mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Draft Environmental Impact Assessment and Environmental Management Programme

For The

Amendment of the Existing EMP and Inclusion of Listed Activities Associated with Operations at Driefontein Mining Right Area, Sibanye Gold Limited

DMR Reference Number: GP 30/5/1/2/2 (55) 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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This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft Environmental Impact Assessment and Environmental Management Programme**
Project Name:	**Amendment of the Existing EMP and Inclusion of Listed Activities Associated with Operations at Driefontein Mining Right Area, Sibanye Gold Limited**
Project Code:	**GOL2376**

Name	Responsibility	Signature	Date
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IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) as amended (MPRDA), 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 (EIA) and an Environmental Management Programme (EMP) report in terms of the National Environmental Management Act, 1998 (Act No. 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 (EAP) 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 EIA 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

Digby Wells Environmental (Digby Wells) was appointed by Sibanye Gold Limited (SGL) to conduct the Environmental Impact Assessment (EIA) process for the West Rand Tailings Retreatment Project (WRTRP) in Gauteng, South Africa.

The EIA is considered a tool with which to identify and manage potential impacts on the environment as a result of a particular project. Environmental risks associated with such a project or development are also identified and mitigation measures are proposed. The completion of an EIA is a regulatory requirement in terms of the provisions of the National Environmental Management Act, 1998, as amended (NEMA) and the EIA process which is regulated in accordance with the Environmental Impact Assessment Regulations, 2014[1] (the EIA 2014 Regulations). The overarching purpose of the EIA process is to determine, assess and evaluate the consequences (positive and negative) of a proposed development, activity or project. The objectives of this EIA and EMP report are to:

- Detail policies and legislation relevant to the activity;
- Motivate the need and desirability of the proposed activity;
- Detail and confirm the preferred activity and alternative(s);
- Determine and assess the significance of the potential impacts of the project including the nature, consequence, extent, duration and probability of the impacts;
- Determine the most ideal location for the activity;
- Determine suitable measures to manage, avoid or mitigate identified impacts; and
- Determine residual risks that need to be managed and monitored.

The Scoping Report for the project was compiled and submitted for public review from 15 September to 6 November 2015. Comments and issues raised by Interested and Affected Parties (I&APs) were recorded and responded to before the Scoping Report was updated and submitted to the Department of Mineral Resources (DMR) on 13 November 2015. In parallel to the scoping phase specialist studies were undertaken to determine the baseline of the receiving environment. Following the acceptance of the Scoping Report, specialist studies were finalised and all additional requirements of the IAPs and competent authorities taken into consideration. The studies assessed the significance of the potential impacts associated with the project's activities and proposed mitigation and management measures to mitigate adverse impacts and enhance benefits.

[1] GN R982 published in Government Gazette 38282 of 4 December 2014

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 the tailings 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 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), listed 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 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

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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

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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. The Driefontein 4 TSF currently falls outside the Driefontein Mining Right area; the inclusion of Driefontein 4 TSF into the Driefontein Mining Right area is part of this EIA and Section 102 amendment submitted to the DMR;
- 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/m of tailings and current underground arisings. The CPP will eventually comprise the following:

- Gold Plants;
- Floatation 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.

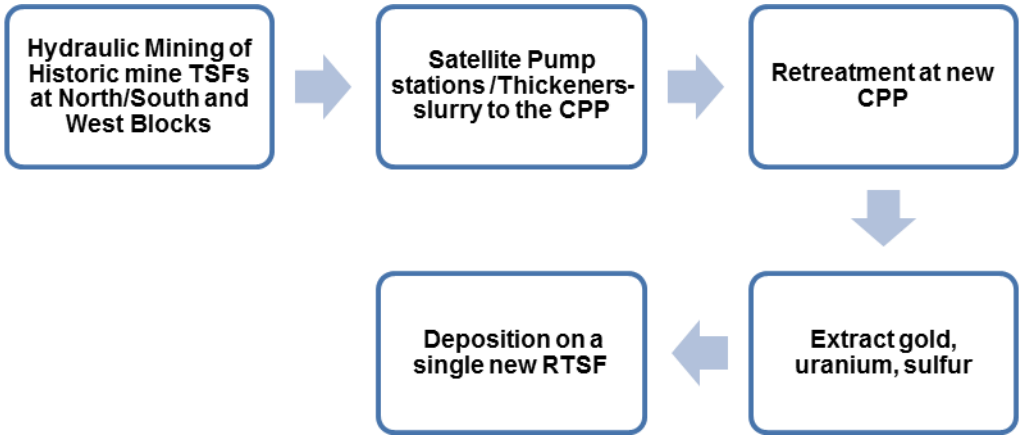

Figure I: Summary of WRTRP

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 an approved IWUL.

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 and the 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;
  - Floatation 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 and 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 kilotonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.

The Initial Implementation of the project is outlined in the Figure II below.

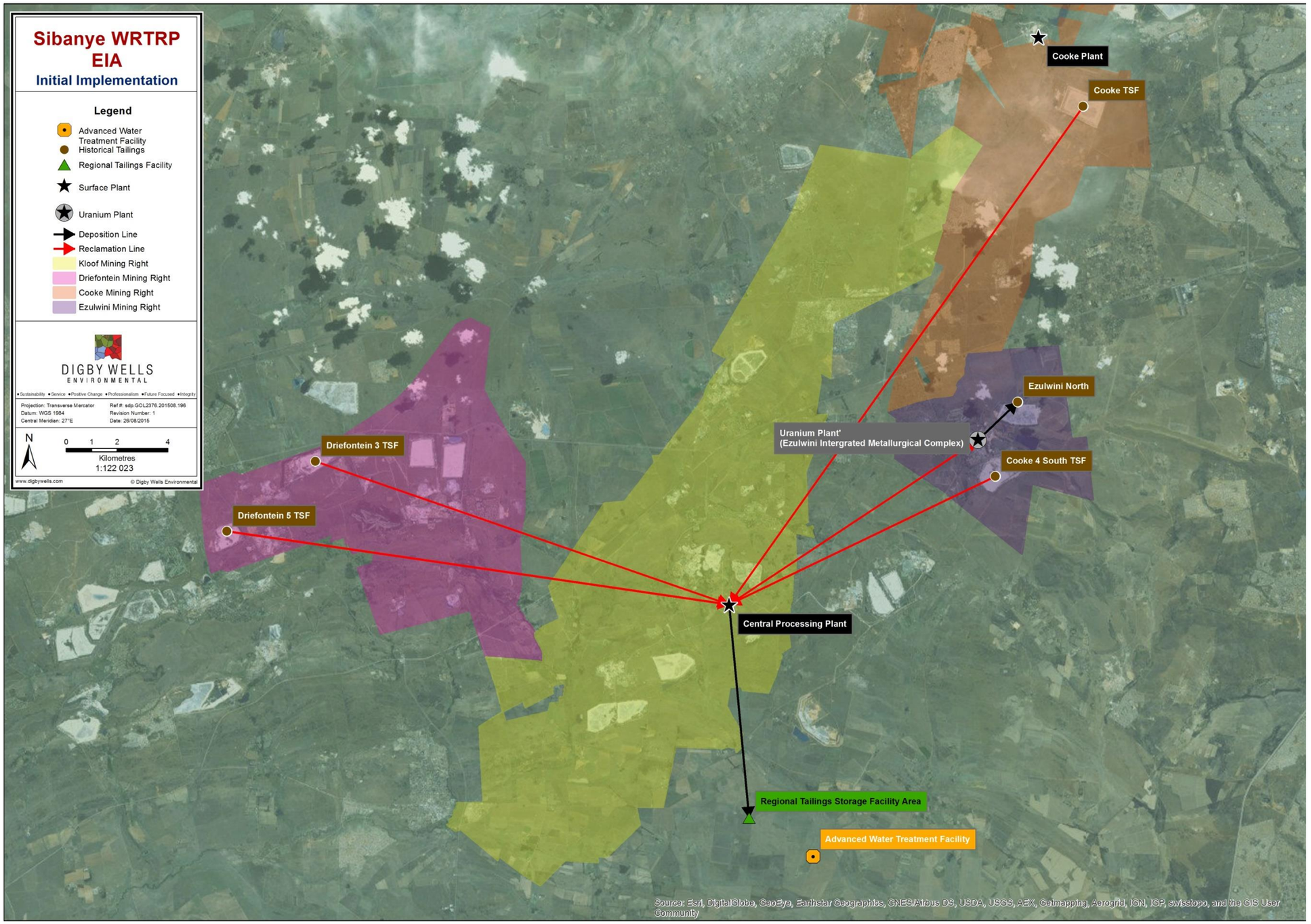

Figure II: Initial Implementation Phase

Driefontein 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 Driefontein Mining Right or are to be included in the Driefontein Mining Right. Authorisation for this component of the Initial Implementation phase (Driefontein) will require the amendment of the Driefontein Mining Right, Mining Work Programme (MWP) and EMP to cover the processing of reclaimed slimes at the CPP and the deposition of the resultant tailings on the RTSF.

The Driefontein Mining Right will be amended to include:

- The inclusion of Driefontein 4 TSF into the Driefontein Mining Right Area;
- The reclamation of Driefontein 3 and 5 TSFs;
- The construction and operation of the West Block Thickener (WBT) and Bulk Water Storage Facility (BWSF); and
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The intention of this EIA report is, therefore, to identify these activities within the current and expanded Driefontein Mining Right area, to assess the potential impacts that they may have on the receiving environment and to provide mitigation measures and monitoring plans for the potential impacts.

Project Alternatives

Alternatives for the various aspects of the WRTRP have been assessed during the pre-feasibility of the Project. The alternatives considered include 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 EIAs for the respective Mining Right areas. **This EIA and EMP report, however, details the alternatives considered specifically for the Driefontein Mining Right area.**

WBT and BWSF Complex Site Alternatives

The alternatives associated with the WBT and BWSF are based around the location of the facilities. The WBT and BWSF have been located adjacent to each other to minimise the required footprints, as well as optimising and aiding in the operational and maintenance efficiency during the operational phase. The footprint of the WBT and BWSF complex has been optimised and the alteration of the footprint shape will reduce the operational efficiency. As a result, the block footprint has been utilised to select suitable locations.

The WBT and BWSF complex has been located adjacent to the R501 regional road, where the road alters direction and arcs to avoid depressions and sink holes in the landscape. The presence of the depressions and sink holes limits the potential land use adjacent to the

R501 regional road arc. The identified location is also situated approximately midway between the K10 shaft water abstraction point and Driefontein 3 TSF, as well as where the slurry pipeline heads southwards to the CPP, making the location the central point for the pipeline routes. An alternative location was identified further to the west of the current location but was excluded as the water pipeline and thickened slurry pipeline would share a servitude resulting in additional pumping costs; the preferred location is central to the water pipeline, slurry pipeline and thickened slurry pipeline, optimising the pumping requirements.

Furthermore, SGL has proposed to construct a solar farm to generate electricity to the south of the R501 regional road arc, limiting the potential footprint locations to within the road arc. The site specific location will be investigated and selected based on potential sensitivities, as well as being based to avoid the depressions and sink holes.

Pipeline Alternatives

The pipeline routes and supporting infrastructure need to be located where the feed sources, current infrastructure, services and proposed infrastructure including the WBT and BWSF complex, CPP and RTSF are located. Alternative pipeline routes between the WBT and the CPP have been identified.

Premised on the primary requirement of the pipe routes being selected being the shortest distance between infrastructure, feed sources and the historical TSFs, alternative routes were considered which capitalised on the following:

- Following existing routes where possible;
- Avoiding identified environmental sensitive areas, predominantly wetland areas;
- Crossing existing impacted land;
- Maximising mine owned land; and
- Assessing the operating costs pertaining to topographical considerations on pumping costs.

The preferred pipeline route was determined using the above criteria and overlaying sensitive areas, such as wetlands, over the proposed routes. The preferred pipeline route has been selected based on the location of current servitudes, and the locations and frequency of wetlands.

No-Go Option

In terms of the "No-go" option, the primary land uses for the region are mining, agriculture, and in some areas, residential. Should the project not be implemented, the Driefontein 3 and 5 TSFs will not be reclaimed; the TSFs will remain *in situ* and continue to impact on the environmental and social landscapes, as per the status quo. None of the envisioned benefits 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 existing impacts include:

- Potentially leaching contaminants e.g. uranium and sulfur, into the sensitive dolomitic aquifers;
- Risk to community health and an increased potential for AMD in the Western Basin;
- Further weakening of the West Rand's economy as mining declines; and
- The AWTF will not be funded which will result in mine affected water not being treated to potable standards (SANS 241:2011). This results in water quality resources continuing to be impacted upon by contaminated water, impacting on the receiving environment and downstream water users.

The infrastructure associated with the Driefontein Mining Right area, such as the WBT, BWSF and associated pipelines, roads and transmission lines are required for the efficient implementation of the WRTRP. If any component of it is not approved, the entire project will be abandoned.

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 Driefontein Mining Right Area Environment

The WRTRP is situated in the Upper Vaal WMA 8 and within the quaternary catchments C23E, C23J, C23D, C22J and C22H, with the Driefontein Mining Right area falling within quaternary catchments C23E, C23D and C23J. The WRTRP area is drained by the Wonderfonteinspruit, Leeuspruit and the Loopspruit. The Wonderfonteinspruit flows westwards, north of the Driefontein 3 and 5 TSFs, and eventually becomes the Mooirivierloop before a confluence with the Mooi River downstream.

The overall surface water quality for the WRTRP area indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the In-Stream Water Quality Guidelines for the Vaal Barrage (Barrage WQO). This indicates that rivers within this area are already impacted; the majority of river systems associated with the WRTRP 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.

Wetlands within the Driefontein Mining Right area are characterised by valley bottom systems associated with the Wonderfonteinspruit, 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 identified wetlands are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems and has contributed to the direct loss of wetland habitat. The wetlands have been demarcated a Present Ecological Status (PES) of D (largely modified) and an Ecological Importance and Sensitivity (EIS) of low to moderate. The aquatic ecosystems associated with the project area mirror the impacted nature of the surface water quality and wetlands functioning, with the aquatic systems determined to have PES of Class D and E, which is moderately to seriously modified.

