended by the Groundwater Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7.
Soil Impact Assessment	▪ Significance of impacts ▪ Mitigation measures	Yes	The Soil Impact Assessment has been included in Appendix G. All mitigation and management measures included in this report were recommended by the Soil Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7.
Surface Water Impact Assessment	▪ Significance of impacts ▪ Mitigation measures ▪ Monitoring Programme	Yes	The Surface Water Impact Assessment has been included in Appendix H. All mitigation and management measures included in this report were recommended by the Surface Water Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7.
Fauna and Flora Impact Assessment	▪ Significance of impacts ▪ Mitigation measures ▪ Monitoring Programme	Yes	The Fauna and Flora Impact Assessment has been included in Appendix I. All mitigation and management measures included in this report were recommended by the Fauna and Flora Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.
Aquatics Impact Assessment	▪ Significance of impacts ▪ Mitigation measures ▪ Monitoring Programme	Yes	The Aquatics Impact Assessment has been included in Appendix J. All mitigation and management measures included in this report were recommended by the Aquatics Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.

List of studies undertaken	**Recommendations of specialist reports**	**Specialist Recommendations that have been included in the EIA report**	**Reference to applicable section of report where specialist recommendations have been included**
Wetlands Impact Assessment	▪ Significance of impacts ▪ Mitigation measures	Yes	The Wetlands Impact Assessment has been included in Appendix K. All mitigation and management measures included in this report were recommended by the Wetland Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.
Visual and Topography Impact Assessment	▪ Significance of impacts ▪ Mitigation measures	Yes	The Visual and Topography Impact Assessment has been included in Appendix L. All mitigation and management measures included in this report were recommended by the Visual Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7.
Noise Impact Assessment	▪ Significance of impacts ▪ Mitigation measures	Yes	The Noise Impact Assessment has been included in Appendix M. All mitigation and management measures included in this report were recommended by the Noise Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7.
Social Impact Assessment	▪ Significance of impacts ▪ Mitigation and enhancement measures	Yes	The Social Impact Assessment has been included in Appendix O. All mitigation and management measures included in this report were recommended by the Social Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.
Economic Impact Assessment	▪ Significance of impacts	Yes	The Economic Impact Assessment has been included in Appendix C. All mitigation and management measures included in this report were recommended by the Economic Specialist, as well as the monitoring programmes. This includes the impact assessment as discussed in Section 10.

14 Item 3(k): Environmental impact statement

14.1 Item 3(k)(i): Summary of the key findings of the environmental impact assessment

The Environmental Impact Statement is utilised to summarise all of the potential environmental impacts identified during each phase of the proposed project. The significance of the impacts associated with the biophysical and social environment, pre-mitigation and post-mitigation, is summarised in Table 14-1.

Table 14-1: Summary of the Potential Impacts on the Biophysical and Social Environment

Activity	Potential Impact	Aspects Affected	Significance	Significance
Construction Phase				
Site clearing for the construction of pipelines, thickeners and pump stations	Loss of topsoil resource	Soil	Moderate (Negative)	Minor (Negative)
Site clearing for the Construction of Infrastructure	Increase in sedimentation due to exposed surfaces	Surface Water	Minor (Negative)	Negligible (Negative)
Site clearing for the Construction of Infrastructure	Mixing of upstream clean water runoff with dirty water runoff from cleared site areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Moderate (Negative)	Negligible (Negative)
Construction of infrastructures (pipelines, sumps).	Mixing of upstream clean water runoff with dirty water runoff from within infrastructure areas resulting in dirty water reporting to the downstream clean water catchment.	Surface Water	Moderate (Negative)	Minor (Negative)
Employment and	Local employment	Socio-	Minor (Positive)	Moderate

Activity	Potential Impact	Aspects Affected	Significance	Significance
Procurement for the construction and operation of the WRTRP.	and procurement of goods and services, as well as skills development, capacity building and economic development will have a positive impact. All these impacts will result in a positive contribution to the GDP.	economic		(Positive)
Employment and procurement for the construction and operation of the WRTRP.	Disruption of movement and mobility for people and livestock.	Socio-economic	Moderate (Negative)	Minor (Negative)
Employment and procurement for the construction and operation of the WRTRP.	Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.	Socio-economic	Minor (Negative)	Minor (Negative)
Operational Phase				
Reclamation of the historical TSFs	Water and habitat quality modification	Aquatics	Moderate (Negative)	▪ Minor (Negative)
Existence, operation and maintenance of the pipeline through the pan wetland, under the N12.	The pipeline containing tailings slurry has the potential to impact the wetlands if an unplanned spill occurs. Disturbance of wetland habitat as the pipeline is an	Wetlands	Minor (Negative)	Minor (Negative)

Activity	**Potential Impact**	**Aspects Affected**	**Significance**	**Significance**
	industrial negative impact to wetland integrity is anticipated			
Employment and procurement during the operational phase of the WRTRP	Local employment and procurement of goods specific to the operational phase of the WRTRP.	Socio-economic	Minor (Positive)	Moderate (Positive)
Production of gold and uranium	Export of uranium and gold will contribute to South Africa's export earnings and allows the country to earn foreign exchange.	Socio-economic	Moderate (Positive)	N/A
Decommissioning Phase				
Removal of historical TSFs through hydraulic reclamation activities	Impact on groundwater contamination due to re-mining of historical TSFs	Groundwater	Moderate (Positive)	Moderate (Positive)
Removal of pipelines	The removal of the pipeline route will cause a loss of topsoil as a resource as a result of compaction and erosion.	Soil	Minor (Negative)	Negligible (Negative)
Reclamation of the historical TSFs	The removal of the tailings and the reclamation of the land use and land capability	Soil	Moderate (Negative)	Moderate (Positive)
Removal of infrastructure	Water and habitat quality modification	Aquatics	Moderate (Negative)	Negligible (Negative)
Removal of TSF material	Water and habitat quality modification	Aquatics	Moderate (Positive)	N/A
Rehabilitation of	Restoration of	Fauna and	Low (Positive)	N/A

Activity	Potential Impact	Aspects Affected	Significance	Significance
infrastructure footprint areas	vegetation and habitat types.	Flora		
Rehabilitation of infrastructure footprint areas	Rehabilitation of infrastructure footprint areas	Fauna and Flora	Moderate (Positive)	N/A
Decommissioning of the mined Cooke and Cooke 4 South TSF footprints.	This may have a positive impact on the surrounding wetlands if rehabilitation occurs as this is removing a current highly significant negative impact to the wetlands. If rehabilitation of the footprint is not done, a negative impact will be realised.	Wetlands	Moderate (Negative)	Moderate (Positive)
Decommissioning of the WRTRP operations	Retrenchments of mine employees will take place as operations close. The local economy will likely be dependent on the WRTRP to an extent which will be impacted once operations cease.	Socio-economic	Moderate (Positive)	Moderate (Positive)
Post-closure Phase				
Rehabilitation of footprint area	Improvement in catchment yield	Surface Water	Moderate (Positive)	Moderate (Positive)

14.2 Item 3(k)(ii): Final Site Map

The infrastructure layout plan for the Cooke Mining Right Area is illustrated in Plan 20 and in Appendix A of this report. A composite Plan is provided in Plan 21 and in Appendix A of this report.

Plan 20: Cooke Mining Right Infrastructure

Plan 21: Composite Plan

14.3 Item 3(k)(iii): Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

The predominant negative impacts associated with the Cooke Mining Right area are due to the site clearing for the construction of the pipeline servitude from Cooke TSF to the CPP via the Ezulwini mining Right area. The construction of the reclamation infrastructure and pipeline servitudes will potentially result in an impact on the soil and surface water resources. An increase in surface water sedimentation is anticipated during the construction phase. Increased sedimentation is as a result of increased runoff from the cleared and stripped areas which are high in suspended solids. An increase in surface runoff and potentially contaminated water is also anticipated. Minor (negative) groundwater impacts are anticipated as a result of the reclamation of the historical TSFs. Reclamation activities also increase the AMD potential due to the exposure of the sulfur rich tailings to water and oxygen. Measures to mitigate and manage the abovementioned impacts have been recommended in Section 10 of this report.

The positive impacts associated with the project are predominantly occurring as part of the remaining Mining Right areas, Driefontein, Ezulwini and Kloof, as the historical TSFs will be reclaimed and removed from the landscape. This will result in the removal of permanent pollution sources from the environment, as well as resulting in the availability of occupied land. Decommissioning of the project will have a direct negative impact through the retrenchment of the mine workforce, as well as a cumulative impact on the local economy due to its dependency on mining.

15 Item 3(l): Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored.

The EMP will address the environmental impacts during the construction, operational, decommissioning and post-closure phases of the project. Due regard must be given to environmental protection during the entire project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the contractor maintains adequate control over the project to:

- Minimise the extent of an impact during the life of the project;
- Ensure appropriate restoration of areas affected by the project; and
- Prevent long term environmental degradation.

The specific impact management objectives and outcomes for the WRTRP include the following:

- Maintain and minimise impacts to the ecosystems within the WRTRP area;

- Provide suitable end land capability and land use following the reclamation of the historical TSFs;
- Provide suitable vegetation establishment on the RTSF to prevent long term impacts;
- Implement concurrent rehabilitation measures where possible;
- Reduce dust contamination and generation of dust from historical TSFs;
- Prevent soil, surface water and groundwater contamination;
- Comply with local and national regulatory requirements; and
- Maintain and monitor operational and rehabilitated areas for impact identification.

16 Item 3(m): Final proposed alternatives

The infrastructure layout plan for the Cooke Mining Right area as illustrated in Plan 20 is the final layout proposed for the purposes of the project. The preferred alternatives as seen on this plan have been considered based on environmental and technical studies. Sensitive areas such as wetland areas and pans could not be avoided, which resulted in pipelines being constructed over such sensitive landscapes. The alternatives considered were described in detail in Section 8.1 of this document. Mitigation and management measures have been provided however where impacts could not be avoided. It is also important to note that another major determining factor in the alternatives considered was owed to the already existing infrastructure and servitudes, prompting new infrastructure to be constructed within proximity for economic feasibility purposes.

17 Item 3(n): Aspects for inclusion as conditions of authorisation

It is not foreseen that any additional aspects other that what has been included and discussed in this document, are required.

18 Item 3(o): Description of any assumptions, uncertainties and gaps in knowledge

The assumptions, uncertainties and knowledge gaps specific to each of the specialist studies conducted are included in the sections which follow.

18.1 Air Quality Impact Assessment

The following assumptions and limitations were identified:

- Modelled data will be used if site-specific meteorological data is not available for the impact assessment study of the Project area;
- Data input into the model will be based on all documentation provided by the Client;
- Stack parameters and some emission factors were adopted from previous reports as the exact specifications of onsite stack were not available; and

- Emissions from the CPP may have been under estimated due to the limited data available for proper assessment.