The groundwater within the Driefontein Mining Right area is typical of contaminated water emanating from historical TSFs and current mining operations, with elevated concentrations of sulfate, TDS and nitrates, as well as manganese and chloride. The pH values range between 4.1 and 8 and are indicative of AMD impacts associated with seepage from existing TSFs. The historical TSFs are located on dolomite which is dewatered to allow for dry and safe underground workings; the dewatering result in a low pressure within the dolomite and encourages drainage of mine affected water from the TSFs into the groundwater system and the seepage is expected to migrate downwards into the aquifers.

The regional vegetation of the WRTRP area consists of the Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Rand Highveld Grassland and Soweto Highveld Grassland, with the two former vegetation types being classified as Vulnerable and the Highveld Grassland vegetation types classified as Endangered.

The infrastructure associated with the Driefontein Mining Right area is located within grassland, wetland, ridges, agricultural (cultivation and grazing) and transformed areas. The grassland is composed of dominant and well developed graminoid components, as well as a healthy forb component. The dominant grassland sub community associated with the WBT and BWSF complex and pipelines between the K10 shaft, WBT and BWSF complex and Driefontein 3 TSF is the *Eragrostis gummiflua – Themeda triandra* grassland, with the southern section of the pipeline towards the CPP being the *Themeda triandra – Hyparhennia hirta* grassland and the central section of the pipeline from the WBT to the CPP being delineated as *Cymbopogon excavates – Helichrysum regulosum* grasslands.

No Red Data mammal or bird SSC were identified during the field survey, although the Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder, 2008) and is expected to occur within the wetland habitats identified within the project area. This species has been allocated a status of Vulnerable. Reptile Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*) (Vulnerable) and the Striped Harlequin Snake (*Homoroselaps dorsalis*) (Rare). Invertebrate Red Data species expected to occur on site include the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey.

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography which is characterised by underground drainage systems with sinkholes, dolines and caves. The heritage resources identified within the Driefontein Mining Right area were three structures older than 60 years old and are protected under Section 34 of the NHRA. The identified structures do not occur within the proposed infrastructure footprints but are located between 30 m and 100 m from the pipeline route. The identified resources are considered to have a negligible cultural significance.

Potential Impacts

The predominant negative impacts associated with the Driefontein Mining Right area are due to the site clearing for and construction of the WBT and BWSF complex. The construction of the WBT and BWSF complex will potentially impact on soil and surface water resources due to the clearance of vegetation and resultant soil erosion and compaction. Eroded soils may report to surface water resources due to runoff from the site which can lead to sedimentation of water and deterioration of water quality. In addition, the WBT and BWSF complex has been partially located within a pan which has a high (negative) impact due to the loss of wetland habitat; the partial location within the pan was unavoidable due to the presence of sinkholes and depressions, the R501 road to the north and future construction to the south. A wetland offset strategy will be implemented to compensate for the loss of wetlands, subject to a WUL.

The positive impacts associated with the project are predominantly part of the Kloof Mining Right area as significant capital expenditure will take place which will boost the local

economy and have a multiplier effect. Job creation and skills development will also result from the project.

The significant positive impacts associated with the Driefontein Mining Right area activities will be realised following the complete reclamation of the historical TSFs and the rehabilitation of the footprints. The removal of the historical TSFs will have a positive visual impact on the landscape, as well as positive impacts on air quality, surrounding wetlands and aquatic ecology and surface water and groundwater quality as the source of pollution will be removed from the landscape. In addition, surface water yield to the catchment will increase as runoff is not restricted or contaminated by the TSFs; fauna and flora biodiversity will increase due to the removal of unfavourable habitats and the visual environment will improve due to the removal of visual intrusions on the landscape.

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 Driefontein Mining Right Area of the WRTRP

Activity	Potential Impact	Aspects Affected	Significance Prior to Mitigation	Significance Post Mitigation
Construction Phase				
WBT and BWSF Complex	Loss of topsoil as a resource	Soils	Medium-high (negative)	Low (negative)
	Loss of land capability	Soils and land capability	Medium-high (negative)	Medium-high (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	Medium-high (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Minor (positive)	Moderate (positive)
	Direct investment and multiplier effect.	Socio-economic	Minor (positive)	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Significance Prior to Mitigation	Significance Post Mitigation
	Population influx and associated impacts	Socio-economic	Medium high (negative)	Medium low (negative)
Operational Phase				
Reclamation of Driefontein 3 and 5 TSFs	Contamination and deterioration of soils	Soils	Medium-high (negative)	Medium-low (negative)
	Modification of instream habitat	Aquatic ecology	Medium-high (negative)	Medium-low (negative)
WBT and BWSF Complex	Contamination and sedimentation of wetlands	Wetlands	Medium-high (negative)	Low (negative)
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Minor (positive)	Moderate (positive)
	Contribution to country's economy	Socio-economic	Moderate (positive)	Moderate (positive)
Decommissioning Phase				
Reclamation of Driefontein 3 and 5 TSFs	Removal of a pollution source will improve the ambient air quality.	Air quality	Low (negative)	Moderate (positive)
	Improvement of land capability due to the removal of the TSFs.	Soil and land capability	Moderate (positive)	Moderate (positive)
	Increased biodiversity of the area due to the removal of unfavourable habitats.	Fauna and Flora	Negligible (positive)	Moderate (positive)
	Reduced impacts to surrounding wetlands	Wetlands	N/A	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Significance Prior to Mitigation	Significance Post Mitigation
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Medium-high (negative)	Medium-low (negative)
Post Closure				
Reclamation of Driefontein 3 and 5 TSFs	Improvement of groundwater quality	Groundwater	N/A	Moderate (positive)
	Increase in catchment yields and improved surface water runoff	Surface water	N/A	Moderate (positive)
	Improvement of visual landscape and change of land use from mining	Visual Environment	Moderate (positive)	Moderate (positive)
	Removal of radiation impacts to environment and public	Radiological	Low (negative)	Moderate (positive)

Conclusions and Recommendations

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 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. The removal of the historical TSFs is expected to have positive impacts on the groundwater and air quality surrounding the historical TSFs; potentially improving community health. 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.

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List of Acronyms and Abbreviations

ASTP	Average Score Per recorded Taxon
AWTF	Advanced Water Treatment Facility
BWSF	Bulk Water Storage Facility
C4S	Cooke 4 South
CPP	Central Processing Plant
CR	Critically Endangered
COP	Cooke Optimisation Project
CoR	Certificate of Registration
CUP	Cooke Uranium Project
CV	Curriculum Vitae
CVB	Channelled valley bottom
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Programme
EN	Endangered
FTE	Full time equivalent
GAC	Granular activated carbon
GDARD	Gauteng Department of Agriculture and Rural Development
GDP-R	Gross Domestic Product per Region
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IHAS	Integrated Habitat Assessment System
IHIA	Intermediate Habitat Integrity Assessment
IUCN	International Union for the Conservation of Nature
KDC	Kloof Driefontein Complex
LC	Least Concern

LM	Local Municipality
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MIRAI	Macroinvertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
NDCR	National Dust Control Regulations, 2013
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NGO	Non-government Organisation
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NNR	National Nuclear Regulator
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological Status
PFS	Pre-feasibility study
PHRA-G	Gauteng Provincial Heritage Resources Authority
POSA	Plants of South Africa
PP	Public Participation
PPP	Public Participation Process
RO	Reverse Osmosis
RTSF	Regional Tailings Storage Facility
RWD	Return Water Dam
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Index
SANS	South African National Standards
SASS5	South African Scoring System version 5
SAWQG	South African Water Quality Guidelines

SGL	Sibanye Gold Limited
SSC	Species of Special Concern
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSP	Total Suspended Particles
VB	Valley bottom without a channel
VU	Vulnerable
WBT	West Block Thickener
WMA	Water Management Area
WRDM	West Rand District Municipality
WRTRP	West Rand Tailings Retreatment Project
WULA	Water Use Licence Application
WWP	West Wits Project

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 1[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 (Registration Number 2002/031431/06), listed 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.

[2] All plans are also provided in Appendix A.

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.

In early 2013 Gold Fields unbundled its KDC and Beatrix gold mines to create SGL.

1.3 Project Description

The broader West Rand area[3] 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 the tailings 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 eventually up to 4 million tonnes per month (Mt/m) 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 1 and 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 (Plan 3).

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

Plan 1: Regional Setting

Plan 2: Ultimate WRTRP 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 Driefontein, Kloof, Cooke and 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 floatation and gold plants of the CPP. The remainder of the TSFs will be processed once Module 3 has been constructed;
- Driefontein Mining Right area: Driefontein 1, 2, 3 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. The Driefontein 4 TSF currently falls outside the Driefontein Mining Right area; the inclusion of Driefontein 4 TSF into the Driefontein Mining Right area is part of this EIA and Section 102 amendment submitted to the DMR;
- 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.

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 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 area 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 reused 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' West Wits Project (WWP) and the Rand Uranium's Cooke Uranium Project (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 processes for the outstanding authorisations.

Plan 3: Initial Implementation

Plan 4a: Driefontein Mining Right Area

Plan 4b: Kloof Mining Right Area

Plan 4c: Cooke Mining Right Area

Plan 4d: Ezulwini Mining Right Area

1.3.1.1 Mining Rights Concerned

1.3.1.1.1 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 1-1 provides a summary of the ultimate project and Figure 1-1 shows the geographical extent of the ultimate project.

1.3.1.1.2 Kloof Mining Right Area

Kloof holds in its own right, GP 66 MR within which the CPP and K10 water supply forms part. Adjacent to the Kloof Mining Right area are the Venterspost TSFs (North and South), as well as the proposed RTSF and AWTF; the Mining Right area will be amended to incorporate these areas into the right as part of this application.

1.3.1.1.3 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.

1.3.1.1.4 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.

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

Proposed Construction Start Date*	**2016**	**2018**	**2020**
Operation Date	**2019**	**2021**	**2024**
Activities	▪ Treat Driefontein 3 and 5, C4S TSF (at 1Mt/m) and Cooke TSFs at0.5Mt/m totalling 1.5 Mt/m through Gold Module 1, uranium, roaster and acid plants of the new CPP with deposition onto the 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 now) ▪ West Block Thickener (WBT) and bulk water storage ▪ Pipelines between Driefontein 3, Driefontein 5, C4S, Cooke TSF, WBT, CPP and RTSF	▪ CPP Gold Module II: • Gold Plant II • Pipelines, roads and pumps	▪ CPP Gold Module III: • Gold Plant III • Uranium Plant II • Pipelines, roads and pumps • Thickener

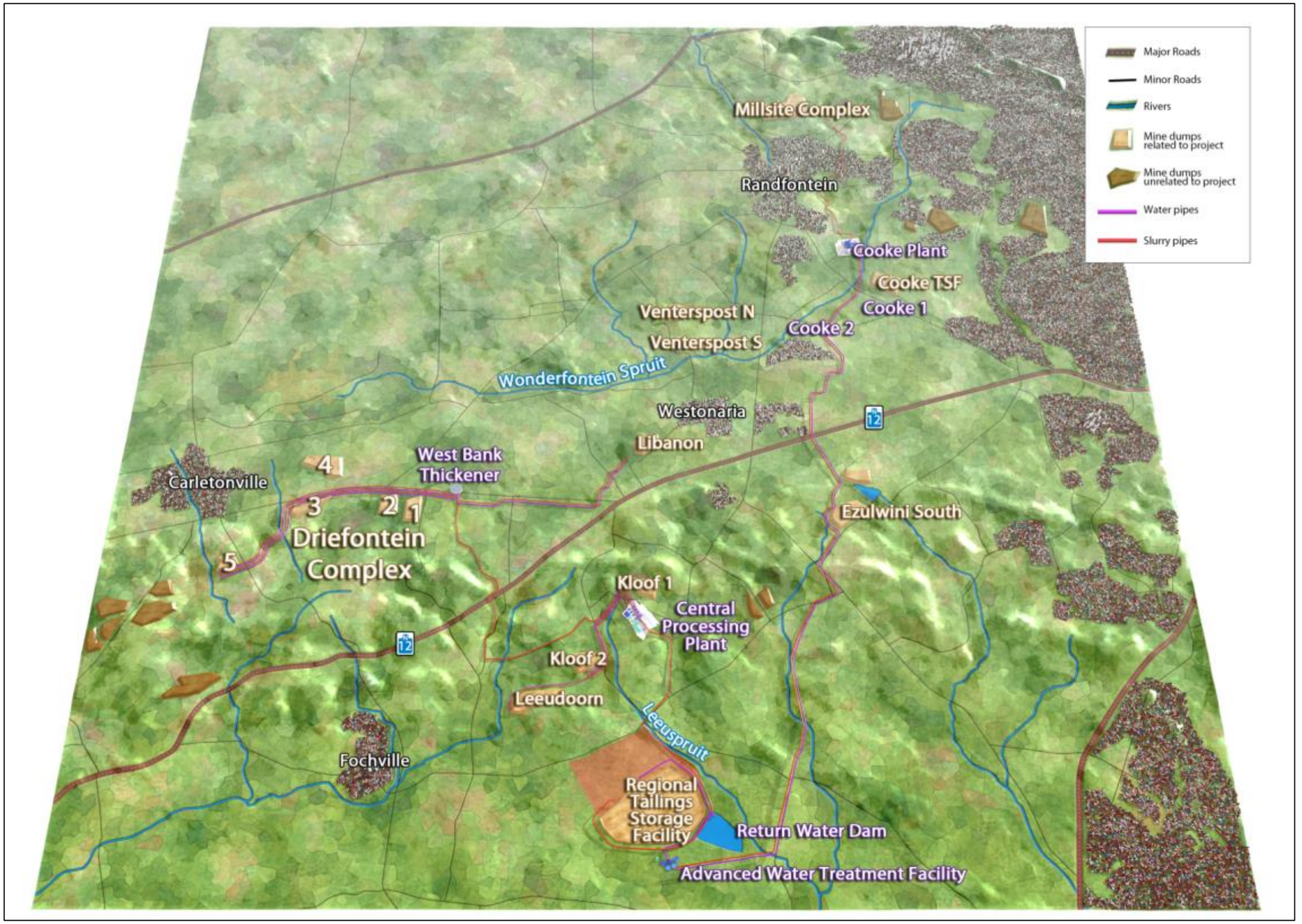

Figure 1-1: Geographical Extent of the WRTRP – Ultimate Project

1.3.1.2 Water Sources

A number of mine impacted water sources have been identified 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, such as mine affected water at the Kloof K10 shaft, Cooke 1 and 2 Shafts and Cooke 4 South Shaft, 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 Return Water Dam (RWD) and treated through the Advanced Water Treatment Facility (AWTF).

1.3.1.3 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 to 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 1-2. The RTSF footprint will be approximately 1 350 ha, liberating a nett 310 ha of currently sterilised land.

Table 1-2: Total Area Covered by the TSFs that will be reclaimed over the Life of the Ultimate Project

Mining Right Area	Name	Area (ha)	Mining Right Area	Name	Area (ha)
Kloof Mining Right Area	Kloof 1 TSF	86.99	Driefontein Mining Right Area	Driefontein 1 TSF	87.15
	Kloof 2 TSF	72.76		Driefontein 2 TSF	85.26
	Venterspost S TSF	30.51		Driefontein 3 TSF	72.76
	Venterspost N TSF	60.68		Driefontein 4 TSF	165.66
	Leeudoorn TSF	186.27		Driefontein 5 TSF	67.72
	Total	**437.21**		Libanon TSF	93.64
Cooke Mining Right Area	Millsite Complex	315.47		**Total**	**572.19**
	Cooke TSF	178.99	Ezulwini Mining Right Area	Ezulwini South	157.99
	Total	**494.46**	Potential future TSFs[4]	South shaft and Twin shaft TSFs	107.66

1.3.1.4 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 WBT, North Block Thickener (NBT) and Cooke Thickener);
- Thickened slurry pipeline (from the WBT, NBT 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).

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

1.3.1.5 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.

1.3.1.6 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 5). The Plant will be developed in phases to treat eventually up to 4 Mt/m of historical tailings and current underground arisings. The CPP will eventually comprise (Plan 6):

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

1.3.1.7 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) the 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 of the

region. The RTSF will consolidate and mitigate the potential impacts of the historical TSFs currently scattered throughout the West Rand.

1.3.1.8 Return Water Dam

The design and management of the RTSF 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 3.5 million m^3. To limit seepage of process water, the RWD will be lined with a geocomposite liner consisting of a geomembrane underlain by a 300 mm thick layer of clayey material won from site. A seepage collection system will also be provided to intercept and identify any leakage.

1.3.1.9 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 0.36 ha and will cater for the scope of the Ultimate Project.

Plan 5: CPP Location

Plan 6: CPP Layout

Plan 7: RTSF Location

1.3.2 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 (50 k tonnes per month) for the extraction of uranium. 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 as part of the Initial Implementation of the WRTRP, whilst Plan 3 provides a visual overview of the project to be implemented in the various phased.

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 in 3 phases 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. Similarly the RTSF will be developed in two phases over the life of the project, but this application is for the entire RTSF footprint and will be assessed as such. The decision to take this approach, as opposed to authorising these components in stages as they are developed, is to provide the regulators and the public with an impact assessment that takes the whole project into consideration. This approach allows the authorities to make a decision based on a complete impact assessment as opposed to incremental applications for each new phase.

The primary activities to take place during the Initial Implementation of the WRTRP are listed in Table 1-3, with the pipeline routes outlined in Table 1-4.

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

Category	Activity
Driefontein Mining Right area	
Infrastructure	Pipeline Routes (water, slurry and thickened tailings).
	West block Thickener (WBT) and Bulk Water Storage Facility (BWSF) complex.
	Collection sumps and pump stations at the Driefontein 3 and 5 TSFs
Processes	Hydraulic reclamation of the Driefontein 3 and 5 TSFs.
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.
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 complex.
Kloof Mining Right area	
Infrastructure	Pipeline Routes (residual tailings).
	Central processing Plant (CPP) incorporating Module 1 floatation and gold plants and uranium, roaster and acid plants.
	The Regional Tailings Storage Facility (RTSF), RTSF Return Water Dam (RWD) and the Advanced Water Treatment Facility (AWTF). Collectively known as the RTSF complex.

Category	Activity
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.
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.
Electricity supply	Power supply from Kloof 1 substation to the CPP.
	Power supply from Kloof 4 substation to the RTSF and AWTF.
Cooke Mining Right area	
Infrastructure	Pipeline routes (water, slurry and thickened tailings).
	Cooke thickener and BWSF.
	Collection sumps and pump stations at Cooke TSF and Cooke 4 South TSF.
Processes	Abstraction of water from Cooke 1 shaft.
	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 TSF 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	Pipeline routes (water, slurry and thickened tailings).
Processes	Uranium extraction at Ezulwini (tailings to Ezulwini North Dump).
	Abstraction of water from Cooke shaft.
Pumping	Pumping water from Cooke 4 Shaft to the C4S TSF for reclamation.
	Pumping slurry from the TSF sump to the CPP.
Electricity supply	Power supply from Ezulwini plant to the C4S TSF

Table 1-4: Pipeline Route Lengths

Name	Length (m)	Type
Driefontein 3 TSF to WBT	7 665	Slurry Pipeline -dilute
Driefontein 5 TSF to Driefontein 3 TSF	6 646	Slurry Pipeline -dilute
WBT to CPP	17 029	Slurry Pipeline -thickened
Cooke TSF to Cooke Thickener	2 245	Slurry Pipeline-dilute
Cooke Thickener to CPP	33 129	Slurry Pipeline-thickened-existing approved route GDARD,NNR
Ezulwini South TSF to CPP	18 915	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	1 218	Water Pipeline – existing approved route GDARD , NNR
Cooke 4 shaft to C4S TSF	1 218	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 Kloof Mining Right to include the Initial Implementation activities occurring within or associated with this right.

1.3.3 Amendment to the Driefontein Mining Right

This application and EIA Report relates to the required environmental authorisations for initial implementation relevant to the Driefontein Mining Right area which entails:

- The inclusion of Driefontein No 4 TSF into the Driefontein Mining Right Area;
- The reclamation of Driefontein 3 and 5 TSFs;
- The construction and operation of the WBT and BWSF; and
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

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

Table 1-5: Driefontein Activities

Category	Activity
Infrastructure	Pipeline Routes (water, slurry and tailings).
	West Block Thickeners (WBT)
	West Block Bulk Water Storage (BWS) Facility
Processes	Hydraulic reclamation of the TSFs (which include temporary storage of the slurry in a sump).
Pumping – Slurry, Tailings and water	Pumping water from K10 shaft to the BWSF located next to the WBT.
	Pumping water from the BWSF to the Driefontein TSFs that will be reclaimed.
	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 complex.

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 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

SGL holds a Mining Right for Driefontein (which includes Driefontein 1, 2, 3 and 5 TSFs and Libanon TSF), with reference GP 51 MR, in respect of the properties listed in Table 3-1. The additional properties to be included into the Driefontein Mining Right area in respect of Driefontein 4 TSF are provided in Table 3-2.

Table 3-1: Farms Associated with the Driefontein Mining Right Area

Farms			
Oog Van Wonderfontein 110 IQ	Rietfontein 519 IQ	Zuurbult 240 IQ	Leeuwpoort 356 IQ
Oog Van Elandsfontein 114 IQ	Springbok Kraal 359 IQ	Uitval 280 IQ	Davonia 363 IQ
Libanon or Witkleigat 283 IQ	Foch 150 IQ	Planvlakte 291 IQ	Driefontein 113 IQ
Blyvooruitzicht 116 IQ	Waterval 174 IQ	Doornkop 239 IQ	Middelvlei 255 IQ
Hemsbokfontein 290 IQ	Strydpan 243 IQ	Witpoortje 245 IQ	Vlakfontein 238 IQ
Weltevreden 357 IQ	Gemspost 288 IQ	Kraalkop 147 IQ	Rietvalei 241 IQ
Wildebeestkuil 360 IQ	Waterpan 292 IQ	Venterspost 284 IQ	Nelshoogte 286 IQ
Doornkloof 347 IQ	Jachtfontein 344 IQ	Bekkersdal 294 IQ	

Table 3-2: Farms Associated with the Driefontein Mining Right Area Expansion

Farms		
Portion 2 of Driefontein 113 IQ	Remaining Extent of Vlakplaats 112 IQ	Portion 6 of Vlakplaats 112 IQ

Once the Driefontein 3 and 5 TSFs have been depleted the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 and the Libanon TSF, will be processed through the CPP. The amendment of the Driefontein Mining Right to include new activities and infrastructure will entail development on a number of properties (Plan 8). The aspects of the Initial Implementation of the WRTRP relevant to the Driefontein Mining Area and the properties these will take place on are detailed in Table 3-3 to Table 3-7.

Table 3-3: WBT and BWSF Complex Property Description

Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 10 of Driefontein 355	T0IQ00000000035500010
	Portion 11 of Driefontein 355	T0IQ00000000035500011
Application Area (Ha):	3 ha	
Magisterial District:	Merafong City Local Municipality Oberholzer Magisterial District	
Distance and direction from nearest town:	12 km east of Carletonville.	

Table 3-4: Driefontein 3 TSF Property Descriptions

Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 1 of Driefontein 113	T0IQ00000000011300001
	Portion 2 of Driefontein 113	T0IQ00000000011300002
Application Area (Ha):	135.15 ha	
Magisterial District:	Merafong City Local Municipality Oberholzer Magisterial District	
Distance and direction from nearest town:	4.5 km southeast of Carletonville.	

Table 3-5: Driefontein 4 TSF Property Description

Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Remaining Extent of the farm Vlakplaats 112	T0IQ00000000011200000
Application Area (Ha):	165.66 ha	
Magisterial District:	Merafong City Local Municipality Oberholzer Magisterial District	
Distance and direction from nearest town:	4.9 km northeast of Carletonville.	

Table 3-6: Driefontein 5 TSF Property Descriptions

Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 6 of Blyvooruitzicht 116	T0IQ00000000011600006
	Portion 7 of Blyvooruitzicht 116	T0IQ00000000011600007
	Portion 8 of Blyvooruitzicht 116	T0IQ00000000011600008
	Portion 9 of Blyvooruitzicht 116	T0IQ00000000011600009
	Portion 24 of Blyvooruitzicht 116	T0IQ00000000011600024
Application Area (Ha):	118.81 ha	
Magisterial District:	Merafong City Local Municipality Oberholzer Magisterial District	

Distance and direction from nearest town:	3.7 km southeast of Carletonville.

Table 3-7: Pipeline Routes Property Descriptions

Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 70 of the farm Leeuwpoort 356	T0IQ00000000035600070
	Portion 71 of the farm Leeuwpoort 356	T0IQ00000000035600071
	Portion 6 of the farm Blyvooruitzicht 116	T0IQ00000000011600006
	Portion 7 of the farm Blyvooruitzicht 116	T0IQ00000000011600007
	Portion 8 of the farm Blyvooruitzicht 116	T0IQ00000000011600008
	Portion 24 of the farm Blyvooruitzicht 116	T0IQ00000000011600024
	Remaining Extent of the farm Uitval 280	T0IQ00000000028000000
	Portion 8 of the farm Uitval 280	T0IQ00000000028000008
	Portion 9 of the farm Uitval 280	T0IQ00000000028000009
	Remaining Extent of the farm Driefontein 355	T0IQ00000000035500000
	Portion 1 of the farm Driefontein 355	T0IQ00000000011300001
	Portion 4 of the farm Driefontein 355	T0IQ00000000035500004
	Portion 5 of the farm Driefontein 355	T0IQ00000000035500005
	Portion 8 of the farm Driefontein 355	T0IQ00000000035500008
	Portion 10 of the farm Driefontein 355	T0IQ00000000035500010
	Portion 11 of the farm Driefontein 355	T0IQ00000000035500011
	Portion 15 of the farm Driefontein 355	T0IQ00000000035500015
	Portion 21 of the farm Driefontein 355	T0IQ00000000035000021
	Portion 22 of the farm Driefontein 355	T0IQ00000000035500022
	Remaining Extent of the farm Doornkloof 348	T0IQ00000000034800000
	Portion 1 of the farm Doornkloof 350	T0IQ00000000035000001

	Portion 4 of the farm Doornkloof 350	T0IQ00000000035000004
	Portion 5 of the farm Doornkloof 350	T0IQ00000000035000005
	Portion 6 of the farm Doornkloof 350	T0IQ00000000035000006
	Portion 12 of the farm Doornkloof 350	T0IQ00000000035000012
	Portion 13 of the farm Doornkloof 350	T0IQ00000000035000013
	Portion 21 of the farm Doornkloof 350	T0IQ00000000035000021
	Portion 22 of the farm Doornkloof 350	T0IQ00000000035000022
	Portion 33 of the farm Doornkloof 350	T0IQ00000000035000033
	Portion 34 of the farm Doornkloof 350	T0IQ00000000035000034
	Portion 73 of the farm Doornpoort 347	T0IQ00000000034700073
	Remaining Extent of the farm Libanon or Witkleigat 283	T0IQ00000000028300000
	Remaining Extent of the farm Leeudoorn 351	T0IQ00000000035100000
	Portion 11 of the farm Rietfontein 349	T0IQ00000000034900011
	Portion 12 of the farm Rietfontein 349	T0IQ00000000034900012
	Portion 13 of the farm Rietfontein 349	T0IQ00000000034900013
	Portion 14 of the farm Rietfontein 349	T0IQ00000000034900014
	Portion 35 of the farm Rietfontein 349	T0IQ00000000034900035
	Portion 36 of the farm Rietfontein 349	T0IQ00000000034900036
	Portion 47 of the farm Rietfontein 349	T0IQ00000000034900047
Application Area (Ha):	8 500 ha	
Magisterial District:	Oberholzer Magisterial District (Driefontein and Blyvooruitzicht) Potchefstroom Magisterial District (Wildebeestkuil) Vanderbijlpark Magisterial District(Cardoville and Doornpoort) Westonaria Magisterial District (Doornkloof, Leeudoorn, Libanon, Modderfontein, Uitval and Waterpan)	

Distance and direction from nearest town:	15 km SE of Westonaria

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.

Sections of the water supply and slurry pipelines route, as well as the CPP and RTSF, are located within the Westonaria City Local Municipality, with the Driefontein Mining Right area falling within the Merafong City Local Municipality. Land uses in the Merafong City and Westonaria LMs can be categorised in three main divisions, i.e. agriculture, mining and residential. Agriculture is the dominant land use in both LMs, followed by mining and residential land uses, with the latter accounting for less than 10% of the total land area of the LMs. The area includes a large number of both historical and existing mining activities. The municipalities' 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.