18.2 Noise Impact Assessment

The following assumptions and limitations are included as part of this assessment:

- The construction phase is assumed to be carried out during daytime hours (06:00-22:00), therefore only daytime scenarios were modelled for the construction phase.
- The resulting noise contours represent worst case (unmitigated), LAeq at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the model due to the number of surrounding receptors. Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions.

18.3 Soils Impact Assessment

The following assumptions were made:

- That the pipelines will be constructed above ground;
- The Pipelines and associated infrastructure have been assessed at a desktop level using existing studies of the area; and
- The historical TSF sites will be completely reclaimed and their footprints rehabilitated.

The limitations identified for this project include:

- Although the geotechnical test pit holes were used in conjunction with the soil auger holes, the two specialities essentially classify the upper soils differently; and
- A field survey was conducted on the RTSF site only and the land type data was used for the pipeline routes.

18.4 Surface Water Impact Assessment

The assumptions and limitations applicable to the Surface Water Impact Assessment include:

- No flow measuring equipment was installed on site. All flow data was obtained from existing DWS flow gauging stations; and
- Additional water quality data provided by the client was also used in the baseline water quality description.

18.5 Aquatics Impact Assessment

The baseline assessment is based predominantly on desktop information with two surveys completed for the Wonderfonteinspruit and a single survey on the Leeuspruit and Kleinwes Rietspruit. Sufficient data is available for the Loopspruit, negating the need for a field survey.

18.6 Fauna and Flora Impact Assessment

A conservative assumption was made that all new pipelines will be above ground and within new servitudes. Furthermore, it was assumed that the pipeline servitudes will be 20m wide. The vegetation or habitat types that will be disturbed due to the pipelines, and calculations on areas of disturbance, was based on these assumptions.

Avifaunal activity is reduced due to the lack of the summer migrants that generally start arriving in South Africa in October and early November. This also coincides with the breeding of most of the Southern African species.

The faunal sampling assessment was intended to document any faunal activity or evidence thereof on site. It is likely that some cryptic, nocturnal or migrant species may not have been recorded during the faunal survey.

Whilst every effort to document all plant species was made, it is possible that the emerging period (including flowering or seed-bearing phases of plant life-cycles) of some plants may not have coincided with the time of sampling. In this case, the absence of these plants from the species list does not imply that they do not occur on site at all.

18.7 Wetlands Impact Assessment

The assumptions and limitations associated with the Wetlands Impact Assessment include:

- Only areas that coincide directly with infrastructure and development were assessed. Given the linear nature of this project, as well as the large extent of the area, only wetlands within a 500 m study area from the infrastructure areas (250 m either side) were studied in detail; this included the pipelines, powerlines, historical TSFs and the footprints of the CPP and RTSF complex;
- It is important to note that not all wetland floral indicators or important species may have been identified as the sampling methodology aims to be representative of the project site and does not cover the entire surface area; and
- Whilst every effort was made to record all plant species, it is possible that the flowering period or seed-bearing phases of plant life-cycles of some plants may not have coincided with the time of sampling.

18.8 Social Impact Assessment

The assessment of potential socio-economic impacts expected to arise as a result of a proposed project is challenging for a number of reasons. Potential social impacts and the elements that combine to determine the socio-economic status of affected populations are generally multi-dimensional and interrelated.

For example, insufficient access to services such as water, sanitation and healthcare is both a cause and an effect of poverty. Hence, if a project increases the availability of services in an area, the ability of surrounding communities to take advantage of these services may, to some extent, depend on their current socio-economic status. In addition, the linkages between various potential project impacts are complex and can be mutually reinforcing and, lastly, many social impacts cascade. Although it is necessary to keep the complexity of social impacts in mind, it is also necessary to produce a Social Impact Assessment that will be accessible to a non-specialist audience and meet the requirements of the project.

19 Item 3(p): Reasoned opinion as to whether the proposed activity should or should not be authorised

19.1 Item 3(p)(i): Reasons why the activity should be authorised or not

It is Digby Wells' opinion that the proposed activity should be authorised. The Cooke Mining Right activities in isolation require authorisation, in conjunction with the activities associated with the remainder of the Mining Right areas to incorporate into the Ultimate WRTRP. Should one application or activity not be authorised, the entire WRTRP would be compromised and the significant positive impacts associated with the project will not be realised.

The WRTRP will bring significant socio-economic contributions to the West Rand; the West Rand economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year, with the Westonaria LM unemployment was recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%. The capital investment and contributions to the GDP associated with the WRTRP, along with the potential multiplier effects, are considered as significant and the life of the operation (50 years) will ensure a sustained economic contribution to the local and national economy.

The development and presence of the RTSF will result in a contamination plume that will impact on groundwater quality. The RTSF will be approximately 13 km^2 is size and, should no mitigation be implemented, the resultant contamination plume will impact an area of approximately 36 km^2 100 years after closure. The implementation of a liner beneath the RTSF will not result in a contamination plume exceeding the SANS 241:2011 Drinking Water Standards for sulfate and manganese after 50 years of operation, with the contamination plume 100 years after closure being restricted to the RTSF footprint. However, the implementation of a liner will result in the WRTRP becoming unfeasible; all of the positive impacts associated with the project will not be realised. SGL has proposed to implement a blast curtain which will restrict the contamination plume to an area of approximately 16 km^2 which is 1.9 km^2 greater than the RTSF. Although the liner is preferred from a groundwater perspective, the implementation of blast curtains will ensure the project is feasible and the larger positive impacts associated with the WRTRP are realised.

The proposed negative environmental impacts associated with the project have been considered in relation to the positive environmental impacts associated with the reclamation of historical TSFs, the treatment of mine affected water at the AWTF and the abovementioned significant socio-economic benefits. It is Digby Wells' opinion that the project be authorised as it will have a significant, long term positive impact on the region, with the potential negative impacts associated with the project being mitigated and managed accordingly. It is also recommended that the blast curtains are utilised should the implementation of a liner result in the project becoming unfeasible.

19.2 Item 3(p)(ii): Conditions that must be included in the authorisation

19.2.1 Specific conditions to be included into the compilation and approval of EMPR

The following specific conditions are proposed to be included in the authorisation:

- All mitigation measures provided in this report must be implemented;
  - The treatment of mine affected water at the AWTF must continue beyond the operational phase;
  - Environmental monitoring must take place as recommended;
  - Chance Find Procedures must be developed for the construction phase in the event of accidental exposure of unidentified heritage resources;
  - A performance assessment will be undertaken every two years by a suitably qualified person; and
- The closure cost assessment must be updated and submitted to the DMR as per the legislative requirements (annually).

19.2.2 Rehabilitation requirements

A Rehabilitation Plan (Appendix Q) has been compiled for the WRTRP, as required and detailed in the MPRDA. A Rehabilitation Plan is an important planning tool designed to assist in preventing, minimising or mitigating adverse long-term environmental and social impacts caused by the proposed project, as well as to create a self-sustaining ecosystem and to ensure the optimal management of rehabilitation issues that may arise. The overall rehabilitation objectives, and requirements, for the WRTRP are as follows:

- Maintain and minimise impacts to the ecosystem within the study area;
- Provide practical rehabilitation measures for the rehabilitation of the Driefontein 3 and 5 TSFs, the Cooke TSF, Ezulwini South and the RTSF;
- Identification of suitable end post reclamation land capability and land use and potential identification of what the future land use could be for these areas;
- Provide suitable vegetation establishment techniques that can be adopted for the two dumps that will be reclaimed and for the RTSF;
- Implement progressive rehabilitation measures where possible;
- Reduction in dust contamination and generation of dust from historical TSFs through rehabilitation efforts and concurrent rehabilitation;
- Prevent soil, surface water and groundwater contamination by removing old tailings off dolomites and reducing the risk of sinkhole formation;
- Comply with the relevant local and national regulatory requirements; and

- Maintain and monitor the rehabilitated areas post reclamation and final capping of the RTSF.

20 Item 3(q): Period for which the environmental authorisation is required

To allow for the processing of all the dumps associated with the Ultimate WRTRP through the CPP and to promote the sustainability of the WRTRP, the environmental authorisation must be valid for a period of at least 30 years.

21 Item 3(r): Undertaking

It is confirmed that an undertaking is provided in Part B, Section 13 of the EMPr and is applicable to the EIA and EMPr sections of this report.

22 Item 3(s): Financial provision

Digby Wells' standard method for assessment of mine closure was used to calculate the closure liability for the Cooke Mining Right boundary. The calculated financial provision amounted to **R 26 459 349.74**. The detailed costs can be seen in Appendix R of this report.

Table 22-1: Summary of the Closure Liability Cost for the Cooke Mining Right Boundary

Cooke Mining Boundary						
Description		**Closure Cost After 5 years of Mining**		**Closure Cost After 10 years of Mining**		**Planned Closure Cost**
Cooke Dump	R	4 397 844.98	R	13 059 143.44	R	18 051 590.29
Linear Infrastructure	R	30 588.89	R	30 588.89	R	30 588.89
Total	**R**	**4 428 433.87**	**R**	**13 089 732.33**	**R**	**18 082 179.18**
Monitoring Costs (groundwater)	R	588 950.00	R	588 950.00	R	588 950.00
Monitoring Costs (vegetation)	R	15 840.00	R	47 820.00	R	73 170.00
Maintenance Costs (vegetation)	R	617 278.04	R	2 151 120.45	R	3 366 971.15
Radiation Clearance	R	370 000.00	R	370 000.00	R	370 000.00
Project Management (12%)	R	531 412.06	R	1 570 767.88	R	2 169 861.50
Contingency (10%)	R	442 843.39	R	1 308 973.23	R	1 808 217.92
GRAND TOTAL	**R**	**6 994 757.37**	**R**	**19 127 363.90**	**R**	**26 459 349.74**

22.1 Item 3(s)(i): Explain how the aforesaid amount was derived

The “*Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*” was used to assess SGL’s environmental liability. The DMR Guideline Document format makes use of a set template for which defined rates and multiplication factors are used.

The infrastructure areas and other areas affected by the mining activities were measured from plans provided by SGL. Measurements that were taken have been standardised to ensure that the costs calculated are easily updatable. The concrete and steel estimates associated with the plants are based on previous experience and assumptions.

The rates used were updated by quotes from demolition and civil contractors and professionals wherever possible. Rate formulation takes into consideration the total labour costs, plant costs, fuel costs and construction costs and provides an accurate, defendable rate.

The closure cost model was compiled in Microsoft Excel. The model consists of an input sheet, containing all measurements of each area of the infrastructure and activities, a standard rate sheet and a summary sheet which summarises the costs for closure. Each sheet is linked to the rate sheet, thereby, allowing the costs calculations to be updated easily from year to year.