As indicated in Plan 1, the Driefontein Mining Right area is situated north and west of the N12 National Road regional road and east of Carletonville.

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 Driefontein Mining Right Area including the following:

- The inclusion of Driefontein 4 TSF into the Driefontein Mining Right Area;
- The reclamation of Driefontein 3 and 5 TSFs;
- The construction and operation of the WBT and The BWSF; and

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

The activities listed above are described in more detail in Section 5.2. The listed activities specific to the construction and operation of the CPP and RTSF are included as part of the Kloof Mining Right area applications.

5.1 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 which 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. The Scoping Report was submitted to the DMR on 13 November 2015;;
- 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- ▪ with an internal diameter of 0.36 metres or more; or ▪ with a peak throughput of 120 litres per second or more.	Transportation of water from K10 Shaft to the BWSF. The pipeline will have a diameter of at least 0.36 m with a daily throughput of approximately 230 litres per second.	The total aerial extent of envisaged pipelines will cover approximately 8 500 m^2.
Activity 10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes- ▪ with an internal diameter of 0,36 metres or more; or ▪ with a peak throughput of 120 litres per second or more.	Pipelines will be installed to convey slurry and process water between the Driefontein 3 and 5 TSFs and the WBT, as well as the WBT and the CPP.	
Activity 11	The development of facilities or infrastructure for the transmission and distribution of electricity- ▪ 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. The electrical switch gear will be 132 kV (transmission will be either 6.6 kV or 11 kV).	The total aerial extent of envisaged power lines will cover approximately 325 ha.

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 12	The development of- ▪ infrastructure or structures with a physical footprint of 100 square metres or more where such development occurs- ▪ within a watercourse; ▪ in front of a development setback; or ▪ if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The pipeline routes traverse watercourses. There are approximately 25 watercourse crossings.	250 m^2
Activity 19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- ▪ a watercourse.	Pipelines routes cross approximately 25 watercourses.	250 m^2
Activity 24	The development of a road with a reserve wider than 13.5 m, or where no reserve exists, the road is wider than 8 m.	Additional roads to be constructed to allow for access to new infrastructure such as the WBT and BWSF complex.	There will be approximately 19 km of roads.
Activity 27	The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation.	Clearing of land for the construction of the WBT and BWSF complex.	Approximately 3 ha will be cleared for the WBT and BWSF complex.

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- ▪ has an internal diameter of 0.36 metres or more; or ▪ has a peak throughput of 120 litres per second or more; and ▪ where the facility or infrastructure is expanded by more than 1 000 metres in length; or where the throughput capacity of the facility or infrastructure will be increased by 10% or more.	Upgrade of pipelines at K10 Shaft to pump water to the BWSF for use for the reclamation of the Driefontein 3 and 5 TSFs.	The total aerial extent of envisaged pipelines will cover approximately 8 500 m^2.
Listing notice GNR 984 (Full Scoping and EIA) (NEMA)			
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.	Applications for authorisation will need to be submitted in terms of the NNRA, NWA and NEM: AQA.	N/A
Activity 7	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods in liquid form, outside an industrial complex, using pipelines exceeding 1 000 m in length with a throughput capacity of more than 50 m^3 per day.	1 Mt/month of reclaimed slurry, containing traces of radioactive material, and will be transported by pipelines to the CPP.	The total aerial extent of envisaged pipelines will cover approximately 8 500 ha.

Listed Activity		Description of Activity	Aerial extent of the activity
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 of TSFs, or residue deposits, requires a Mining Right in accordance with the MPRDA. A Section 102 Amendment will be applied for to include Driefontein 4 TSF into the Driefontein Mining Right.	Driefontein 3 and 5 TSFs are a combined 140.48 ha in extent, with Driefontein 4 TSF being 165.66 ha in extent.
Activity 25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.	Operation of the AWTF.	3 600 m^2

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 9):

- The inclusion of Driefontein 4 TSF into the Driefontein Mining Right Area;
- The reclamation of Driefontein 3 and 5 TSFs;
- The construction and operation of the WBT 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 such as pipelines, WBT, 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 and 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.

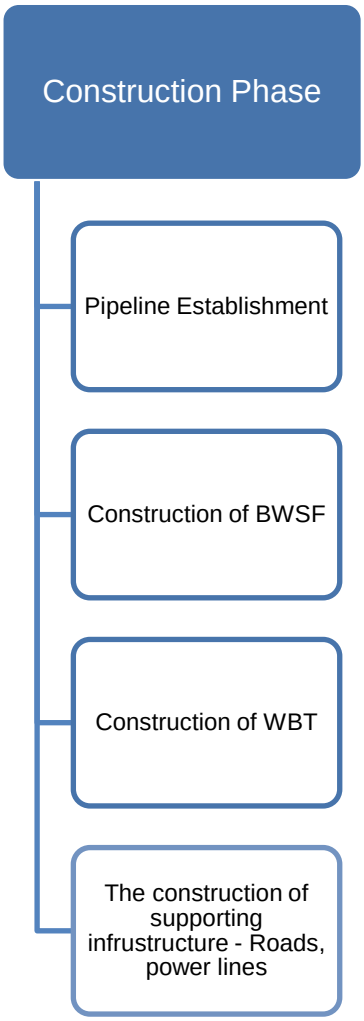

Figure 5-1: Summary of Construction Activities - Driefontein

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 abstraction of water from K10 shaft, 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.

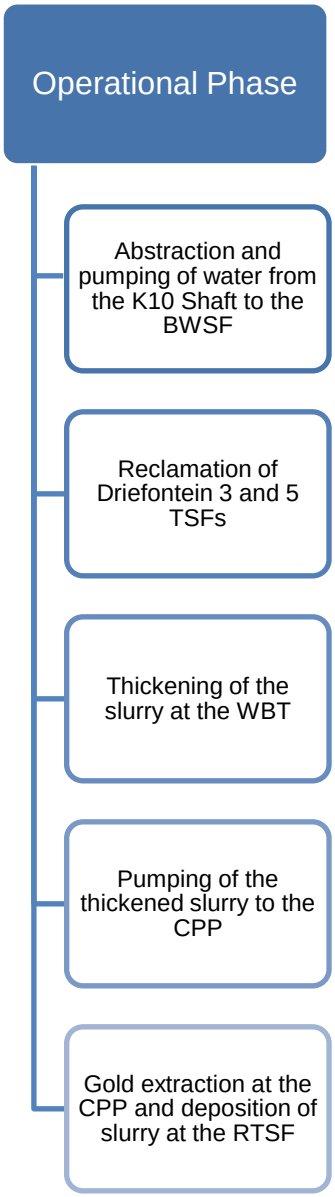

Figure 5-2: Main Activities Associated with the Operational Phase of the Project – Driefontein

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 Driefontein Mining Right area will be extended to include Driefontein 4 TSF.

Plan 2 shows the infrastructure and the Mining Right area liable for it.

5.2.1 Water from K10 Shaft and Bulk Water Storage Facility

A number of water sources have been identified, from which water can be supplied to the surface reclamation operations, one such source being the K10 Shaft[5], located just west of Westonaria. 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 abstracted and pumped to the BWSF for temporary storage in two cylindrical flat bottom tanks, each with a volume of 2 000 m^3, before being pumped for use during the reclamation activities at Driefontein 3 and 5 TSFs. The BWSF is located adjacent to the R501 regional road, approximately 12 km east of Carletonville and 8.6 km west of K10 Shaft and within the WBT and BWSF complex.

Once the impacted mine water has been used in the hydraulic reclamation process, the slurry will eventually find its way to the RTSF. As water builds up in the RTSF it will be drained to the RWD and the option to treat it through an advanced water treatment facility will be investigated. The water will then be treated to potable standards (SANS 241:2011), depending on the final use.

The BWSF and water pipelines from K10 Shaft are illustrated in Plan 4b, with the water pipelines summarised in Table 5-2. The alternative pipeline routes considered are provided in Plan 9.

Table 5-2: Water Supply Pipelines

Name	Length (m)	Type
K10 Shaft to BWSF	10 477	Water Pipeline
BWSF to DRI3	7 699	Water Pipeline
BWSF to DRI5	14 168	Water Pipeline

5.2.2 Reclamation of Driefontein Tailings Storage Facilities

Driefontein 3 TSF will be reclaimed initially, followed by Driefontein 5 TSF, at a rate of 1Mt/month for a period of 11 years. The TSFs will be reclaimed using a water hydraulic monitoring gun; the TSFs will be hydraulically reclaimed in nominal 12 to 15 m benches until the entire TSF has been reclaimed to the natural ground level. The hydraulic monitoring gun will direct pressurised water towards the face of the TSF benches, where the tailings material will be broken from the TSF. The mixing of the tailings material and water used as part of the hydraulic mining will result in the formation of a slurry, which will flow through open channels and over screens to remove vegetation and unwanted oversized material, and into a temporary sump.

[5] The abstraction of water from K10 Shaft is part of the Kloof Mining Right area application.

The reclaimed slurry will be pumped via pipelines to the WBT where flocculants will be added to thicken the slurry. The thickened slurry will then be transported by pipelines to the CPP for gold, uranium and sulfur extraction, with the resultant tailings deposited on the RTSF. The location of the Driefontein 3 and 5 TSFs and the slurry pipelines are provided in Plan 4a.

The water that will be used for the hydraulic reclamation will be transported to the TSFs from the K10 Shaft, via the BWSF. Once the Driefontein 3 and 5 TSFs have been reclaimed, the TSF footprints will be rehabilitated to a suitable end land use and according to the Closure Plan to be compiled for Driefontein Mining Right area. Driefontein 3 TSF is 72.76 ha in extent, with Driefontein 5 TSF being 67.72 ha in extent.

SGL also intend to incorporate Driefontein 4 TSF into the Driefontein Mining Right. The Driefontein 4 TSF is located 2 km north of the Driefontein 3 TSF, with the Mining Right boundary located 0.5 km to the southeast of Driefontein 4 TSF. The reclamation of Driefontein 4 TSF will be subject to a future application following the complete removal of Driefontein 3 and 5 TSFs, although the inclusion of the TSF into the Driefontein Mining Right will be included as part of the Section 102 Amendment.

5.2.3 Thickening of the Slurry at the West Block Thickener and Pumping to the Central Processing Plant

The WBT is located adjacent to the BWSF along the R501 regional road and 11 km northwest of the proposed CPP (Plan 4a). The slurry from the Driefontein 3 and 5 TSFs will be pumped via pipelines to the WBT. The slurry pipelines will be located adjacent to and within the same servitudes of the water supply pipelines from the BWSF, as illustrated in Plan 4a. The WBT will add flocculants (polyacrylamide flocculants) to thicken the slurry which ensure a consistent slurry density, optimising the efficiency of the CPP and volume of water required, as well as minimising pumping costs. The thickened slurry pipeline will transport the thickened slurry to the CPP for gold, uranium and sulfur extraction. The WBT and BWSF complex will have a thickened tailings storage tanks with a storage capacity of 2 200 m^3 which will provide a 1 hour residence time. Any overflow from the WBT will be pumped to the BWSF and reused in the reclamation process.

A summary of the slurry and thickened slurry pipelines are listed in Table 5-3.

Table 5-3: Slurry Pipelines Summary

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

5.2.4 Pump Stations

Pump stations or booster pump stations will be constructed to convey water and slurry as required.

5.2.5 Pipeline Routes (Driefontein Mining Right area only)

Existing mine servitudes will be utilised as far as possible for the overland piping. The following pipeline routes are relevant to this application (refer to Plan 4b and Table 5-4 for the preferred pipeline routes and Plan 9 for the alternatives considered):

- Water pipeline from K10 shaft to the BWSF and to Driefontein 3 and 5 TSFS;
- Slurry pipeline from the Driefontein 3 and 5 TSFs to the WBT; and
- Thickened slurry pipeline from the WBT to the CPP.

The total pipelines route length for Driefontein is 64 158 m. The pipeline routes have been developed to take cognisance of the existing servitudes, the location of the TSFs and the locations of the proposed infrastructure, such as the CPP, RTSF and WBT. In addition, sensitive environments have been taking into consideration, as well as mine owned land and already disturbed areas.

Table 5-4: Summary of Pipeline Route Lengths

Name	Length (m)	Type
K10 Shaft to BWSF	10 477	Water Pipeline
BWSF to DRI3	7 699	Water Pipeline
BWSF to DRI5	14 168	Water Pipeline
DRI3 to WBT	7 665	Slurry Pipeline -dilute
DRI5 to DRI3	6 646	Slurry Pipeline -dilute
WBT to CPP	17 473	Slurry Pipeline -thickened

Plan 9: Pipelines Alternatives

6 Item 3(e): Policy and Legislative Context

This section (Table 6-1 and Table 6-2), although also applicable to the Ultimate WRTRP, relates specifically to the Driefontein Mining Right in the context of this EIA Report. It 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, provincial and local 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 is being undertaken to determine the impacts associated with the project. As part of the EIA process, mitigation measures and monitoring plans have been recommended 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	The EIA process has been undertaken in accordance with the principles of Section 2 of NEMA as well as with the EIA 2014 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 has been identified that a full EIA process is required for the project. An application for the listed activities has been submitted to the DMR who is the relevant Competent Authority

Applicable legislation and guidelines used to compile the report	Reference where applied
04 December 2014 and promulgated on 08 December 2014 (the EIA 2014 Regulations). Together with the EIA 2014 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 NEMA, as amended.	in terms of this application for Environmental Authorisation.
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.	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, 1998 (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. **GN R704 National Water Act, 1998 (Act No. 36 of 1998)** 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:	An Integrated Water Use Licence Application (IWULA) and Integrated Water and Waste Management Plan (IWWMP) has been compiled and submitted to the Department of Water and Sanitation (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

Applicable legislation and guidelines used to compile the report	Reference where applied
▪ 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.	may detrimentally impact on a water resource; ▪ S21 (i) – Altering the bed, banks, course or characteristics of a watercourse; ▪ 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.
<u>Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) (MPRDA)</u> A Mining Right Application (MRA) 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.	This EIA Report, which relates specifically to the Driefontein Mining Right (although it is generally applicable to the WRTRP as a whole) has been compiled in accordance with the MPRDA read with the EIA 2014 Regulations.
<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 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;	As part of this project, a flora, fauna, wetlands and aquatic assessment has 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 project.