22.2 Item 3(s)(ii): Confirm that this amount can be provided for from operating expenditure

SGL confirms that the amount detailed in Table 22-1 can be provided for from the operating expenditure of the WRTRP.

23 Item 3(t): Deviations from the approved scoping report and plan of study

23.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

There were no deviations from the methodology proposed in the Scoping Report and plan of study.

23.2 Item 3(t)(ii): Motivation for the deviation

No deviations were undertaken from the approved Scoping Report from the DMR.

24 Item 3(u): Other Information required by the competent authority

To ensure compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the NEMA, the EIA report must include the information provided in the following chapters.

24.1 Item 3(u)(i)(1): Impact on the socio-economic conditions of any directly affected person

The potential socio-economic impacts are detailed I Sections 10.1.12, 10.2.12 and 10.3.12 of this report. The predominant impacts on directly affected persons associated with this project include a large influx of people in the surrounding community seeking job opportunities presented by the proposed project. This ultimately results in increased pressure on local services, resources and facilities, establishment and growth of informal settlements, conflict amongst communities and an increase in social pathologies and communicable diseases. As a management measure, it is recommended that SGL liaise with the local municipalities to ensure that the expected population influx is taken into account for infrastructure development and planning. Further to this, it is important to clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities.

The Social Impact Assessment is included in Appendix O and it is hereby confirmed that the mitigation measures are provided in Section 10 of this report and Section 11 of the Social Impact Assessment report.

24.2 Item 3(u)(i)(2): Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

A Heritage Impact Assessment (HIA) was initially completed for the Cooke Mining Right area during the running of the Gold One' CUP. At this time, Gold One had intended to reclaim historical TSFs in Westonaria, Randfontein, Mogale City and Johnnesburg regions as detailed in introduction of this report. No direct impacts to heritage resources were identified during the HIA. Only two built structures, generally protected under section 34 of the NHRA, were identified in proximity to the proposed pipeline routing.

As this portion of the WRTRP was previously considered (Case ID 871), and final comment received, this portion of the WRTRP is **not considered further**.

Please see Section 10.1.11 above.

25 Item 3(v): Other matters required in terms of sections 24(4)(a) and (b) of the Act

This EIA report provides the competent authority with a detailed investigation of the activities to be undertaken a part of the project and their potential impacts. In addition, alternatives for the project have been discussed and assessed and no other matters are required in terms of Sections 24(4)(a) and (b) of the NEMA.

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Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

It is confirmed that the details of the EAP have been provided in Part A, Section 2.1 of this report.

2 Item 1(b): Description of the aspects of the activity

It is confirmed that the baseline environment that may be impacted by the activities is detailed and discussed in Part A, Section 9.1 of this report.

3 Item 1(c): Composite Map

A composite plan for the Cooke Mining Right area is illustrated in Plan 21 above, as well as in Appendix A.

4 Item 1(d): Description of Impact management objectives including management statements

4.1 Item 1(d)(i): Determination of closure objectives

Mine closure aims to achieve long-term site stability and the establishment of a self-sustaining ecosystem which supports the final end land use.The overall rehabilitation and closure objective for the WRTRP is to:

- Remove mining infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements must be made to ensure their long term sustainable use;
- Provide practical rehabilitation measures for rehabilitation of the Driefontein Dumps, the Cooke Dump, C4S and the RTSF;
- Any proposed post closure developments on old mining land will need to undergo extensive environmental and stability assessments before they can be permitted
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Clearing the footprint of all slimes and rehabilitating the area;
- Conducting a radiological field survey in order to control or stop any action of radon emitting material;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Follow a process of closure that is progressive and integrated into the mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;

- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements; and
- To maintain and monitor all rehabilitated areas following re-vegetation and, if monitoring shows that the objectives have been met, making an application for closure.

4.2 Item 1(d)(ii): The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

The Listed and specified activities, as detailed in Section 5.1 above, associated with the Cooke Mining Right area will result in ecological degradation, environmental damage and pollution. Potential impacts which have been identified in relation to the listed and specified activities have been assessed for each environmental aspect. In addition to this, mitigation and management measures have been recommended accordingly as detailed in Sections 10.1 to Section 10.4 of this report. The mitigation measures were recommended to reduce the significance of the impacts. Monitoring programmes have also been provided in Sections 9.2 and 9.5 to monitor the potential impacts which will allow alternative mitigation measures to be implemented if necessary.

The construction of the Cooke Thickener and the pipelines will result in various impacts such as the loss of topsoil, floral species/vegetation types, and biodiversity. Sedimentation could also potentially occur due to surface runoff accumulation. Additionally, the mixing of upstream clean water runoff with dirty water runoff from within infrastructure areas could potentially result in dirty water reporting to the downstream water catchment. The locations of all infrastructure placements were selected strategically, taking into consideration and avoiding ecological sensitivities such as wetlands and pans where possible. Managing environmental damage within the Cooke Mining Right area requires the establishment and implementation of Storm Water Management Plan outlining clear dirty water and clean water separation channels. It is important to limit degradation and destruction of natural environment ridges and grassland, to designated project areas by keeping the footprint of the disturbed areas to the minimum and within designated areas only. Further to this, re-vegetating open areas is to be done to limit erosion within the affected area.

4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

To determine the potential for AMD associated with the project, a comprehensive sampling and testing campaign was undertaken by SLR Consulting (2015) to characterise the physical and geochemical properties of the tailings from the historical TSFs. Three typical composite samples were made up on which detailed and specialised geotechnical laboratory test work was undertaken. The composite samples included:

- Typical fine tailings: it is estimated that 95% of all tailings within historical TSFs will be coarser than this grading;
- Typical mean tailings: it is estimated to be a representative average tailings grading; and
- Typical coarse tailings: it is estimated that 80% to 90% of all tailings will be finer than this grading.

AMD results from the exposure of sulfur-bearing material to water and oxygen. Once this occurs, the reaction forms metal-rich water which is usually acidic in nature and a high pollutant and contaminant to water resources. AMD is mainly associated with old mining areas, tailings facilities, and waste rock dumps. The Cooke TSF will be hydraulically reclaimed and the tailings transported to the CPP via the Ezulwini Mining Right area. The process of hydraulic reclamation could potentially result in AMD due to the sulfur content within the tailings and its exposure to water and the atmosphere. However, mitigation measures to minimise the risk and potential for AMD have been provided and include controlling the pH levels through various means. Controlling pH will significantly reduce the concentration of contaminants (Fe, U, Mn, Al, Zn, Cd, Co, Cr, Pb, Ni, and Se) in the drainage solutions.

4.4 Item 1(d)(iv): Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

SLR Consulting (2015) undertook and geochemical and geotechnical analysis of tailings samples from the historical TSFs associated with the WRTRP; the mineralogy and element content of the tailings composite samples were found to be similar. A small scale laboratory leach test was used to evaluate the effect of different metallurgical processes on the tailings leachability.

4.5 Item i(d)(v): Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

The Cooke and C4S TSFs will be hydraulically reclaimed as part of the Cooke Mining right. The AMD potential is heightened with the exposure of the tailings to oxygen and water. The resultant slurry will be collected into sumps and pumped into their respective thickeners (Cooke Thickener and the Ezulwini Thickener). Thereafter, the slurry will be pumped to the CPP for processing.

The processing of the reclaimed tailings to a sulfide mass concentration of less than 0.3% will significantly reduce the AMD potential of the residual tailings, as well as playing a positive role in reducing contaminant concentrations of other elements. Soregaroli and Lawrence (1998) showed that a sulfide-sulfur concentration of at least 0.3% is required for long term acid generation. In addition to the sulfide removal, a correlation to the concentration of other potential contaminants and the potential pH values were identified, such as concentrations of iron, uranium, manganese, aluminium, zinc lead and nickel among others. By controlling the pH of the residual tailings, the concentrations of potential contaminants can be reduced, as well as the potential of AMD generation. The following pH controls will be implemented and are expected to maintain the pH of the residual tailings between 6 and 9 in the long term (SLR Consulting, 2015):

- Sulfide removal and segregation through flotation to achieve a consistent mass concentration of 0.3%;
- Addition of lime to raise the pH of the process water going to the RTSF to around 10.5 initially;
- Construction of a concurrent cover to the RTSF side slopes to limit oxygen ingress and oxidation of any residual sulfide; and
- Control the rate of rise which maintains relatively low air permeability throughout the bulk of the volume of the RTSF.

Thus, the AMD potential of the historical TSFs will be remedied through the processing of the tailings material.

4.6 Item 1(d)(vi): Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

Short-term AMD could be generated due to the exposure of the tailings to water and air during the operational phase. This, however, is expected to be short lived and buffered by the dolomitic carbonates underneath. Groundwater monitoring programmes have been developed for the Cooke Mining Right area to manage these impacts. It is anticipated that the AMD potential will decrease after the operational phase since the tailings will not be exposed. Once the tailings have been reclaimed, the resultant slurry is pumped to the CPP where sulfur, gold and uranium will be abstracted. The residue is then pumped and deposited into the lined RTSF. The risk of AMD is regarded as negligible at this stage.

4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

Approximately 20 Mℓ of mine affected water will be abstracted from K10 shaft, with an additional 12 Mℓ of mine affected water abstracted from Cooke 1 shaft per day required for the reclamation activities. This will result in the requirement for 32 Mℓ of water required per day which is currently being discharged into the Wonderfonteinspruit and is considered to be significantly impacted upon. Following the reclamation activities, processing of the tailings and deposition of the residual tailings on the RTSF, the AWTF will treat runoff and seepage from the RTSF to potable standards prior to discharge, IWUL permitting, into the Leeuspruit. It is anticipated that approximately 15 Mℓ of potable treated water will be discharged per day.

4.8 Item 1(d)(viii): Has a water use licence has been applied for

An IWULA and IWWMP has been compiled and submitted to the DWS as the decision making authority. The water uses triggered under Section 21 of the NWA in relation to the proposed project are listed below:

- S21(c) – Impeding or diverting the flow of water in a watercourse;
- S21 (g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- S21 (i) – Altering the bed, banks, course or characteristics of a watercourse; and
- S21 (j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

5 Item 1(d)(ix): Impacts to be mitigated in their respective phases

The proposed mitigation measures and its compliance with the relevant standards are presented in Table 5-1 below.