Applicable legislation and guidelines used to compile the report	Reference where applied
▪ 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).	
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) 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 CPP and RTSF and respective TSFs. 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 the EMPr. An Atmospheric Emissions Licence has been applied for in terms of Section 21 of the NEM:AQA. The following activities have been applied for: ▪ Category 4, sub-category 4.16: Production of acid; ▪ Category 4, subcategory 4.17: Gold processing; and ▪ Category 7, sub-category 7.2: Production of acids.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) 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 Gauteng Provincial Heritage Resources Authority (PHRA-G), 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) has been submitted, as part of this report, to the Gauteng Provincial Heritage Resources Authority (PHRA-G) and the South African Heritage Resources. Furthermore, a Heritage Impact Assessment (HIA) has also been undertaken.
The Provincial Heritage Resources Authority Gauteng (PHRA-G) The PHRA-G is responsible for the identification, conservation and management of heritage resources throughout the	An HIA has been undertaken in respect of these regulations to determine whether a permit will be required as a result of the proposed

Applicable legislation and guidelines used to compile the report	Reference where applied
province. The Agency was established in terms of the NHRA.	activities.
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 NEM:AQA also provides for noise control.	A Noise Impact Assessment has been undertaken as part of the EIA process to understand the potential impacts as a result of the proposed activities to be undertaken.

Table 6-2: Local By-Laws

Applicable legislation and guidelines used to compile the report	Reference where applied
Spatial Planning and Land Use Management Act, 2013 (Act No 16 of 2013) (SPLUMA) SPLUMA is a framework act for all spatial planning and land use management legislation in South Africa and came into force on 1 July 2015. Municipalities will as a result of the new legislation be solely responsible for processing and dealing with land use applications and the appeals relating thereto. Municipalities will have 5 years from commencement of the Act to adopt and approve a single land use scheme for all of its municipal area. The land use scheme must include appropriate categories of land use zoning and regulations for the entire municipal area, including areas not previously subject to a land use scheme. Rezoning will be required for land that was previously excluded from town planning schemes and zoned as “undetermined”.	This Act will be relevant in terms of the required re-zoning applications related to this project. Mining companies will have to rezone mine property to comply with any new land use scheme of the Municipality, which would have an implication on rates and taxes after rezoning. Notwithstanding that land was previously zoned as mining land (such as Kloof), it may fall within a new land use scheme once this is developed by the municipality.

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, feeing in excess of 300 ha of occupied 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 (Gross Domestic Product per Region), 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 has positive impacts for downstream water uses in terms of both water quality and water quantity.

7.1 Driefontein Specific Components

The activities and infrastructure associated with the Driefontein Mining Right area, as well as the activities associated with the remaining Mining Right areas, are critical for the success of the WRTRP. The WRTRP requires the implementation of all of the proposed activities associated with each Mining Right area; should one aspect of the proposed WRTRP not be approved, the WRTRP would not go ahead. To realise the need and desirability of the WRTRP, the activities associated with the Driefontein Mining Right area are required as discussed below.

7.1.1 Bulk Water Storage Facility and West Block Thickener

A BWSF is required to store water for use in the reclamation activities. Mine affected water from K10 Shaft will be abstracted, pumped via pipelines and stored in the BWSF. The storage of water in the BWSF will ensure that there is adequate supply for use during the reclamation activities. By utilising mine affected water, SGL eliminates the need to use Rand Water or other high quality water sources.

The WBT is required to thicken the reclaimed slurry using flocculants, before pumping the thickened slurry to the CPP for processing. The thickeners provide slurry of consistent density to the CPP which is critical in the optimisation of the CPP and the amount of water

used throughout pipeline circuit. The consistent density of the thickened slurry will also minimise pumping costs associated with the activity.

The need for the BWSF and WBT are a necessity for the efficiency of the reclamation, pumping and processing of the reclaimed TSFs. The BWSF and WBT have been located adjacent together to optimise the construction footprints, as well as optimising the operational layout. The BWSF and WBT are located approximately midway between the K10 Shaft where water will be abstracted and the Driefontein 3 TSF, as well as being located at the servitude where thickened slurry pipeline heads southwards towards the CPP. The BWSF and WBT are located adjacent to the R501 regional road within open fields.

The R501 regional road extends from the N12 national highway in a westwards direction to Driefontein 3 TSF, before curving slightly south-westwards to Carletonville. Approximately 7 km west of the N12 national highway and R501 regional road intersection, the R501 arcs northwards before continuing its existing course westwards; the arc is to avoid depressions and sink holes in the land scape. SGL intends to construct the BWSF and WBT within the unoccupied open areas and adjacent to the depressions and sink holes. The presence of the depressions and sink holes have limited the land use adjacent to the R501 regional road arc and the construction and operation of the BWSF and WBT will make use of this impacted land use potential. It is unlikely that significant development of infrastructure will take place within and adjacent to the depressions and sink holes and the use of such an area for the development is the best practicable environmental option for the location of the BWSF and WBT.

The BWSF and WBT are essential for the reclamation of Driefontein 3 and 5 TSFs, as well as future TSFs associated with the Driefontein Mining Right area. The needs and desirability associated with the reclamation of the TSFs is discussed below.

7.1.2 Reclamation of Driefontein 3 and 5 TSFs

The reclamation of the TSFs is fundamental to the success of the Ultimate Project and Initial Implementation. The reclamation of the TSFs will mobilise tailings material from the TSFs which will be processed to extract gold, uranium and sulfur. 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.

Driefontein 3 and 5 TSFs are located approximately 4.75 km and 4.2 km to the southeast and south of Carletonville, respectively, and occupy a combined 140.48 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 in and surrounding Carletonville. 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 in their entirety, the TSF footprints will be rehabilitated to a suitable end land use and according to the Closure Plan for the sites. The complete reclamation and rehabilitation of the TSF footprints will free 140.48 ha of occupied land within 5 km of Carletonville for an appropriate land use. The reclamation of the TSFs will remove a permanent source of air pollution and groundwater and surface water contamination due to the removal of uranium and sulfur, reducing the risk of AMD; the RTSF is proposed to be located on impenetrable bedrock and away from sensitive dolomitic aquifers.

Mining activities are the dominant sector in the Merafong City Local Municipality, as well as Westonaria Local Municipality, however, the sector has been experiencing a steady decline since 2005 (WRDM IDP, 2013/2014). Although the local municipalities are aiming to diversify the economy with the development of business districts and industrial areas, the predominant economic activity is still mining. The West Rand District still remains significantly dependant on mining activities, both in terms of direct economic contribution and through employment, with mining sector contributing 40.3% to the District GDP in 2010. The WRDM identifies the importance of the mining sector in the Merafong City and Westonaria Local Municipalities and aims to utilise the mining sector as a catalyst for developing other economic activities by strengthening local backward and forward linkages (WRDM IDP, 2013/2014). The reclamation activities of Driefontein 3 and 5 TSFs will last for a period of 11 years, with future reclamation of the remaining TSFs (Driefontein 1, 2 and 4 TSFs) occurring over a period of 23 years, aligning with the District Municipality's strategy to align economic activities based on mining.

In addition, the WRDM aims to improve the environment of the District, through key strategic objectives to "become the Greenest District in South Africa" (WRDM IDP, 2013/2014). The WRDM has identified the legacy of historic mining activities, acid mine drainage and mine dumps (TSFs) as particular challenges that result in environmental and socio-economic impacts, with the primary guiding elements to improve and rehabilitate mining areas (WRDM IDP, 2013/2014). The reclamation of the TSFs within the Driefontein Mining Right area aligns with the objectives of the IDP in that the pollution sources will be removed from their current locations on sensitive dolomitic aquifers and in proximity to sensitive receptors, as well as the footprints rehabilitated to a suitable end land use.

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

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing a project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the no-go alternative. Alternatives also help identify the activity with a reduced environmental and/or social impact.

With reference to the site plan provided in Plan 4 and the location of the individual activities on site, this section provides details of the alternatives considered for the infrastructure relevant to the Driefontein Mining Right area. The criteria used to assess the alternatives include:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

Alternatives in terms of the site location of key infrastructure were limited as SGL prioritised placing infrastructure not only on properties that they owned and/or fell within their current Mining Right areas, but also on properties and servitudes that made economic, environmental and social sense. Furthermore, it was crucial that infrastructure was to be placed within reasonable distances of the resources (i.e. historical TSFs) and the ultimate deposition site at the RTSF.

In addition to the above, a site selection process was undertaken in terms of the placement of the CPP as well as the RTSF. Essentially the site selection process considered not only environmental and social aspects, but also sensible economics as mentioned. The site selection process for the CPP and RTSF is detailed in the Kloof Mining Right area applications.

8.1.1 WBT and BWSF Complex

The alternatives associated with the WBT and BWSF are based around the location of the facilities. The WBT and BWSF have been located adjacent to each other to minimise the required footprints, as well as optimising and aiding in the operational and maintenance efficiency during the Operational Phase. The footprint of the WBT and BWSF complex has been optimised and the alteration of the footprint shape will reduce the operational efficiency. As a result, the block footprint has been utilised to select suitable locations. The considered alternatives are illustrated in Plan 10.

The WBT and BWSF complex has been located adjacent to the R501 regional road, where the road alters direction and arcs to avoid depressions and sink holes in the landscape. The presence of the depressions and sink holes limits the potential land use adjacent to the R501 regional road arc. The identified location is also situated approximately midway between the K10 shaft abstraction point and Driefontein 3 TSF, as well as where the slurry pipeline heads southwards to the CPP, making the location the central point for the pipeline routes. An alternative location was identified further to the west of the current location but was excluded as the water pipeline and thickened slurry pipeline would share a servitude resulting in additional pumping costs; the preferred location is central to the water pipeline, slurry pipeline and thickened slurry pipeline, optimising the pumping requirements. Furthermore, SGL has proposed to construct a solar farm to generate electricity to the south of the R501 regional road arc, limiting the potential footprint locations to within the road arc. The site specific location will be investigated and selected based on potential sensitivities, as well as being based to avoid the depressions and sink holes.

A polyacrylamide flocculant will be used at the WBT.

8.1.2 Pipeline Routes

The pipeline routes and supporting infrastructure need to be located where the feed sources, current infrastructure, services and proposed infrastructure, including the WBT, CPP and RTSF, are located. Alternative pipeline routes between the WBT and the CPP and between the CPP and the RTSF have been identified. The pipeline routes have been designed to make use of the shortest possible routes, while making use of existing road servitudes. The use of the road servitudes will prevent additional impacts associated with the clearing and construction of the pipelines, as well as ensuring that the pipeline routes are easily accessible for maintenance requirements during the Operational Phase. The pipeline routes alternatives investigated are included in Plan 9.

Premised on the primary requirement of the pipe routes being selected being the shortest distance between the respective project activities, alternative routes were considered which capitalised on the following:

- Following existing routes where possible;
- Avoiding identified environmental sensitive areas, predominantly wetland areas;
- Crossing existing impacted land;

- Maximising mine owned land; and
- Assessing the operating costs pertaining to topographical considerations on pumping costs.

The preferred pipeline route was determined using the above criteria and overlaying sensitive areas, such as wetlands, over the proposed routes. The preferred pipeline route has been selected based on the location of current servitudes, and the locations and frequency of wetlands.

8.1.3 The Option of Not Implementing the Activity

In terms of the "No-go" option, the primary land uses for the region are mining, agriculture, and in some areas, residential. Should the project not be implemented, the Driefontein 3 and 5 TSFs will not be reclaimed; the TSFs will remain *in situ* and continue to impact on the environmental and social landscapes, as per the status quo. None of the envisioned benefits (described in Section 0) 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 existing impacts include:

- Leaching contaminants e.g. uranium and sulfur, into the sensitive dolomitic aquifers;
- Risk to community health and an increased potential for AMD in the Western Basin;
- Further weakening of the West Rand's economy as mining declines; and
- The AWTF will not be funded which will result in mine affected water not being treated potable standards (SANS 241:2011). This results in water quality resources continuing to be impacted upon by contaminated water, impacting on the receiving environment and downstream water users.

The infrastructure associated with the Driefontein Mining Right area, such as the WBT, BWSF and associated pipelines, roads and transmission lines are required for the efficient implementation of the WRTRP. If any component of it is not approved, the entire project would not proceed.

Plan 10: WBT and BWSF Complex Alternatives

8.2 Item 3(g)(ii): Details of the Public Participation Process followed

The 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 and Water:** Farmers associations and entities responsible for water management and/or regulation;
- **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 associated with the Driefontein Mining Right activities have been identified, as per Table 8-1, and included into the stakeholder database.

Table 8-1: Landowners and Properties Directly Affected by Driefontein Mining Right Area Activities

Farm	Portion	Registered Landowner
Uitval 280 IQ	RE	Far West Rand Dolomitic Water Association
Uitval 280 IQ	8	Far West Rand Dolomitic Water Association
Uitval 280 IQ	9	Far West Rand Dolomitic Water Association
Doornkloof 350 IQ	5	Far West Rand Dolomitic Water Association
Leeuwpoort 356 IQ	71	Far West Rand Dolomitic Water Association
Leeuwpoort 356 IQ	70	Far West Rand Dolomitic Water Association
Doornkloof 350 IQ	RE/6	Mamellong General Trading
Doornkloof 350 IQ	21	Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	RE/1	Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	22	Bergdeel CC
Libanon or Witkleigat 283 IQ	RE	Kloof Gold Mining Company Limited (Sibanye)
Driefontein 355 IQ	22	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	4	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	10	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	11	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	20	Murray and Roberts Cementation Pty Ltd
Driefontein 113 IQ	2	Driefontein Consolidated (Pty) Ltd (Sibanye)

Farm	Portion	Registered Landowner
Driefontein 355 IQ	15	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	21	Golden Dries Developments CC
Driefontein 355 IQ	5	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	8	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 113 IQ	RE\1	Driefontein Consolidated (Pty) Ltd (Sibanye)
Driefontein 355 IQ	R	Driefontein Consolidated (Pty) Ltd (Sibanye)
Blyvooruitzicht 116 IQ	6	Driefontein Consolidated (Pty) Ltd (Sibanye)
Blyvooruitzicht 116 IQ	7	Driefontein Consolidated (Pty) Ltd (Sibanye)
Blyvooruitzicht 116 IQ	24	Blywonder Trust Pty Ltd
Blyvooruitzicht 116 IQ	8	Nortjie Elizabeth Margaritha
Doornkloof 350 IQ	4	Kloof Gold Mining Company Limited (Sibanye)
Rietfontein 349 IQ	35	Kloof Gold Mining Company Limited (Sibanye)
Rietfontein 349 IQ	73	Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	R	Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	13	Kloof Gold Mining Company Limited (Sibanye)
Rietfontein 349 IQ	36	Kloof Gold Mining Company Limited (Sibanye)
Rietfontein 349 IQ	5	Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	12	Kloof Gold Mining Company Limited (Sibanye)
Leeudoorn 351 IQ		Kloof Gold Mining Company Limited (Sibanye)
Doornkloof 350 IQ	33	Kloof Gold Mining Company Limited (Sibanye)

Farm	Portion	Registered Landowner
Rietfontein 349 IQ	35	Kloof Gold Mining Company Limited (Sibanye)
Libanon or Witkleigat 283 IQ	R	Sibanye Gold Ltd

8.2.1.2 Adjacent Landowners

The various adjacent landowners associated with the Driefontein Mining Right area activities are reflected in Table 8-2 below.