Table 5-1: Impacts to be Mitigated

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Construction Phase						
Site clearing for construction of infrastructure	Air Quality	Construction Phase	Local	■ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ■ Limit activity to non-windy days; ■ The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur; ■ Drop heights when loaders and offloading material should be minimised; and ■ Vehicle travel speed and distances should be minimised.	■ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ■ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).	Measurement must commence prior to start of operation and for the project life.
Site clearance for the construction of the pipelines and other surface infrastructure ;	Noise	Construction Phase	Local	■ Limit construction activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the Gauteng Noise Control Regulations	During Construction Phase
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	soil	Construction Phase	Length of the pipeline route	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as	■ Chamber of Mines – Guidelines for the rehabilitation of mined land	Throughout all phases

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				defined in rehabilitation report.		
Site clearing and grubbing	Surface Water	Construction	Local	■ Construct temporary ditches and a temporary storage area along downstream boundary of cleared areas to capture sediments. Water within temporary storage area can be used for construction and should be operated empty. ■ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event. ■ It is recommended that the containment facility be operated empty such that water captured within these facilities are used within the mine operations between a period of 10 days, so as to ensure that capacity is always available to store the mentioned 1:50 year storm volume.	■ Based on the Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. ■ The clean water diversion will be sized to accommodate the 1:50 year storm event. ■ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.	During the construction period all water storage and conveyance structures should be sized accurately.
Construction of infrastructures	Surface Water	Construction	Local	■ The pipeline routes which intersect various drainage paths/rivers need to be assessed such that the elevation of the pipe at the crossings is located above the 1:100 year modelled flood elevation.	■ Based on Reg 704, the mine infrastructure in question should fall outside of the 1:100 year floodline or 100 m away, whichever is greater.	During the construction period all water storage and conveyance structures should be sized accurately.
Site clearing for infrastructure placement	Aquatics	Construction Phase	Local	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with Construction sequencing. ■ Diversion trenches and berms should convey	■ National Water Act (Act No. 36 of 1998)	During the construction phase

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				dirty water to temporary ditches so as to contain runoff.		
Construction of infrastructure	Aquatics	Construction Phase	Local	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Construction sequencing is proposed. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ■ Unobtrusive infrastructure design over river systems. ■ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ■ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ■ Soils adjacent the river that has been compacted must be loosened to allow for germination. ■ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ■ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	■ National Water Act (Act No. 36 of 1998)	Construction Phase
Construction of the pipeline within grassland habitat type	Fauna and Flora	Pre-construction and construction phases	Local	■ Red Data Status plants located in areas of development should be marked prior to construction and the necessary permits for relocations of protected species must be obtained from the relevant government department. The relocation strategy must be	■ South African National Biodiversity Institute (SANBI) Red List of South African plants version 2012.1 ■ National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species;	Continually, specifically during the construction phase

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				approved by relevant authorities prior to relocation to a safe place to avoid destruction. A nursery should be developed on site for this purpose ■ Illegal waste dumping should be prohibited ■ Training should be given to onsite staff on which plants have Red Data Status and how to identify them ■ Destruction of vegetation should be limited to the areas essential for the development ■ All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly ■ Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats ■ Rehabilitation of disturbed areas should take place as soon as possible	■ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ■ Gauteng Protected Plants.	
Operational Phase						
Reclamation of the Cooke and C4S TSFs	Air Quality	Operational Phase	Local and immediate surroundings	■ Vehicle travel speed and distances should be minimised when transporting personnel on and off site on dirt roads; ■ Vegetation removal must be limited to the section to be reclaimed.	■ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); and ■ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005.	Prior to the commencement of the activity and for the duration of the project life
Reclamation activities; Processing activities; and Pumping activities	Noise	Operational Phase	Local	■ Pump stations to be housed in noise attenuating enclosures; ■ Regular service maintenance on pipelines as well as maintaining a constant flow rate during pumping of water and slurry to mitigate water hammer noise	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the Gauteng Noise Control Regulations	During Operational Phase
Seepage from TSF	Groundwater	Operational Phase	Local to immediate	■ Application of the blast curtain to contain contamination plume	■ The mitigation of contamination plume is in line with the National Water Act (Act No. 36	The blast curtain needs to be developed during the

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			surroundings		of 1998)	construction phase
Reclamation activities	Groundwater	Operational Phase	Local	▪ Monitoring of groundwater quality and water levels	▪ National Water Act (Act No. 36 of 1998)	During the operation phase
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Soils	Operational Phase	Pipeline route	▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ▪ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ▪ Only the designated access routes are to be used to reduce any unnecessary compaction; ▪ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ▪ Implement Land rehabilitation measures as defined in rehabilitation report.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land	Throughout all phases
Operation of sumps and pumps	Surface Water	Operational Phase	Local	▪ The pumps located at each of the sumps should be installed within closed off areas to contain material spillages. During power failure, manual monitoring of the sump associated with the pump station should be carried out.	▪ Emergency procedures need to be in place and comply with DWA BPG G1.	During the operational Phase
Reclamation activities	Aquatics	Operational Phase	Local	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used. ▪ Groundwater management according to the	▪ National Water Act (Act No. 36 of 1998)	During the operational phase

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				ground water study (Digby Wells, 2015).		
Unplanned spills from the pipelines	Wetlands	Operational Phase	Local	■ Monitoring of the pipeline and its flows must be a continuous mitigation effort to identify a leak or burst or to identify a burst as soon as possible. ■ Should it occur valves need to be shut down to minimise spillage of hazardous material. Investigation into the impact to the Leeuspruit must be undertaken if necessary and remediation actions must take place.	■ National Water Act (NWA, Act 36 of 1998) ■ Section 21 of the Environment Conservation Act, 1989 ■ Section 5 of the National Environmental Management Act (Act 108 of 1998)	During the operational and Decommissioning Phases
Decommissioning Phase						
Removal of surface infrastructure such as pipelines and pump stations	Air Quality	Decommissioning Phase	Local and immediate surroundings	■ The area of disturbance must be kept to a minimum; ■ Drop heights when loaders off load rubble should be minimised; ■ Vehicle travel speed and distances should be minimised.	■ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ■ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).	Measurement must commence prior to the decommissioning operation and few month after it ends.
Rehabilitation of old footprint will result in dust generation	Air Quality	Decommissioning Phase	Local and immediate surroundings	■ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ■ The area of disturbance must be kept to a minimum; ■ Drop heights when loaders rubbles and offloading rehabilitation materials should be minimised; ■ Vehicle travel speed and distances should be minimised.	■ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ■ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).	Measurement must commence prior to the decommissioning operation and few month after it ends.
Dismantling and removal of surface infrastructure including pipelines; and Rehabilitation of TSF footprints	Noise	Decommissioning Phase	Local	■ Limit decommissioning activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the Gauteng Noise Control Regulations	During decommissioning phase

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Reclamation of historical TSFs	Groundwater	Decommissioning Phase	Local	■ Monitoring of groundwater quality and water levels	■ National Water Act (Act No. 36 of 1998)	During the decommissioning phase
Reclamation of Cooke TSF, and Cooke 4 South TSF – the land capability and land use	Soils	Decommissioning Phase	Local and immediate surroundings	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.	■ Chamber of Mines – Guidelines for the rehabilitation of mined land	Decommissioning and rehabilitation phases
Dismantling infrastructure	Surface Water	Decommissioning Phase	Local	■ To manage the impact of spillages unto the downstream watercourse the following targets are required. ■ Ensure that the infrastructure is first emptied of all residual material before decommissioning. This can be input of the standard operation procedures at each of the dumps to ensure it's carried out.	■ GN 704 Condition 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.	During the decommissioning phase
Removal of infrastructure	Aquatics	Decommissioning Phase	Local	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Construction sequencing is proposed. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ■ Unobtrusive infrastructure design over river systems. ■ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation;	■ National Water Act (Act No. 36 of 1998)	Decommissioning Phase

Activities	Aspects	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ▪ Soils adjacent the river that has been compacted must be loosened to allow for germination. ▪ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive.		
Post-closure Phase						
Post closure rehabilitation	Surface Water	Post-closure Phase	Local	▪ Potential impacts from the mine should have been identified and be covered in the closure plan and the closure financial provisions. If post closure impacts are identified, methods of withholding and treating the water should be further investigated depending on parameters of concern.	▪ GN 704 Condition 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these regulations.	During the decommissioning phase

6 Item 1(e): Impact management outcomes

A description of the objectives and outcomes of the EMP is outlined in Table 6-1, taking into account the impact and mitigation type.

Table 6-1: Impact Management Outcomes

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Construction Phase					
Site clearing for construction of infrastructure	Poor air quality due to site clearing and wind erosion	Air Quality	Construction Phase	■ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ■ Limit activity to non-windy days; ■ The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur; ■ Drop heights when loaders and offloading material should be minimised; and ■ Vehicle travel speed and distances should be minimised.	South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) National Dust Control Regulations (2013).
Site clearance for the construction of the pipelines and other surface infrastructure ;	Impact on ambient noise at surrounding noise sensitive receptors	Noise	Construction Phase	■ Limit construction activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	To comply with Gauteng Noise Control Regulations
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Loss of topsoil as a resource – Compaction and Erosion	soil	Construction Phase	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Site clearing and grubbing	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing and grubbing occur.	Surface Water	Construction Phase	■ Construct temporary ditches and a temporary storage area along downstream boundary of cleared areas to capture sediments. Water within temporary storage area can be used for construction and should be operated empty. ■ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff	

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
				emanating from these areas are captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event. ■ It is recommended that the containment facility be operated empty such that water captured within these facilities are used within the mine operations between a period of 10 days, so as to ensure that capacity is always available to store the mentioned 1:50 year storm volume.	
Construction of infrastructures	Increase in sedimentation of surface water during construction caused by an increase in runoff from the cleared and stripped areas which is high in suspended solids.	Surface Water	Construction Phase	■ The pipeline routes which intersect various drainage paths/rivers need to be assessed such that the elevation of the pipe at the crossings is located above the 1:100 year modelled flood elevation.	
Site clearing for infrastructure placement	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.	Aquatics	Construction Phase	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with Construction sequencing. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.	Maintain PES
Construction of infrastructure	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased	Aquatics	Construction Phase	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Construction sequencing is proposed. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ■ Unobtrusive infrastructure design over river systems.	Maintain PES

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.			▪ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ▪ Soils adjacent the river that has been compacted must be loosened to allow for germination. ▪ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	
Construction of the pipeline within grassland habitat type	Removal of vegetation and habitat	Fauna and Flora	Construction Phase	▪ Red Data Status plants located in areas of development should be marked prior to construction and the necessary permits for relocations of protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities prior to relocation to a safe place to avoid destruction. A nursery should be developed on site for this purpose ▪ Illegal waste dumping should be prohibited ▪ Training should be given to onsite staff on which plants have Red Data Status and how to identify them ▪ Destruction of vegetation should be limited to the areas essential for the development ▪ All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly ▪ Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats ▪ Rehabilitation of disturbed areas should take place as soon as possible	
Construction of the pipeline within grassland habitat type	Introduction of alien invasive species	Fauna and Flora	Construction Phase	▪ Review of the monitoring programme to determine the spread of invasive species and if this has occurred, to action the removal and eradication ▪ All alien invasive species within the project area should be eradicated and their reintroduction controlled	Alien and Invasive Species Lists, 2014 (GN R599 in GG 37886 of 1 August 2014) of the NEMBA (Act 10 of 2004).

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Operational Phase					
Reclamation of the Cooke and C4S TSFs	Reduced air quality due to stack emissions	Air Quality	Operational Phase	■ Vehicle travel speed and distances should be minimised when transporting personnel on and off site on dirt roads; ■ Vegetation removal must be limited to the section to be reclaimed.	■ South African National Environmental Management: Air Quality Act, Act.39 of 2004, 2004. ■ National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013 ■ National Atmospheric Emissions Reporting Regulation, 2015
Reclamation activities; Processing activities; and Pumping activities	Impact on ambient noise at surrounding noise sensitive receptors	Noise	Operational Phase	■ Pump stations to be housed in noise attenuating enclosures; ■ Regular service maintenance on pipelines as well as maintaining a constant flow rate during pumping of water and slurry to mitigate water hammer noise	To comply with Gauteng Noise Control Regulations
Seepage from TSF	Contamination plume in the groundwater	Groundwater	Operational Phase	■ Application of the blast curtain to contain contamination plume	National Water Act (Act No. 36 of 1998), NEMWA
Reclamation activities	Positive impact since the source of contamination is getting rid of	Groundwater	Operational Phase	■ Monitoring of groundwater quality and water levels	National Water Act (Act No. 36 of 1998), NEMWA
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Loss of topsoil as a resource – Compaction and Erosion	Soils	Operational Phase	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	Chamber of Mines – Guidelines for the rehabilitation of mined land

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Operation of sumps and pumps		Surface Water	Operational Phase	■ The pumps located at each of the sumps should be installed within closed off areas to contain material spillages. During power failure, manual monitoring of the sump associated with the pump station should be carried out.	
Reclamation activities	Potential persistent pollutant contamination with increased suspended and dissolved solids resulting in water and habitat quality modification and subsequent loss of sensitive aquatic biota and a reduction in overall aquatic biodiversity.	Aquatics	Operational Phase	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used. ■ Groundwater management according to the ground water study (Digby Wells, 2015).	
Unplanned spills from the pipelines	This will result in significant contamination of the wetland ecosystem as these are sensitive receptors to water quality impacts.	Wetlands	Operational Phase	■ Monitoring of the pipeline and its flows must be a continuous mitigation effort to identify a leak or burst or to identify a burst as soon as possible. ■ Should it occur valves need to be shut down to minimise spillage of hazardous material. Investigation into the impact to the Leeuspruit must be undertaken if necessary and remediation actions must take place.	
Decommissioning Phase					
Removal of surface infrastructure such as pipelines and pump stations	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	Decommissioning Phase	■ The area of disturbance must be kept to a minimum; ■ Drop heights when loaders off load rubble should be minimised; ■ Vehicle travel speed and distances should be minimised.	■ South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013). ■ National Environmental Management: Air Quality Act (Act.39 of 2004) – Listed Activities and Associated Minimum Emission Standard, 2013.
Rehabilitation of old footprint will result in dust generation	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	Decommissioning Phase	■ Application of wetting agents or dust suppressant on the dirt road and exposed areas;	South African National Environmental Management: Air Quality Act, 2004 (Act No. 39 of

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
				■ The area of disturbance must be kept to a minimum; ■ Drop heights when loaders rubbles and offloading rehabilitation materials should be minimised; ■ Vehicle travel speed and distances should be minimised.	2004), National Dust Control Regulations (2013).
Dismantling and removal of surface infrastructure including pipelines; and Rehabilitation of TSF footprints	Impact on ambient noise at surrounding noise sensitive receptors	Noise	Decommissioning Phase	■ Limit decommissioning activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	To comply with Gauteng Noise Control Regulations
Reclamation of historical TSFs	Positive impact since the source of the contamination plume is being removed	Groundwater	Decommissioning Phase	■ Monitoring of groundwater quality and water levels	National Water Act (Act No. 36 of 1998), NEMWA
Reclamation of Cooke TSF, and Cooke 4 South TSF – the land capability and land use	Land Capability and Land Use	Soils	Decommissioning Phase	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Dismantling infrastructure		Surface Water	Decommissioning Phase	■ To manage the impact of spillages unto the downstream watercourse the following targets are required. ■ Ensure that the infrastructure is first emptied of all residual material before decommissioning. This can be input of the standard operation procedures at each of the dumps to ensure it's carried out.	National Water Act (Act No. 36 of 1998)
Removal of infrastructure	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased	Aquatics	Decommissioning Phase	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Construction sequencing is proposed. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.	The mitigation aims to comply with the National Water Act (Act No. 36 of 1998)

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.			■ Unobtrusive infrastructure design over river systems. ■ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ■ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ■ Soils adjacent the river that has been compacted must be loosened to allow for germination. ■ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ■ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	
Decommissioning of Infrastructure		Fauna and flora	Decommissioning Phase	■ Ensure areas are rehabilitated with correct grass seed mix. ■ Ensure areas that are to be rehabilitated are prepared beforehand, this includes correct slopes, correct soil placement, correct machinery is available for the task. ■ (Please refer to Digby Wells Rehabilitation report 2015)	Please refer to Digby Wells Rehabilitation report 2015

7 Item 1(f): Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs 4 and 0 will be achieved, is provided in Table 7-1.

Table 7-1: Impact Management Objectives

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
Construction Phase					
Site clearing for construction of infrastructure	Poor air quality due to site clearing and wind erosion	Air Quality	■ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ■ Limit activity to non-windy days; ■ The area of disturbance must be kept to a minimum and no unnecessary clearing of vegetation must occur; ■ Drop heights when loaders and offloading material should be minimised; and ■ Vehicle travel speed and distances should be minimised.	Measurement must commence prior to start of operation and for the project life.	■ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ■ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) - National Dust Control Regulations (2013).
Site clearance for the construction of the pipelines and other surface infrastructure ;	Impact on ambient noise at surrounding noise sensitive receptors	Noise	■ Limit construction activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	During Construction Phase	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the Gauteng Noise Control Regulations
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Loss of topsoil as a resource – Compaction and Erosion	soil	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	Throughout all phases	■ Chamber of Mines – Guidelines for the rehabilitation of mined land

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
Site clearing and grubbing	Increase of surface runoff and potentially contaminated water that needs to be maintained in the areas where site clearing and grubbing occur.	Surface Water	■ Construct temporary ditches and a temporary storage area along downstream boundary of cleared areas to capture sediments. Water within temporary storage area can be used for construction and should be operated empty. ■ All dirty water channels must be constructed and placed within the dirty water infrastructure areas, such that all dirty water runoff emanating from these areas are captured and contained to a dirty water containment facility. The proposed channels should be lined and sized to cater for the 1:50 year storm event. ■ It is recommended that the containment facility be operated empty such that water captured within these facilities are used within the mine operations between a period of 10 days, so as to ensure that capacity is always available to store the mentioned 1:50 year storm volume.	During the construction period all water storage and conveyance structures should be sized accurately.	■ Based on the Reg 704 requirements regarding storm water management for mining activities it is noted that all clean and dirty water must be separated. ■ The clean water diversion will be sized to accommodate the 1:50 year storm event. ■ The containment facility should be sized to accommodate the anticipated dirty water runoff as a result of the 1:50 year storm event.
Construction of infrastructures	Increase in sedimentation of surface water during construction caused by an increase in runoff from the cleared and stripped areas which is high in suspended solids.	Surface Water	■ The pipeline routes which intersect various drainage paths/rivers need to be assessed such that the elevation of the pipe at the crossings is located above the 1:100 year modelled flood elevation.	During the construction period all water storage and conveyance structures should be sized accurately.	■ Based on Reg 704, the mine infrastructure in question should fall outside of the 1:100 year floodline or 100 m away, whichever is greater.
Site clearing for infrastructure placement	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification.	Aquatics	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary with Construction sequencing. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.	During the construction phase	■ National Water Act (Act No. 36 of 1998)

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
	Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.				
Construction of infrastructure	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions.	Aquatics	■ Establish riparian buffer up to 500m (minimum 100m). ■ Silt traps placed within clean water return channels. ■ Re-vegetation of construction footprint and unpaved roads as soon as possible. ■ Construction sequencing is proposed. ■ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ■ Unobtrusive infrastructure design over river systems. ■ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ■ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ■ Soils adjacent the river that has been compacted must be loosened to allow for germination. ■ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ■ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	Construction Phase	■ National Water Act (Act No. 36 of 1998)

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
	These physical impacts could lead to reduced aquatic biodiversity.				
Construction of the pipeline within grassland habitat type	Removal of vegetation and habitat	Fauna and Flora	■ Red Data Status plants located in areas of development should be marked prior to construction and the necessary permits for relocations of protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities prior to relocation to a safe place to avoid destruction. A nursery should be developed on site for this purpose ■ Illegal waste dumping should be prohibited ■ Training should be given to onsite staff on which plants have Red Data Status and how to identify them ■ Destruction of vegetation should be limited to the areas essential for the development ■ All bare patches of soil should be vegetated, preferably with pioneer species which will colonise open and disturbed areas relatively quickly ■ Community awareness should be implemented as part of the stakeholder engagement procedure to create awareness of biodiversity and preservation of natural habitats ■ Rehabilitation of disturbed areas should take place as soon as possible	Continually, specifically during the construction phase	■ South African National Biodiversity Institute (SANBI) Red List of South African plants version 2012.1 ■ National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species; ■ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ■ Gauteng Protected Plants.
Operational Phase					
Reclamation of the Cooke and C4S TSFs	Reduced air quality due to stack emissions	Air Quality	■ Vehicle travel speed and distances should be minimised when transporting personnel on and off site on dirt roads; ■ Vegetation removal must be limited to the section to be reclaimed.	Prior to the commencement of the activity and for the duration of the project life	■ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); and ■ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005.
Reclamation activities; Processing	Impact on ambient noise at surrounding noise sensitive receptors	Noise	■ Pump stations to be housed in noise attenuating enclosures; ■ Regular service maintenance on pipelines as well as maintaining a constant flow rate during pumping of water and slurry to mitigate water hammer noise	During Operational Phase	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
activities; and Pumping activities					Gauteng Noise Control Regulations
Seepage from TSF	Contamination plume in the groundwater	Groundwater	■ Application of the blast curtain to contain contamination plume	The blast curtain needs to be developed during the construction phase	■ The mitigation of contamination plume is in line with the National Water Act (Act No. 36 of 1998)
Reclamation activities	Positive impact since the source of contamination is getting rid of	Groundwater	■ Monitoring of groundwater quality and water levels	During the operation phase	■ National Water Act (Act No. 36 of 1998)
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	Throughout all phases	■ Chamber of Mines – Guidelines for the rehabilitation of mined land
Operation of sumps and pumps	Overflow of sumps to the downstream surface water resources. Additionally, The failure of pumps may result in the slurry from sumps overflowing to the downstream environment.	Surface Water	■ The pumps located at each of the sumps should be installed within closed off areas to contain material spillages. During power failure, manual monitoring of the sump associated with the pump station should be carried out.	During the operational Phase	■ Emergency procedures need to be in place and comply with DWA BPG G1.
Reclamation activities	Potential persistent pollutant	Aquatics	■ Establish riparian buffer up to 500m (minimum 100m).	During the operational phase	■ National Water Act (Act