Table 8-2: Adjacent Property Details Associated with the Driefontein Mining Right Area Activities

Farm	Portion	Registered Landowner
Uitval 280 IQ	6	Far West Rand Dolomitic Water Association
Uitval 280 IQ	5	Far West Rand Dolomitic Water Association
Uitval 280 IQ	4	Far West Rand Dolomitic Water Association
Driefontein 355 IQ	23	Corobrik Pty Ltd
Blyvooruitzicht 116 IQ	9	Blywonder Trust Pty Ltd
Driefontein 355 IQ	28	Eskom Holdings Ltd

8.2.1.3 Authorities

As indicated in Table 8-3, various authorities are listed who have been engaged during the pre-application phase.

Table 8-3: Authorities Engaged

Authority	Representative
Department of Water Affairs and Sanitation (DWS)	Ms Petunia Ramunenyiwa Acting Provincial Head
	Bashan Govender Water Quality Manager
Department of Mineral Resources (DMR)	Dimakatso Ledwaba Acting Regional Manager
	Jimmy Sekgale

Authority	Representative
	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 request to identify lands over affected farm portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Based on feedback from the Commission, there are land claims on the following properties:

- Portion 5 of Doornkloof 350 (associated with the Driefontein pipeline);
- Portion 70 of Leeuwpoort 356 (associated with the Driefontein pipeline); and
- Portion 71 of Leeuwpoort 356 (associated with the Driefontein pipeline).

8.2.3 Pre-Consultation with Interested and Affected Parties

A summary of consultation activities is provided in Table 8-4 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 8-4 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 8-4: 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 and feedback indicated there are no existing land claims thus far. Further feedback was received by means of written correspondence on Monday, 3 August 2015 which indicated there is land claims on Driefontein 355-IQ Portion 15 (Merafong Local Municipality); Doornpoort 347 Portion 30, 29, 2, 37 (Westonaria Local Municipality) which reside over the direct affected and adjacent land portions.	**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 8-5 details PP activities that will be undertaken as part of the Scoping Phase have been detailed.

Table 8-5: 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 Doornkloof 350 Ptn 5, Leeuwpoort 356 Ptn 71 and Leeuwpoort 356 Ptn 70. 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*	**Appendix D** Letter to announce availability of Scoping Report

Activity	Details	Reference in PP Report
Scoping Phase		
	comment and about the public comment period extension was sent to the full 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,	**Appendix D** Comment and Response Report.

Activity	Details	Reference in PP Report
Scoping Phase		
	6 October 2015 from 09:00 – 11:00. All the officials met at Lido Sand 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).	**Appendix D** 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-	**Appendix D** Announcement Letter.

Activity	Details	Reference in PP Report
Scoping Phase		
	documents/sibanye-gold-west-rand-tailings-retreatment-project/). ***(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 8-6 to Table 8-8.

Table 8-6: 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.)
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				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	

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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 8-7: 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 8-8: 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

The Air Quality Impact Assessment report is attached as Appendix E.

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 West Rand 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.

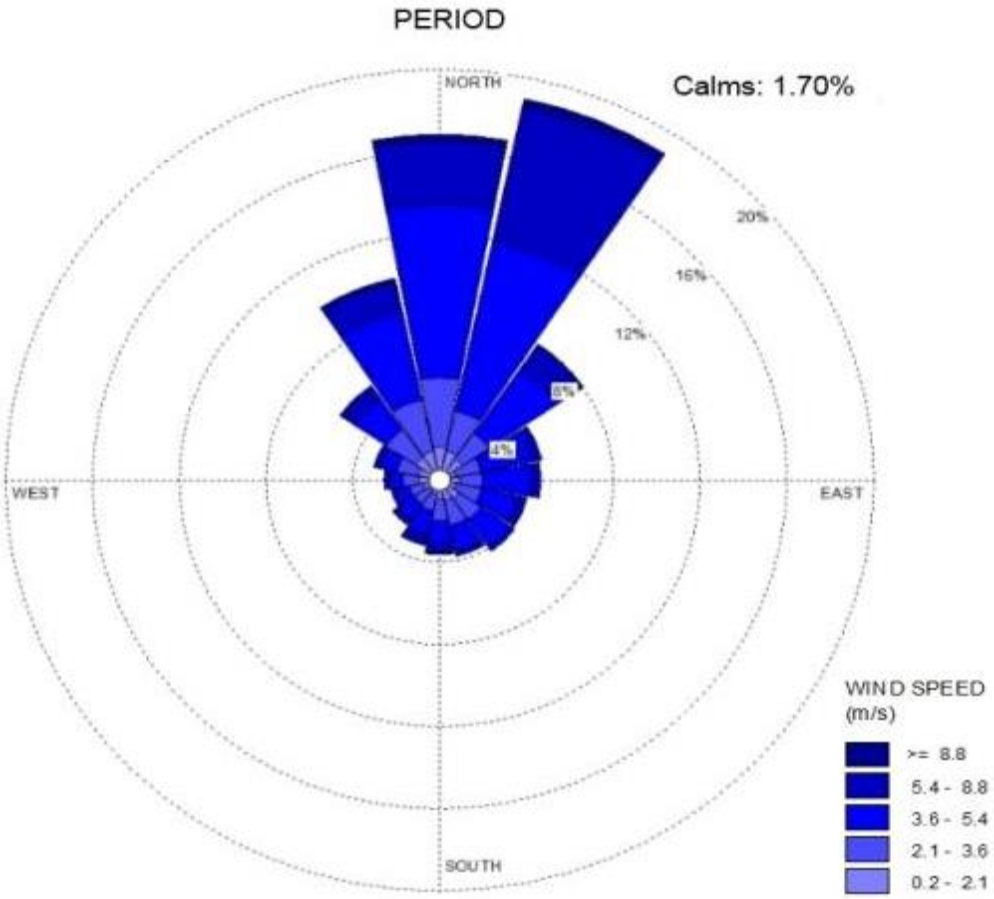


Figure 9-1: Surface Wind Rose for Sibanye Project Area

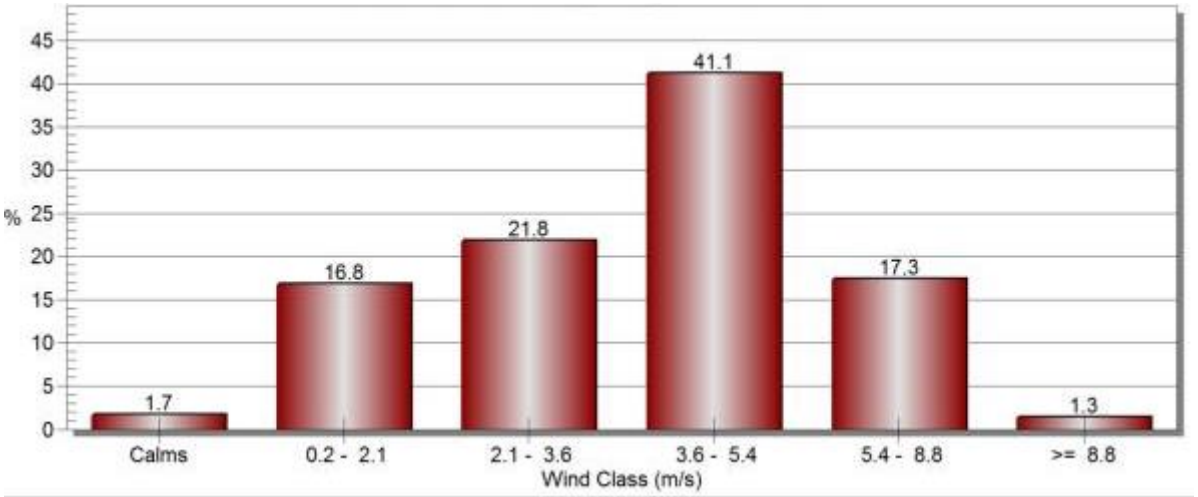


Figure 9-2: Wind Class Frequency Distribution

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 distribution of average daily maximum temperatures indicate that the average midday temperatures for Westonaria range from 16.6°C in June to 26.7°C in January. The region is the coldest during July with temperatures of 0.1°C on average during the night.

9.1.1.4 Relative Humidity

The data in Table 9-2 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 9-2: Monthly Average Relative Humidity Values

Relative Humidity (%)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly Maximum	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 Minimum	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 Average	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 9-3, for the three years data considered, the total monthly rainfall (maximum) and average total monthly rainfall are reported. The annual totals, maximum and average of 1 065 mm and 591 mm are reported.

Table 9-3: Total Monthly and Average Precipitation Values

Precipitation (mm)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Total Monthly Rainfall (Maximum)	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 9-4, the annual averages for maximum, minimum and mean monthly evaporation rates for Westonaria area are 263 mm, 113 mm and 178 mm, respectively. The highest monthly maximum evaporation (322 mm) occurred in October. The rate decreases to the lowest in 68 mm in April. The monthly minimum evaporation ranges between 68 mm (April) and 180 mm in October.

Table 9-4: Monthly Evaporation Rates for Westonaria

Evaporation (mm)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
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 Emissions and Particulates

Dust deposition results confirm that the area experiences dust deposition rates that are generally within the recommended residential limit specified by the National Dust Control Regulations (NDCR, 2013). Some sites were observed to be in violation of the recommended frequency of exceedance. At some sites, three or more sequential months are in exceedance, which violates the two permissible and non-sequential months allowed in a year (NDCR, 2013).

Dust deposition rates measured between 2010 and 2013 were compliant at all sites, with the exception of August and September 2010 (two sequential months that exceeded the standard - 600 mg/m^2/day (NDCR, 2013). In 2014, all sites (Venterspost Primary, Manyano Shaft, Ikamva Shaft Thuthukane Shaft, Bekkersdal Community Clinic and Hills Haven) were in violation of the permissible frequency of exceedance (two within a year). These sites exceeded the recommended standard for four sequential months. A detailed dust deposition baseline for the project area is provided as part of the Air Quality Impact Assessment report attached as Appendix E.

9.1.2 Geology

9.1.2.1 Regional Geology

The Karoo Supergroup is underlain by the Transvaal Supergroup, which is preserved in three structural basins. Of these basins, the Transvaal Basin is of consequence here and dates from 2 650 to 290 million years ago (*The Vaalian Erathem*). The Transvaal Supergroup comprises of the Pretoria and Chuniespoort Group formations.

The regional geology based on the 1:250 000 Geological Map 2626 West Rand series suggests that the lithographies are associated with the Pretoria Group. The Pretoria Group comprises of several formations including Rooihoogte, Timeball Hill, Boshoek, Hekpoort, Strubenkop, Daspoort and Silverton. The upper Pretoria Group is approximately 6 – 7 km thick and comprises of predominant mudrock alternating with quartzitic sandstone, significant interbedded basaltic-andesitic lavas and subordinate conglomerate, diamictite and carbonate rocks, all of which have been subject to low-grade metamorphism (Eriksson, Altermann & Hartzer, 2006). This group forms a prominent east-west trending ridges in the vicinity of the WRTRP. 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.

The Malmani Subgroup dolomite of the Chuniespoort Group has an inherent stromatolitic nature and has the potential for karst topography to develop. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Dissolution of these soluble Malmani dolomites created voids – karst caves – that filled with fine- to coarse-grained alluvium during periodic flooding. The alluvium may be represented by bodies of breccia, sandstone and siltstone.

The Witwatersrand Supergroup lithostratigraphy dates to 2 800 to 2 650 million years ago. The West Rand Group of the Witwatersrand Supergroup comprise of formations consisting of quartzite, shale and minor / subordinate conglomerate.

9.1.2.2 Local Geology

The geological map of the area indicates that the site is covered with Quaternary age sediment (Plan 11). However, the quaternary sediment was only found partially on site while shale and diabase outcrop are common.

The historical TSFs, with the exception of Driefontein 5 TSF, are located on dolomitic outcrops, with Driefontein 5 TSF located on Pretoria Supergroup formations which directly overlies the same dolomite of the historical TSFs. The region has been dewatered due to mining operations which has resulted in numerous sinkhole formations that continue to affect the terrain presently. The thickness of the dolomite ranges from the surface to 1 500 mbgl. The dolomitic rocks historically contained vast quantities of water but have been largely dewatered in targeted mining areas.

Plan 11: Project Area Geology

9.1.3 Groundwater

The Groundwater Impact Assessment report has been included as Appendix F.

9.1.3.1 Groundwater Level and Flow Direction

Groundwater levels in the dolomite aquifers are controlled by topography, permeability, mine compartmentalisation, recharge and dewatering. Groundwater levels in the shallow aquifer zones tend to mimic the topography, while more complex groundwater flow paths exist in the deep dolomitic and fractured aquifers. The groundwater table in the dolomitic aquifers is relatively flat and is influenced largely by compartmentalisation. Highly variable water level measurements were taken over short distances indicating the presence of groundwater barriers.

Pre-mining water levels were shallow and ranged from 1 mbgl to 30 mbgl and averages 14.49 mbgl. Nengovhela (2008) reported that dolomitic springs feeding into streams were common across the dolomitic area, but are now dry due to the dewatering activities associated with mining operations. The underground operations are kept dry to allow for safe mining conditions and the water levels are currently kept between 800 mbgl and 1 200 mbgl.