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
	contamination with increased suspended and dissolved solids resulting in water and habitat quality modification and subsequent loss of sensitive aquatic biota and a reduction in overall aquatic biodiversity.		▪ Silt traps placed within clean water return channels. ▪ Surface and storm water management should capture and store dirty water and divert clean water. Mitigation actions provided in the surface water report (Digby Wells, 2015) should be used. ▪ Groundwater management according to the ground water study (Digby Wells, 2015).		No. 36 of 1998)
Unplanned spills from the pipelines	This will result in significant contamination of the wetland ecosystem as these are sensitive receptors to water quality impacts.	Wetlands	▪ Monitoring of the pipeline and its flows must be a continuous mitigation effort to identify a leak or burst or to identify a burst as soon as possible. ▪ Should it occur valves need to be shut down to minimise spillage of hazardous material. Investigation into the impact to the Leeuspruit must be undertaken if necessary and remediation actions must take place.	During the operational and Decommissioning Phases	▪ National Water Act (NWA, Act 36 of 1998) ▪ Section 21 of the Environment Conservation Act, 1989 ▪ Section 5 of the National Environmental Management Act (Act 108 of 1998)
Decommissioning Phase					
Removal of surface infrastructure such as pipelines and pump stations	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loaders off load rubble should be minimised; ▪ Vehicle travel speed and distances should be minimised.	Measurement must commence prior to the decommissioning operation and few month after it ends.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ▪ National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).
Rehabilitation of old footprint will result in dust generation	Reduced air quality due to dust generation from rehabilitation and wind erosion	Air Quality	▪ Application of wetting agents or dust suppressant on the dirt road and exposed areas; ▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loaders rubbles and offloading rehabilitation materials should be	Measurement must commence prior to the decommissioning operation and few month after it ends.	▪ National Environmental Management: Air Quality Act, Act.39 of 2004, 2004; ▪ National Environmental Management: Air Quality

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
			minimised; ■ Vehicle travel speed and distances should be minimised.		Act, 2004 (Act No. 39 of 2004), National Dust Control Regulations (2013).
Dismantling and removal of surface infrastructure including pipelines; and Rehabilitation of TSF footprints	Impact on ambient noise at surrounding noise sensitive receptors	Noise	■ Limit decommissioning activities to daylight hours; ■ Switch of vehicles and machinery not in use; and ■ machine and vehicles must be serviced on a regular basis to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;	During decommissioning phase	■ Mitigation measures will assist in keeping noise levels as low as possible to comply with the Gauteng Noise Control Regulations
Reclamation of historical TSFs	Positive impact since the source of the contamination plume is being removed	Groundwater	■ Monitoring of groundwater quality and water levels	During the decommissioning phase	■ National Water Act (Act No. 36 of 1998)
Reclamation of Cooke TSF, and Cooke 4 South TSF – the land capability and land use	Land Capability and Land Use	Soils	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.	Decommissioning and rehabilitation phases	■ Chamber of Mines – Guidelines for the rehabilitation of mined land
Dismantling infrastructure	Water pollution could result from accidental spillages during decommissioning of infrastructures	Surface Water	■ To manage the impact of spillages unto the downstream watercourse the following targets are required. ■ Ensure that the infrastructure is first emptied of all residual material before decommissioning. This can be input of the standard operation procedures at each of the dumps to ensure it's carried out.	During the decommissioning phase	■ GN 704 Condition 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have been designed, modified, constructed and maintained so as to comply with these

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
					regulations.
Removal of infrastructure	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.	Aquatics	▪ Establish riparian buffer up to 500m (minimum 100m). ▪ Silt traps placed within clean water return channels. ▪ Re-vegetation of construction footprint and unpaved roads as soon as possible. ▪ Construction sequencing is proposed. ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff. ▪ Unobtrusive infrastructure design over river systems. ▪ The crossing points should be stabilised to reduce the resulting erosion and downstream sedimentation; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation. ▪ Soils adjacent the river that has been compacted must be loosened to allow for germination. ▪ Stockpiling of removed soil and sand must be done outside the 1:100 floodline or delineated riparian habitat (whichever is greater). This will prevent solids from washing into the river. ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive.	Measurement must commence prior to start of operation and for the project life.	▪ National Water Act (Act No. 36 of 1998)
Post-closure Phase					
Post closure rehabilitation	Improvement in catchment yield	Surface Water	▪ Potential impacts from the mine should have been identified and be covered in the closure plan and the closure financial provisions. If post closure impacts are identified, methods of withholding and treating the water should be further investigated depending on parameters of concern.	▪	▪ GN 704 Condition 9 describes the temporary or permanent cessation of mine or activity. At cessation of operations, the persons operating a mining activity should ensure that all pollution control measures have

Activities	Potential Impacts	Aspects	Mitigation Measures	Time period for implementation	Compliance with standards
					been designed, modified, constructed and maintained so as to comply with these regulations.

8 Financial provision

8.1 Item (i)(1): Determination of the amount of Financial Provision

8.1.1 Item (i)(1)(a): Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

Mine closure aims to achieve long-term site stability and the establishment of a self-sustaining ecosystem which supports the final end land use.The overall rehabilitation and closure objective for the WRTRP is to:

- Remove mining infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements must be made to ensure their long term sustainable use;
- Any proposed post closure developments on old mining land will need to undergo extensive environmental and stability assessments before they can be permitted;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Conducting a radiological field survey to control or stop any action of radon emitting material;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Follow a process of closure that is progressive and integrated into the mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements; and
- To maintain and monitor all rehabilitated areas following re-vegetation and, if monitoring shows that the objectives have been met, making an application for closure.

8.1.2 Item (i)(1)(b): Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

As part of the PPP, the closure objectives and Rehabilitation Plan have been made available for public review.

8.1.3 Item (i)(1)(c): Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

A Rehabilitation Plan has been compiled for the Cooke Mining Right area and the WRTRP and is provided in Appendix Q.

8.1.4 Item (i)(1)(d): Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which is to remove unwanted infrastructure and rehabilitate the land to a suitable post-mining land use which provides a safe and stable environment for surrounding receptors and faunal species.

8.1.5 Item (i)(1)(e): Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

The "*Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*" was used to assess SGL's environmental liability. The DMR Guideline Document format makes use of a set template for which defined rates and multiplication factors are used.

The infrastructure areas and other areas affected by the mining activities were measured from plans provided by SGL. Measurements that were taken have been standardised to ensure that the costs calculated are easily updatable. The concrete and steel estimates associated with the plants are based on previous experience and assumptions.

The rates used were updated by quotes from demolition and civil contractors and professionals wherever possible. Rate formulation takes into consideration the total labour costs, plant costs, fuel costs and construction costs and provides an accurate, defendable rate.

The closure cost model was compiled in Microsoft Excel. The model consists of an input sheet, containing all measurements of each area of the infrastructure and activities, a standard rate sheet and a summary sheet which summarises the costs for closure. Each sheet is linked to the rate sheet, thereby, allowing the costs calculations to be updated easily from year to year.

The calculated financial provision amounted to R 26 459 349.74 and is calculated in and summarised in Table 8-1 below.

Table 8-1: Summary of the Closure Liability Cost for the Cooke Mining Right Boundary

Cooke Mining Boundary						
Description	**Closure Cost After 5 years of Mining**		**Closure Cost After 10 years of Mining**		**Planned Closure Cost**	
Cooke Dump	R	4 397 844.98	R	13 059 143.44	R	18 051 590.29
Linear Infrastructure	R	30 588.89	R	30 588.89	R	30 588.89
Total	**R**	**4 428 433.87**	**R**	**13 089 732.33**	**R**	**18 082 179.18**
Monitoring Costs (groundwater)	R	588 950.00	R	588 950.00	R	588 950.00
Monitoring Costs (vegetation)	R	15 840.00	R	47 820.00	R	73 170.00
Maintenance Costs (vegetation)	R	617 278.04	R	2 151 120.45	R	3 366 971.15
Radiation Clearance	R	370 000.00	R	370 000.00	R	370 000.00
Project Management (12%)	R	531 412.06	R	1 570 767.88	R	2 169 861.50
Contingency (10%)	R	442 843.39	R	1 308 973.23	R	1 808 217.92
GRAND TOTAL	**R**	**6 994 757.37**	**R**	**19 127 363.90**	**R**	**26 459 349.74**

8.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

The applicant, SGL, confirms that the financial provision will be provided for as determined in Section 8.

9 Monitoring compliance with and performance assessment

SGL will be responsible for the implementation of all of the monitoring of mitigation and management measures, as well as compliance with the EMP. The recommended monitoring for the identified impacts is detailed below. SGL will keep a record of all environmental monitoring undertaken as part of the WRTRP. A summary of the environmental monitoring to be undertaken is included in Table 9-2

9.1 Item 1(g): Monitoring of impact management actions

9.1.1 Air Quality

9.1.1.1 Dust Monitoring Programme

There is an existing dust monitoring networks for the respective Mining Right areas (Driefontein, Ezulwini, Kloof and Cooke) and it is considered that the number of monitoring locations is sufficient for the WRTRP. However, the dust monitoring network does not include the proposed RTSF site. It is recommended that some of the existing monitoring locations are decommissioned, particularly where monitoring locations are in close proximity to each other, and replaced with monitoring locations around the proposed RTSF complex.

There must be a monitoring programme in place to ensure regular review and update of the network and to assess the data collected against regulatory standards. If such data are assessed properly, tailored mitigation measures can be applied to sources that will contain fugitive dust, resulting in reduced risk of damage to property, improved visibility, and reduced impacts on flora and fauna habitats.

9.1.1.2 PM_{10} Monitoring Programme

It is recommended that a PM10 monitoring network is established for at least each of the Mining Right areas (Driefontein, Ezulwini, Kloof and Cooke). This is to be done to establish ambient pollution levels within each site. Such data will be will be useful if in future the Project comes under scrutiny from regulatory authorities. Monitoring site should be placed downwind of the proposed activities and preferably at a residential receptor site(s). It is recommended that a programme be put in place to ensure the monitors are calibrated annually to ensure the integrity of the measured data.

9.1.1.3 Gaseous Monitoring Programme

It is recommended that once operation commences, isokinetic sampling of emissions from the different stacks be conducted at least twice a year. In addition to the following, ground level concentrations of gaseous pollutants should be monitored:

- Sulphur dioxide (SO_2);
- Nitrogen dioxide (NO_2);
- Volatile organic compounds (VOCs);
- Carbon monoxide (CO); and
- Carbon dioxide (CO_2).

The proposed ambient monitoring must be a continuous process for the life of the WRTRP to assess the public exposure concentrations at the nearest residential receptor(s).

9.1.2 Fauna and Flora

The fauna and flora monitoring programme should be initiated pre-construction and continue through construction thereafter conducted annually during the growing season (December to March) as close to the same time of year as possible. Should the monitoring results indicate the additional presence of red data species, or threatened species, this may necessitate the need to undergo monitoring for that particular species more frequently, especially during the breeding season and birthing season for that species.

Monitoring will include sites in the undisturbed vegetation which will act as control plots, plots within the disturbed infrastructure areas which will have baseline data and then be monitored during the rehabilitation phase. The same plots will be monitored with each survey so as to ensure collected data is comparable and trends are identified.

Where rehabilitation is conducted, additional plots will be included to monitor the efficacy of the re-vegetation.

Aspects that will be monitored in the annual surveys will include, species richness, vegetation composition i.e. proportion grasses, forbs and woody species, canopy height, cover percentage, presence of Red Data or protected species, and presence of alien invasive species.

9.1.2.1 Flora

9.1.2.1.1 Vegetation Cover Monitoring

The vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out, to ensure that the rehabilitation work has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces), and that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to disturbance (and on adjacent undisturbed areas) (Dawson, 2007).

Various parameters need to be measured, both on the rehabilitation sites and in the adjacent undisturbed areas, to determine the success or otherwise of the establishment of the rehabilitation vegetation cover, and how this compares with the undisturbed vegetation in the area.

These parameters include (Dawson, 2007):

- Plant species presence / absence;
- Presence / absence of weed species in the rehabilitation cover;
- The number of individuals of a species in a given area (“density”);
- The number of times a species is recorded in a given number of sample points (“frequency”);
- The area covered by vegetation at ground level (“basal cover”);
- The “biomass” of representative sample plots, giving an indication of the mass of living material present above the surface;
- An assessment of the vitality or “vigour” of the various species present. This can be assessed by measuring factors such as the amount of inflorescences (flowering heads) or seed produced, and the proportion of senescent (dead) material present within the vegetation cover;
- Photographic recording of vegetation appearance, at fixed points, to provide a visual record of appearance and changes over time; and

- Potential climatic influences on local biodiversity, which will be apparent with inclusion of control plots.

This assessment needs to be undertaken by a botanist / environmental scientist trained and experienced in vegetation assessments of this nature (Dawson, 2007).

Vegetation cover of rehabilitated areas should be assessed during the summer growing season; at least a month after rain has fallen (so that there has been an opportunity for fresh plant growth to have occurred). It is recommended that this should be done annually for the first five years. Thereafter, visual spot-checking with photographic recording by an experienced field botanist / rehabilitation practitioner every three years will suffice, depending on results found. Remote sensing information and aerial photos will also be used to determine impacts and management plans. A detailed botanical study should again be undertaken, comparing plots on the rehabilitated areas with plots in the undisturbed adjacent vegetation, 20 years post rehabilitation (Dawson, 2007).

The environmental indicators which will demonstrate whether the rehabilitation has been successful or not include:

- Increasing similarity between rehabilitated and undisturbed areas in terms of species composition and vegetation structure;
- Increasing species diversity of desired (local) species in rehabilitation cover over time;
- Reduction in presence of weed species over time;
- Increase in woody plant growth, and achievement of reproductive status and production of reproductive propagules (seed);
- Ability of the rehabilitation species populations to reproduce, indicated by the presence of seedlings of the rehabilitation species once the original generation has reached sexual maturity (“population recruitment”);
- Increase in vegetation basal cover and biomass; and
- Increase in soil organic matter.

In the event that the vegetation cover remains static, or should deteriorate; additional seeding, with locally harvested species, and possibly fertilisation would be required as a mitigation measure.

9.1.2.1.2 Alien Vegetation Monitoring

During vegetation monitoring, the presence of alien species should also be detected. An active programme of weed management, to control the presence and spread of invasive weeds, will need to be instituted so that any weeds encroaching because of the disturbed conditions are controlled by means appropriate to the species.

Species likely to be problematic include those identified during the fauna and flora study of the site, namely *Datura stramonium* and *D. ferox* and *Opuntia ficus-indica*.

The environmental indicator assessed in this instance is the reduction in presence of weed species over time, to the point where no invasive weed species are present and no further population recruitment occurs.

9.1.2.2 Fauna

The fauna monitoring will be closely linked to the flora monitoring to enable solid scientific conclusions and comparisons; also, the strong ecological link between vegetation and animals can only be measured if monitoring is similar (e.g. in terms of monitoring points) for both disciplines.

To successfully monitor faunal and floral biodiversity, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project.

9.1.2.2.1 Mammals

Small mammals will be surveyed by using small mammal live traps – line transects will be used to gather repeatable quantitative data with regards to species richness and population dynamics. Tracks and ecological indicators will be used to assess the presence of larger free-roaming mammals – frequencies of such observations will be used for quantitative comparisons. The nesting sites, burrows and possible home ranges of these species will be recorded, marked, monitored and actively avoided.

All wetland and riverine habitats must be continuously surveyed for the following mammal species: Rough-haired golden moles (*Chrysospalax villosus)*, Spotted-necked otter (*Lutra maculicollis)*, and African marsh rat *(Dasymys incomtus).* This must also include any other SSC that has been identified on or near the project area.

9.1.2.2.2 Birds

Line transects will be used to compile quantitative lists of birds present in the areas surveyed; both sounds and visual observations will be used. Nesting sites of threatened birds, will be marked and the area preserved with an adequate buffer zone. The authorities will be informed of any sites found and Sibanye will abide by their recommendations. It is recommended that the more detailed avifaunal monitoring is conducted in the breeding season between October and January.

Surveys for terrestrial birds must be conducted in summer, but only once the vegetation layer has recovered sufficiently from winter fires to allow for assessment of available habitat.

Surveys for aquatic birds must also be conducted in summer. For species associated with rivers, the assessment must coincide with average flow conditions (i.e. not dry and not in flood) and preferably within the breeding season. For species associated with wetlands, the assessment must follow good summer rains i.e. standing water must be present and the vegetation must have recovered sufficiently from winter fires to allow for assessment of available habitat.

9.1.2.2.3 Reptiles and Amphibians

Active searches for both reptiles and amphibians will be used to assess species richness of these groups in the area; due to the difficulty in recording occurrence of these groups data gathering will be limited to species counts.

9.1.2.2.4 Invertebrates

Invertebrate biodiversity will be measured by using pitfall trap lines. This method concentrates on ground-living invertebrates – the groups found in pitfall traps are good indicator groups for general biodiversity. Pitfall traps can be repeated exactly and works well in areas where vegetation cover at ground level is low (open habitat) as is found in the study area. In addition sweep net sampling will be conducted to provide an indication of airborne and canopy dwelling species.

9.1.3 Aquatics

An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative impacts brought about by the proposed project.

Aquatic biotas have been proven to be excellent indicators of water quality and ecosystem health. In addition, aquatic biota can detect slight changes in the aquatic environment, which have been shown to be a fluctuating system. Table 9-1, highlights some important aspects to monitor in reference to aquatic biota for the duration of the proposal.

Table 9-1: Aquatic Ecology Monitoring Programme

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in this study will suffice.	Determine if habitat deterioration is occurring.	Bi-annual	Water clarity should not vary between surveys, by more than 40%.
Current sites used in this study will suffice.	Determine if water quality deterioration is occurring.	Bi-annual	SASS5 scores should not decrease as a result of the WRTRP (currently impacts are related to sewage/urban runoff).
Site used in this study and the surface water	Determine if water quality deterioration is	Monthly	Standard water quality monitoring, as per the

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
assessment.	occurring.		surface water specialist report.
Current sites used in this study will suffice.	Determine if water/habitat quality deterioration is occurring.	Bi-annual	Monitor for presence of fish.

Key performance indicators for the aquatic biomonitoring study would be an improvement of SASS5 scores, ASPT values and the increased presence of fish (when compared to this study).

9.1.4 Wetlands

Monitoring of the wetlands and the above discussed mitigation measures is important as the impacts from the activities need to be identified and rectified as far as possible. This will be mostly relevant during the construction phase. Monitoring should be done by a qualified wetland specialist on a monthly basis for the duration of the construction phase. The wetland monitoring should be undertaken concurrently with the faunal monitoring.

9.1.5 Socio-economic Environment

It is proposed that a monitoring programme be developed and implemented to monitor the implementation of social management actions. Furthermore, it is recommended that this is conducted by a competent monitoring and evaluation officer as the implementation of monitoring tools (surveys, databases, etc.) will require specialised skills.

The monitoring and evaluation approach recommended in this section is based on the “inputs-outputs-outcomes-impacts” model, which assesses performance of each level of the "results chain." As such, the following four categories of monitoring and evaluation indicators have been defined:

- **Input indicators:** These indicators measure the quantity, quality, and timeliness of resources – human, financial and material, technological and information – provided for an activity/ project/ programme;
- **Output indicators:** These indicators measure the quantity, quality, and timeliness of the products – goods or services – that are the short-term results of an activity/ project/ programme;
- **Outcome indicators:** These indicators measure the intermediate results generated by programme outputs. They often correspond to any change in people’s behaviour as a result of programme; and

- **Impact indicators:** These indicators measure the quality and quantity of long-term results generated by programme outputs (e.g. measurable change in quality of life, reduced incidence of diseases, increased income, reduced mortality, etc.).

A framework for monitoring the implementation and performance of social management actions is provided in the Social Impact Assessment Report attached in Appendix O of this report.

9.2 Item 1(h): Monitoring and reporting frequency

Please refer to Table 9-2 below for this information.

9.3 Item 1(i): Responsible persons

Please refer to Table 9-2 below for this information.

9.4 Item 1(j): Time period for implementing impact management actions

Please refer to Table 9-2 below for this information.

9.5 Item 1(k): Mechanism for monitoring compliance

Table 9-2 sets out the method of monitoring the implementation of the impact management actions, the frequency of monitoring the implementation of the impact management actions, an indication of the persons who will be responsible for the implementation of the impact management actions, the time periods within which the impact management actions must be implemented and the mechanism for monitoring compliance with the identified impact management actions.