Local confined to semi-confined conditions exist where the dolomite is overlain by impermeable strata such as the Ventersdorp lavas or Karoo sediments. The water level in the shallow aquifers is different from that of the dolomite, if they are separated by an impermeable layer. Borehole yields in the shallow aquifer have been recorded between 0.5 litres and 2 litres per second, with yields in the dolomitic aquifers exceeding 5 litres per second.

The historical TSFs are not lined and drain directly into the dolomitic systems. The dewatering activities of the underground operations result in a low pressure within the dolomite which encourages drainage from the historical TSFs.

9.1.3.2 Groundwater Quality

The Driefontein Mining Right area consists of Driefontein 1, 2, 3, 4 and 5 TSFs, with Driefontein 1, 2 and 5 TSFs still in operation, Driefontein 5 TSF partially operational and 3 TSF was decommissioned in 2003. The historical TSFs are located on dolomitic aquifers and any seepage from the TSFs is expected to migrate downwards into the aquifers. Monitoring data indicates elevated concentrations of sulfate, TDS and nitrate in the groundwater which are all typical constituents associated with contamination emanating from gold mining areas. The pH ranges from 4.1 to 8 and is indicative of AMD impacts associated with seepage from existing tailings and surface mining facilities; only Driefontein 1 TSF shows an overall neutralising capacity according to geochemical testing conducted by the Institute for Groundwater Studies (IGS, 2008).

The groundwater in the vicinity of Driefontein 3 TSF is classified as Class I and Class II according to the SANS 241:2011 drinking water standards, with boreholes to the north of the TSF classified as Class II due to increased TDS values. Driefontein 5 TSF is contaminated with sulfate, TDS, calcium, manganese and chloride, with pH values showing a more alkaline signature than the groundwater for the remaining TSFs with a pH between 7 and 9.

9.1.4 Soils

A Soils Impact Assessment report has been included as Appendix G.

9.1.4.1 Land Type

The land type data for the Ultimate Project area includes 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.

The soils associated with the respective land types are summarised in Table 9-5, with the land type for the project area illustrated in Plan 12.

Table 9-5: Dominant Land Types and Slopes within the WRTRP 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 12: Land Types

9.1.4.1.1 Driefontein Mining Right Area Soil Forms

Land type data was used to determine the soil forms for the areas specific to the Driefontein Mining Right area activities. The Driefontein 3 TSF is located within the Ab7 land type, with the Driefontein 5 TSF located within land type Fb15. The Ab land type is dominated by feely draining deep red soils of the Hutton soil form, with shallow rocky soils, such as Mispah soil forms, dominating the Fb land type.

Similarly, the pipeline route between the Driefontein 5 TSF and Driefontein 3 TSF is associated with land type Fb15 (shallow rocky soils such as Mispah) and crosses into Ab7 land type (deep, well drained red soils such as Hutton) in proximity to the Driefontein 3 TSF. The proposed WBT and BWSF complex is located within the Ab7 land type. From the WBT, the thickened slurry pipeline crosses back into FB15 land type, before traversing land type Ba1, which is a mix of deep red Hutton soil forms in the midslopes and shallow rocky Mispah soil forms on the crests, and land type Fb5 which also consist of shallow rock soils.

9.1.4.2 Land Capability and Land Use

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. The land capability and land use for the project area is provided in Plan 13 and Plan 14, respectively. The current land use for the region is dominated by agricultural and mining activities, with agriculture including both cultivation of crops and grazing.

The land capability for the Driefontein Mining Right area is dominated by Class II, Class III and Class VI, which is intensive cultivation and moderate cultivation/intensive grazing and moderate grazing respectively.

Plan 13: Land Capability

Plan 14: Land Use

9.1.5 Surface Water

The Surface Water Impact Assessment report is included as Appendix H.

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).

9.1.5.1 Regional Hydrology

The WRTRP is situated in the Upper Vaal WMA 8 and within the quaternary catchments C23E, C23J, C23D, C22J and C22H (Plan 15). The Driefontein Mining Right area falls within quaternary catchments C23E, C23D and C23J, although the quaternary catchments associated with the Ultimate WRTRP have been discussed below.

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 9-6 (WRC, 2005).

Table 9-6: 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 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 Wonderfonteinspruit flows in a south westerly direction and eventually drains into the Mooiriverloop at a point below the Muiskraal Dam, located west of the WRTRP area. This catchment has been changed as most of the normal flow from the Donaldson Dam is directed into a pipe known as the 1m pipe. Other flows from regional WWTW and the K10 shaft also discharge into this pipe. This pipe, which includes discharges from K10 shaft, Cooke 1 Shaft and regional waste water treatment works (WWTW), takes the Wonderfonteinspruit flow over a dolomitic area to reduce recharge and discharges at a point near Oberholzer. At this discharge point the Driefontein Mining Right area also discharges large amounts of pumped mine impacted water.

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 Loopspruit forms part of the Mooiriverloop catchment and flows into the Mooiriverloop at Potchefstroom, located southwest of the WRTRP area. All runoff drained by the Loopspruit eventually reaches the Vaal River.

The registered water users within the affected quaternary catchments include mining, irrigation, livestock watering, industry and urban and non-urban users, based on the DWS water use database (Table 9-7). The predominant use of surface water throughout the WRTRP area is irrigation and livestock watering.

Table 9-7: Surface Water Users within the Driefontein Mining Right Area Affected Catchments

Quaternary Catchment	Primary Drainage	Potential Surface Water Users
C23D	Wonderfonteinspruit	Agriculture, Mining, Carletonville and surrounding towns and Residential areas, Agricultural Holdings
C23E	Mooirivierloop	Towns and Residential areas in upper reaches, Mining in upper reaches, Agriculture, Pivot Irrigation
C23J	Loopspruit	Mining in upper reaches, Agriculture, Potchefstroom in lower reaches

Plan 15: Quaternary Catchments and Monitoring Locations

9.1.5.2 Surface Water Quality

Where data from SGL's current monitoring networks were not sufficient to characterise the baseline of the WRTRP, additional samples were taken. Surface water quality samples were collected from the rivers and dams within and around the project area to determine the baseline water quality for the project area. The sampled rivers include the Leeuspruit, Loopspruit and other unnamed rivers around the project area.

Samples were submitted to Aquatico Laboratory (Pty) Ltd, a SANAS accredited laboratory in Pretoria for analysis of their physical and chemical quality status, as well as additional water quality data sets (January 2013 to March 2015) also provided to Digby Wells and used to describe the current water quality status for those monitoring points.

Water quality results have been benchmarked against the SANS 241-1: 2011 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 L of water per day for 70 years by a person that weighs 60 kg).

The results were also benchmarked with the In-stream Water Quality Guidelines for the Vaal Dam Catchment. This is due to the fact that the project area lies within the Vaal Dam drainage region/catchment.

The Receiving Water Quality Objectives (RWQOs) are defined by the NWA as "clear goals relating to the quality of the relevant water resources" (DWAF, 2006a). In South Africa, the South African Water Quality Guidelines (SAWQG) has been developed as discrete values that set out the change from one category of fitness for use to another (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;
- **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 surface water monitoring locations are provided in Plan 15 and Table 9-8, with the water quality results benchmarked against the SANS 241:2011 drinking water quality standards in Table 9-9 and against the RWQOs in Table 9-10 and against the Water Quality Guidelines for Agricultural Use (DWAF, 1996) in Table 9-11.

Table 9-8: Surface Water Monitoring Locations

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
LP002	26.431°E	27.552°S	Kloof Mining Right
LP004	26.44°E	27.549°S	Kloof Mining Right
LP005	26.457°E	27.549°S	Kloof/Driefontein Mining Rights
LP006	26.467°E	27.548°S	Kloof/Driefontein Mining Rights
LU014	26.473°E	27.615°S	Kloof Mining Right
DSW9	26.349°E	27.432°S	Driefontein Mining Right
DSW42	26.342°E	27.428°S	Driefontein Mining Right
L1	26.367°E	27.704°S	Cooke 4 South/Ezulwini mining rights
L2	26.396°E	27.700°S	Cooke 4 South/Ezulwini mining rights
L3	26.423°E	27.681°S	Cooke 4 South/Ezulwini mining rights
W12	26.233°E	27.737°S	Kloof/Cooke Mining Rights
W13	26.242°E	27.734°S	Kloof/Cooke Mining Rights
W15	26.266°E	27.699°S	Kloof/Cooke Mining Rights
DP006	26.424°E	27.640°S	Kloof Mining Right
DP003	26.416°E	27.635°S	Kloof Mining Right
LU009	26.429°E	27.600°S	Kloof Mining Right
GOL2376-SW1	26.397°E	27.646°S	Kloof Mining Right

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
GOL2376-SW2	26.455°E	27.637°S	Kloof Mining Right
GOL2376-SW3	26.526°E	27.676°S	Kloof Mining Right
GOL2376-SW4	26.472°E	27.617°S	Kloof Mining Right
GOL2376-SW5	26.428°E	27.601°S	Kloof Mining Right
GOL2376-SW6	26.479°E	27.539°S	Kloof/Driefontein Mining Rights
GOL2376-SW7	26.422°E	27.553°S	Kloof Mining Right
GOL2376-SW8	26.411°E	27.406°S	Driefontein Mining Right
GOL2376-SW9	26.398°E	27.403°S	Driefontein Mining Right
GOL2376-SW13	26.434°E	27.552°S	Kloof Mining Right
GOL2376-SW21	26.375°E	27.592°S	Kloof Mining Right
GOL2376-SW23	26.418°E	27.602°S	Kloof Mining Right
GOL2376-SW26	26.453°E	27.604°S	Kloof Mining Right

Table 9-9: Water Quality Results benchmarked against the SANS 241-1:2011 Drinking Water Quality Standards

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	Sulphate 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
SANS241-1:2011	(Aesthetic quality Recommended)		5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<10	<1	<0.3	<0.3	<0.1	<1.5
	(Drinking water quality Max. Allowable)		4-5 or 9.5-10	370	2400	300	100	400	100	600	500	11	1.5	0.5	2	0.5	2
	Exposure Duration (years)		70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs
		Date	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	N_Amonia 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 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

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	Sulphate 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
SANS241-1:2011	(Aesthetic quality Recommended)		5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<10	<1	<0.3	<0.3	<0.1	<1.5
	(Drinking water quality Max. Allowable)		4-5 or 9.5-10	370	2400	300	100	400	100	600	500	11	1.5	0.5	2	0.5	2
	Exposure Duration (years)		70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs	70yrs
		Date	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	N_Amonia mg/l
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
DP006		02/03/2015	7.7	11	82	27	11	6	0	4	6	0	0.0	6.6	0.0	0.2	0.2
DP003		02/03/2015	7.0	36	306	95	33	14	0	65	14	0	0.0	23.1	0.0	0.2	0.2
LU009		02/03/2015	7.6	114	896	0	226	63	0	112	386	1	0.0	133.0	55.0	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

Concentrations highlighted in orange exceed the aesthetic quality threshold.

Concentrations highlighted in red exceed the maximum allowable drinking water quality threshold.

Table 9-10: Water Quality Results benchmarked against the In-Stream Water Quality Guidelines for the Vaal Barrage sub-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
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
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
	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

Concentrations highlighted in green and orange indicate acceptable and tolerable limits respectively, with concentrations highlighted in red being deemed unacceptable.

Table 9-11: 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	<90	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	N/A	>540	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
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

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
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
DP006		**02/03/2015**	7.7	11	82	27	11	6	0	4	6	0	0.0	6.6	0.0	0.2	0.2
DP003		**02/03/2015**	7.0	36	306	95	33	14	0	65	14	0	0.0	23.1	0.0	0.2	0.2
LU009		**02/03/2015**	7.6	114	896	0	226	63	0	112	386	1	0.0	133.0	55.0	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

Concentrations highlighted in red exceed the maximum allowable limit, with concentrations highlighted in orange exceeding the ideal limits for agricultural use.

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 per litre and 372 mg per litre respectively. Water quality monitoring points LP004, LP005 and LP006 indicate high concentrations of nitrate, with the latter two exceeding 230 mg per litre. Sampling points LP004, LP005 and LP006 drain a portion of the Kloof and Driefontein Mining Right areas.

The overall water quality data indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the In-Stream Water Quality Guidelines for the Vaal Barrage (Barrage WQO). This indicates that rivers within this area are already impacted. The project area is comprised of various land uses which includes mining, historical TSFs, industrial areas, residential areas and agricultural activities. All these land uses could possibly have contributed to the current water quality status.

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 also 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 levels as nitrates form when microorganisms break down organic residues such as decaying plants, fertilisers and manures.

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.

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

9.1.5.3 Surface Water Quantity

The Driefontein Mining Right area is drained by the Wonderfonteinspruit and the Loopspruit. The Wonderfonteinspruit flows westwards and eventually becomes the Mooirivierloop before a confluence with the Mooi River downstream. The Wonderfonteinspruit is divided into the Upper and the Lower Wonderfonteinspruit; the Upper Wonderfonteinspruit ends at the outflow of the Donaldson Dam, where a 1 m diameter pipeline signifies the beginning of the

Lower Wonderfonteinspruit. The Lower Wonderfonteinspruit is made up of the 1 m diameter pipeline which extends approximately 30 km down the natural drainage path of the Wonderfonteinspruit.

Currently, approximately 33 Mℓ/day of mine impacted water is being discharged into the Wonderfonteinspruit from K10 shaft, along with additional discharges into the Wonderfonteinspruit including 20 Mℓ/day from Cooke 1 Shaft, 15 to 20 Mℓ/day from the Flip Human WWTW and 10 Mℓ/day from the Hannes van Niekerk WWTW. It is SGL's intention to abstract 20 Mℓ/day of the mine impacted water from K10 shaft, as well as 12 Mℓ per day from Cooke 1 Shaft, for use as part of the WRTRP. Following the reclamation processes, water from the RWD of the RTSF will be treated and approximately 15 Mℓ/day of water will be discharged into the Leeuspruit. The abstraction and use of water from K10 shaft has been discussed as part of the Kloof Mining Right area EIA, with the abstraction and use of water from the Cooke 1 Shaft discussed as part of the Cooke Mining Right area EIA and have not been assessed in this report.

The average flows of water per day for the Wonderfonteinspruit (C2H080 flow gauge system), and Loopspruit (C2H051 and C2H169 flow gauge systems) are detailed in Table 9-12.