Table 9-2: Monitoring and Management of Environmental Impacts

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions

All activities associated with the Cooke Mining Right Area	Deterioration to the ambient air quality	The following aspects should be monitored on a continuous basis, with analysis taking place monthly:
		▪ Dust deposition;
		▪ PM_{10}; and
		▪ Gaseous emissions including:
		  ▪ Sulphur dioxide (SO_2);
		  ▪ Nitrogen dioxide (NO_2);
		  ▪ Volatile organic compounds (VOCs);
		  ▪ Carbon monoxide (CO); and
		  ▪ Carbon dioxide (CO_2).
			An Air Quality Specialist must undertake the monitoring of the air quality and must be responsible for the changing of the dust buckets on a monthly basis.	The dust buckets must be analysed and changed on a monthly basis, with a report compiled every quarter. The Environmental Manager will be responsible for implementing impact management actions based on the findings and results of the quarterly reports.

	Loss of biodiversity	The fauna and flora monitoring must be undertaken on a yearly basis by an independent ecologist, starting prior to construction and commencing until post closure. The fauna and flora monitoring must be undertaken during the growing season (December to March) and must monitor the following: ▪ Vegetation cover; ▪ Alien invasive vegetation establishment; ▪ Mammals; ▪ Birds; ▪ Reptiles and amphibians; and ▪ Invertebrates.	An independent ecologist must undertake the fauna and flora monitoring and compile a yearly report. It is the responsibility of the Environmental Manager to appoint the ecologist on an annual basis.	Annual monitoring and reporting must take place. The reporting must detail the changes in the biodiversity based on previous monitoring findings.
	Impact to water quality and aquatic ecosystems.	Bi-annual aquatic monitoring must take place and must include monitoring of the water clarity, SASS5 scores and the presence of fish. The bi-annual monitoring must be undertaken during the high-flow and low-flow seasons. The aquatic monitoring locations utilised in the Aquatic Impact Assessment must be used. In addition, monthly water quality monitoring must be undertaken.	An independent Aquatic Ecologist must be appointed for the bi-annual monitoring.	Bi-annual monitoring and reporting must be undertaken by the independent aquatic ecologist.
	Deterioration of groundwater quality and reduction in water levels.	Water levels must be monitored on a monthly basis by a groundwater specialist. In addition to the monitoring of the water levels, groundwater quality monitoring must be undertaken on a quarterly basis and must analyse the following constituents:	A groundwater specialist must undertake the monthly water level monitoring and quarterly groundwater quality monitoring.	Water levels will be monitored monthly, with groundwater quality monitored on a quarterly basis. A database must be managed and must keep records of all monitoring results. A report must be compiled on a quarterly basis detailing the

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions
		▪ Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO3, F, Cl; ▪ Initial full suite metals and then As, Al, Fe, Mn and other metals identified according to results of the initial analyses; ▪ pH and Alkalinity; ▪ TDS and EC; and ▪ Radio-active constituents, particularly uranium and its daughter decay nuclides.		results of the water levels and groundwater quality.
	Deterioration of ambient noise levels as a result of the proposed activities	Noise measurements are to be taken for a period of no less than 10 minutes at each location of the complainant. Sampling is to be done in accordance with the Gauteng Noise Control Regulations in conjunction with the SANS 10103:2008 guidelines. Noise levels from the project should not measure above the SANS 10103:2008 rating levels for the specific district the receptor falls within.	A noise specialist is to undertake ad hoc noise sampling at the complainant locations should complaints of noise disturbance be received.	A report must be compiled after the monitoring has been carried out then submitted to management to ascertain compliance with the required regulations and standards.

10 Item 1(l): Indicate the frequency of the submission of the performance assessment report

A performance assessment will be undertaken on an annual basis by an independent consultant. Following the performance assessment, a report will be compiled and submitted to the DMR for review.

11 Item 1(m): Environmental Awareness Plan

11.1 Item 1(m)(1): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

Cooke Gold Mine has specific procedures set in place to create awareness with regards to environmental risks, impacts as well as mitigation measures associated with them. These procedures include the inclusion of environmental conditions in operational contracts which notify contractors of the potential environmental risks associated with the project and the necessity of implementing good housekeeping practices to prevent spillages and other environmental impacts.

The Environmental Management System (EMS) used by Cooke Gold Mine is the ISO 14001 compliance and will include the emergency procedures for all of the company's operations. It is proposed that these emergency procedures which are outlined in the EMS will be used during the reprocessing of the historical TSFs and the proposed infrastructure as per the proposed activities.

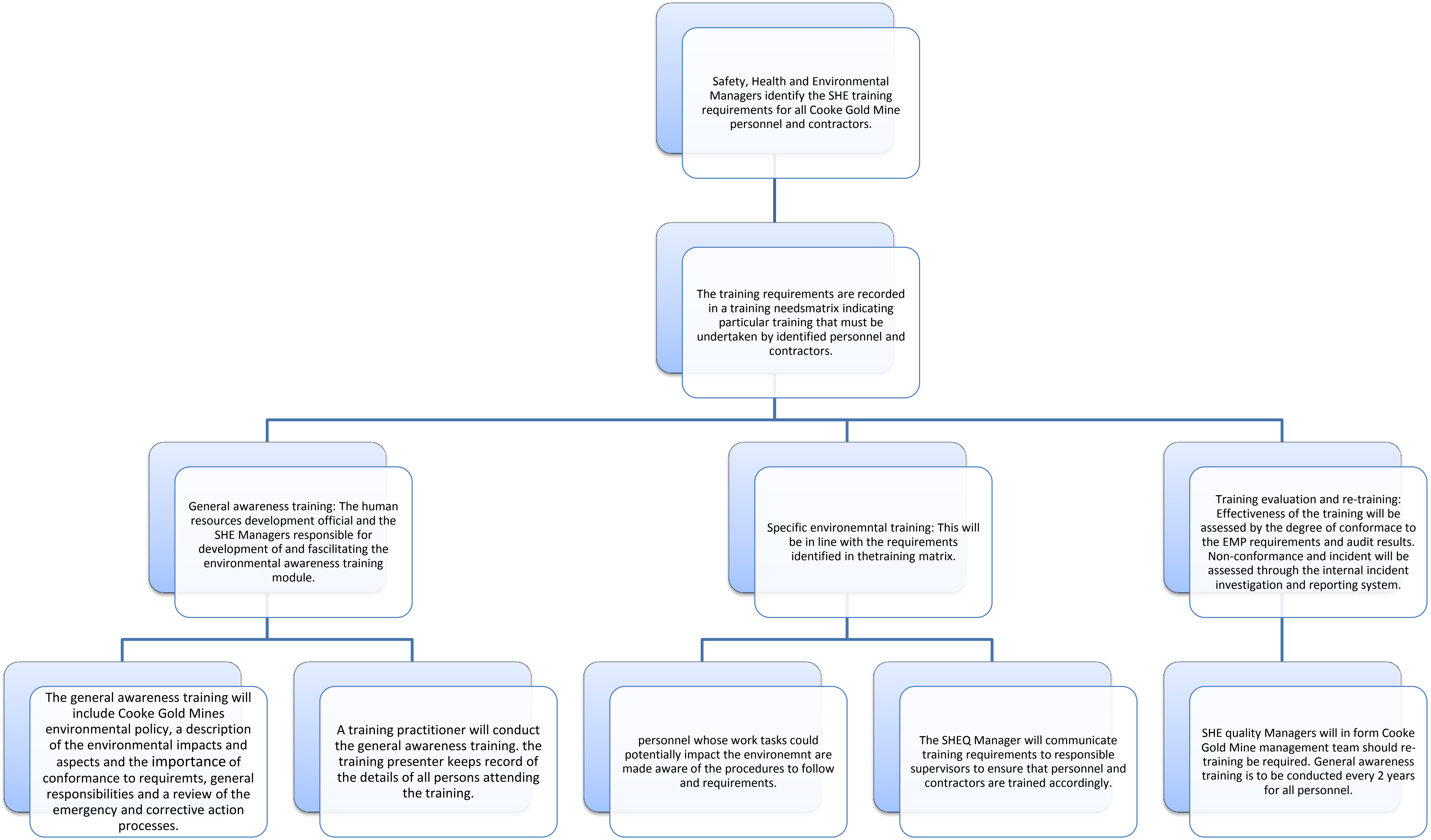

Figure 11-1: Cooke Gold Mine Environmental Awareness and Competence Training Procedure

11.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

In addition, the mitigation and management measures associated with environmental risks for unplanned events that may arise during the operation of the project are provided in Table 11-1. It must be noted that the potential impacts as a result of the project risks have not been rated or assessed in terms of their significance as these are unplanned events.

Table 11-1: Mitigation Measures for Environmental Risks

Unplanned Event	Environmental Aspects	Potential Impact	Mitigation and Management Measures
Hydrocarbon spillages	Aquatics, surface water, groundwater and wetlands	Degradation of surface water quality, impacting downstream users, wetlands functioning and aquatic habitats.	▪ Bunded storage of hydrocarbons outside 1:100 floodline or 500m buffer, whichever is greater. ▪ Hydrocarbon spill kits and employee training in their use; ▪ Regular inspection for leakages and subsequent repair (maintenance); ▪ Emergency Response Plan; and ▪ The refuelling and replacement of oil for vehicles must be undertaken in contained areas (bunded areas) built to the capacity of the facility provided with sumps.
Dust storm episode (erosion of the TSFs)	Air Quality	Deterioration of ambient air quality due to an increase of dust pollution	▪ Vegetation of tailings, ▪ Dust monitoring
Pipeline leaks, spills, bursts and failure	Wetlands and Surface Water	Deterioration of surrounding wetlands' health and functioning, as well as impacting on water quality	▪ Electronic monitoring of pipeline pressure to identify potential leaks or bursts and soon as possible; ▪ Emergency valves must be shut down immediately should a burst pipeline be identified; ▪ Implement the Emergency Response Plan; ▪ Ensure pipelines are emptied before removal from site during the decommissioning phase.

12 Item 1(n): Specific information required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by the NEMA which provides, in Section 24P, that the holder of a Mining Right must make financial provision for rehabilitation of negative environmental impacts. The financial revision will be reviewed on an annual basis.

13 Item 2: Undertaking

The EAP herewith confirms:-

2(a) the correctness of the information provided in the reports

2(b) the inclusion of comments and inputs from stakeholders and I&APs ;

2(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

2(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

Appendix A: Plans

Appendix B: CV and Proof of Qualifications

Appendix C: Macro-Economic Impact Assessment

Appendix D: Public Participation Process

Appendix E: Air Quality Impact Assessment

Appendix F: Groundwater Impact Assessment

Appendix G: Soils Impact Assessment

Appendix H: Surface Water Impact Assessment

Appendix I: Fauna and Flora Impact Assessment

Appendix J: Aquatics Impact Assessment

Appendix K: Wetlands Impact Assessment

Appendix L: Topography and Visual Impact Assessment

Appendix M: Noise Impact Assessment

Appendix N: Heritage Impact Assessment

Appendix O: Social Impact Assessment

Appendix P: Radiological Impact Assessment

Appendix Q: Rehabilitation Plan

Appendix R: Closure Cost Assessment