Table 9-12: Average Surface Water Flows for the Project Area (DWS, 1990 to 2014)

	Wonderfonteinspruit (DWS Monitoring Point C2H080)	**Loopspruit (DWS Monitoring Point C2H169)**
Months	**Average Flows (m^3/day)**	**Average Flows (m^3/day)**
January	70 006	5 348
February	66 401	5 923
March	79 602	7 720
April	70 837	6 204
May	66 715	5 858
June	77 652	5 853
July	71 681	5 169
August	87 647	4 351
September	80 061	4 035
October	57 867	5 756
November	67 706	4 665
December	69 296	4 672
Average	**72 123**	**5 463**

9.1.6 Fauna and Flora

A Fauna and Flora Impact Assessment is included as Appendix I.

9.1.6.1 Regional Vegetation

The project area falls within four vegetation types according to Mucina and Rutherford (2006) as described below and shown in Plan 16. The sections below also discuss the fauna and flora of the region.

9.1.6.1.1 Carletonville 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.

9.1.6.1.2 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.

9.1.6.1.3 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.

9.1.6.1.4 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 16: Vegetation Types

9.1.6.2 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 (National Herbarium Pretoria Computerised Information System), 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 grids. 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. 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 list below were confirmed by scrutinising previous specialist studies that were undertaken in the past. The IUCN category descriptions for fauna and flora are provided in Table 9-13, with the Species of Special Concern (SSC) likely to occur on site are listed in Table 9-14.

Table 9-13: Red Data Categories (SANBI, 2012)

Category		Description
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.
	Extinct	**Threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories **CR, EN** or **VU** is a threatened species. **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories**, NT, LC** and **DD**
	Threatened	
	Other categories of conservation concern	
	Other categories	

Table 9-14: 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

9.1.6.3 Driefontein Mining Right Area Vegetation Delineation

The Driefontein Mining Right area, as well as the associated pipelines, is located within grassland, wetland, ridge, agricultural (cultivation and grazing) and transformed areas. The delineated communities within the Driefontein Mining Right area are discussed further below.

9.1.6.3.1 Grasslands

The proposed pipeline route traverses three delineated grassland sub-communities that are associated with the respective vegetation types, as summarised in Table 9-15. The vegetation types that reflect the dominant sub-communities are illustrated in Plan 16.

Table 9-15: Grassland Sub-communities

Sub-community	***Eragrostis gummiflua* – *Themeda triandra* grassland**	***Cymbopogon excavates* – *Helichrysum regulosum***	***Themeda triandra* – *Hyparhennia hirta* grassland,**
Vegetation Type	Carletonville Dolomite Grassland/Andesite Mountain Bushveld	Rand Highveld Grassland	Soweto Highveld Grassland
Location	Northern	Middle	Southern
Expected Species	63	71	47
Identified Expected Species	10	18	9
Identified Species	73	72	54
Ecological Integrity (%)	(10/63= 15.9% Natural)	(18/71 = 25% Natural)	(9/47 = 19% Natural)
Ecological Integrity	Moderate - Poor	Moderate - Poor	Moderate - Poor

The *Eragrostis gummiflua – Themeda triandra* grassland sub-community was found predominantly in the northern part of the Driefontein Mining Right area, with the water pipelines falling entirely in this sub-community, as well as the WBT and BWSF complex and Driefontein 3 TSF, the slurry pipeline and a large portion of the thickened slurry pipeline. This grassland community falls within the Carletonville Dolomite Grassland (Mucina and Rutherford, 2006). A dominance of Common Thatching Grass (*Hyparrhenia hirta)* and a large number of problem plants indicated poor ecological health. This was further confirmed through comparison of expected species listed for Carletonville Dolomite Grassland.

The *Cymbopogon excavatus – Helichrysum regulosum* dominated grassland, with the common occurring *Acacia karroo* (Sweet Thorn), falls within the Rand Highveld Grassland (Mucina and Rutherford, 2006) and is associated with the central thickened slurry pipeline route and Driefontein 5 TSF. Due to the favourable microclimate created by *Acacia karroo*, there are a larger number of small shrubs and forbs in these areas. The ecological health is estimated to moderate to poor due to the high number of alien invasive species, such as Wild Verbena *(Verbena bonariensis*).

The southern section of the thickened slurry pipeline route to the CPP is predominantly described as *Themeda triandra – Hyparhennia hirta* grassland, which falls within the Soweto Highveld Vegetation type. Much of this vegetation type is assumed to have been transformed for agricultural purposes and is regarded as being slightly to largely modified. The extent of the degradation is illustrated through diminished species richness and the presence of alien invasive vegetation. The result grasslands are vulnerable to destruction by cultivation; once ploughed they are invaded by weed pioneer plants that are predominantly alien (Ferrar and Lotter, 2006). A high number of species were identified within the various grassland sub communities, however these species are not typical of the vegetation type (many of the species are alien invasive), and therefore the grassland is largely modified from the original state, with poor ecological integrity.

9.1.6.3.2 Ridge Areas

Similar vegetation species exist between ridge areas and the grassland sub-communities. The increased rockiness and shallow soils in the ridge areas, however, has resulted in these areas having largely escaped anthropogenic disturbances and transformation. Ridges provide diverse habitat and refuge for a number of species and are generally regarded to be sensitive habitats due to the high levels of biodiversity that they host. The ridges within the project area are elevated above the grassland and host abundant woody species, which are not present in the grassland community. Ridges are regarded as sensitive habitats as many of these species are specifically adapted to this microclimate. The vegetation associated with the ridge areas is listed in Appendix I.

9.1.6.3.3 Wetland

Wetland and riparian vegetation is associated predominantly with proposed pipeline crossings, as well as adjacent and within the WBT and BWSF complex. The delineated wetlands are discussed in further detail in Section 9.1.8.

9.1.6.3.4 Agricultural

Agricultural activities are undertaken in the project area. Agricultural crops which have replaced natural vegetation include Maize (*Zea mays*) which is the primary crop in the area, Soybean (*Glycine max*) and Sunflowers (*Helianthus annulus*). Small plots of commercial vegetables, Lucerne and Peaches are also cultivated in the area. Livestock farming (including sheep and cattle) is also popular, which has resulted in degradation of the natural grassland biodiversity. This is evident through the presence of Bankrupt Bush (*Seriphium plumosum)*, which has overtaken numerous fields in the area, as well as a number of other problem plants and general assumed diminished species richness.

9.1.6.3.5 Transformed

Transformed areas are associated with alien invasive and exotic vegetation and features prominently in the grassland landscape, with areas where the natural grasslands have been transformed in its entirety occurring. This is typically in the form of stands of exotic trees that have been planted, usually for the uptake of water. Red River Gum ((*Eucalyptus camaldulensis*) surrounds much of the mining areas, often planted for their robust nature and ability to take up toxic leachates from the groundwater surrounding retention dams. Pampas grass (*Cortaderia selloana)* is a similarly robust plant which has been planted in an effort to rehabilitate areas which have been mined. Alien invasive vegetation recorded on site is listed in Appendix I.

9.1.6.3.6 Ecological Importance

The ecological importance of the vegetation communities is described in Table 9-16. The remnant natural vegetation communities illustrate high ecological importance due to their ecosystem functioning. Despite their diminished ecological integrity they are seen to be valuable for biodiversity maintenance and therefore these communities, namely; grasslands, ridges and wetland vegetation should be conservation priorities. Transformed vegetation is not regarded to have high ecological importance due to poor integrity, limited ecosystem functioning and abundance of introduced alien vegetation species.

Table 9-16: Ecological Integrity of the Vegetation Communities within the Driefontein Mining Right Area Infrastructure

Community	Ecological State	Ecological Function	Conservation Importance	Reasoning
Grassland Vegetation	Natural	Moderate	High	Grassland areas have been transformed and impacted by surrounding land uses and must be protected.
Ridge Vegetation	Natural	Good	High	Largely natural/undisturbed. Important habitat
Wetland vegetation	Natural	Moderate	High	Impacted by surrounding land uses. Important Habitat. Protected (NWA).
Transformed Vegetation	Transformed	Poor	Low	Largely modified vegetation. High number of alien invasive species.

9.1.6.3.7 Plant species of special concern

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 9-17: 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.

Plant species	Threat Status	Current Threats	Proffered habitat on site
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.

9.1.6.4 Fauna

Fauna expected to occur within the Driefontein Mining Right area and larger WRTRP area 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.

Large areas of the terrestrial vegetation and habitat have been modified within the project area. It is assumed that these impacts have had a subsequent effect on the fauna species diversity and abundance. The findings of the fauna survey are used as a secondary reflection of the ecosystem health. Low numbers of Mammalia, Avifauna, Reptiles, Amphibians and Invertebrates were identified within the project area and many of these species are associated with the sensitive habitats associated with the grassland and wetland areas.

9.1.6.4.1 Mammals

A number of small mammals were identified within the project area, such as Steenbok (*Raphicerus campestris*), Ground Squirrels (*Xerus inauris)*, and Porcupine (*Hystrix africaeaustralis*). Species were identified through actual sightings and visual evidence, although none of the identified species are considered SSC. A list of expected mammals to occur within the project area, as well as those species observed and recorded, is provided in Table 9-18.

Table 9-18: Expected Mammals within the Driefontein Mining Right Area and WRTRP Area

Family	Species	Common Name	Recorded on site	Status
Bovidae	*Raphicerus campestris*	Steenbok	X	LC
Bovidae	*Sylvicapra grimmia*	Common Duiker	X	LC
Bovidae	*Damaliscus pygargus phillips*	Blesbuck	X	LC
Chrysochloridae	*Chrysospalax pillosus*	Rough Haired Golden Mole		VU
Chrysochloridae	*Amblysomus septentrionalis*	Highveld Golden Mole		NT
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	X	LC
Herpestidae	*Galerella sanguineus*	Slender Mongoose	X	LC
Hysticidae	*Hystrix africaeaustralis*	Porcupine	X	LC
Muridae	*Rhabdomys pumilio*	Striped Field Mouse	X	LC
Muridae	*Mus musculus*	House Mouse	X	LC
Muridae	*Rattus rattus*	House Rat	X	LC
Muridae	*Myosorex varius*	Forest Shrew		LC
Muridae	*Dasmys incomtus*	African Marsh Rat House rat		LC
Muridae	*Hydrictis maculicollis*	Spotted Necked Otter		NT
Muridae	*Xerus inauris*	Ground Squirrel	X	LC
Mustelidae	*Mystromys albicaudatus*	White-Tailed Mouse		EN

9.1.6.4.2 Avifauna

A number of birds were identified within the area of the proposed RTSF and pipeline routes. The birds are associated with a variety of habitats which correspond with the vegetation communities namely, grassland, ridges, wetland and transformed habitats. Thirty Seven (37) bird species were identified during the survey and are detailed in Appendix I. No Listed Red Data bird species were identified during the field survey. The Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder, 2008) and is expected to occur within the wetland habitats identified within the project area. This species has been allocated a status of Vulnerable.

9.1.6.4.3 Reptiles

One species of reptile, a Rinkhals (*Hemachatus haemachatus*) was identified during the field survey. It should be noted that all land tortoises are protected in the Gauteng Province, however the probability of occurrence of the species in the study area are seen as low. Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*), listed as Vulnerable, and the Striped Harlequin Snake (*Homoroselaps dorsalis*), identified as Rare; both species are allocated a low probability of occurrence.

9.1.6.4.4 Amphibians

Six amphibians were encountered during the field survey. The amphibian species identified and expected for the area are listed in Table 9-19; the species identified were all encountered within the wetlands habitat types.

Table 9-19: Amphibian Species Identified

Scientific Name	Common Name	Occurrence	Habitat
Afrana angolensis	Common River Frog	Widespread; confirmed	Grassland, savanna and forest fringe, breeds in shallow water of pools, dams, streams and slow-flowing rivers
Afrana fuscigula	Cape River Frog	Widespread; high; SA Endemic.	Streams and ponds. Prefers well-vegetated waterways.
Amietophrynus gutturalis	Guttural Toad	Widespread; confirmed	Habitat generalist; breeds in open pools, dams, or streams
Amietophrynus rangeri	Raucous Toad	Marginal, low	Grassland, usually when inundated, man-made impoundments
Cacosternum boettgeri	Common Caco	Widespread; confirmed	Varied including grassland; breeds in vleis and inundated grassland or shallow pans

Scientific Name	Common Name	Occurrence	Habitat
Kassina senegalensis	Bubbling Kassina	Widespread; confirmed	Grasslands; breeds in vleis, pans and dams
Phrynobatrachus natalensis	Snoring Puddle Frog	Marginal; medium	Breeds in pools or marshy areas associated with pans, streams or vleis
Pyxicephalus adspersus	Giant Bullfrog	Confirmed;	Mainly grassland and savanna; breeds in temporary pans or pans.
Schismaderma carens	Red Toad	Widespread; high	Streams and rivers, and still permanent bodies water
Strongylopus fasciatus	Striped Stream Frog	Widespread; confirmed	Streams and rivers, and still permanent bodies water
Tomopterna cryptotis	Tremolo Sand Frog	Widespread; high	Varied habitats; breeds in water bodies that have vegetation
Tomopterna natalensis	Natal Sand frog	Widespread; high	Savanna; breeds in temporary pans
Xenopus laevis	Common Platanna	Widespread; confirmed	Breeds in shallow permanent streams, of temporary water bodies in grassland

9.1.6.4.5 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). Red Data species expected to occur on site are the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey. This may be due to the timing of the survey and it is expected that species will be encountered in the area.

9.1.6.5 Sensitivity Analysis

The sensitivity assessment takes into account all of the desktop information (Gauteng C-Plan, Threatened Ecosystems and the NPAES), as well as the field data gathered during the site visits. This forms as assessment of the perceived biodiversity value and the result assigns sensitivity to the vegetation delineated on site. The sensitivity analysis is provided in Plan 17.

Ridges and wetlands constitute High Sensitivity areas due to their role as process areas within the ecosystem. In addition, high sensitivity was given to areas occurring within a Threatened Ecosystem, and those areas that were pristine or close to pristine with low or no anthropogenic impacts. Areas occurring within Highly Significant C-Plan areas (unless heavily degraded) were also given a High Sensitivity, as were areas on steep rocky slopes and those that have high numbers of species of special concern.

Areas of Medium Sensitivity include those natural areas with some anthropogenic change or degradation, with high numbers of species of special concern and moderate rocky slopes.

Low Sensitivity was assigned to areas completely transformed or heavily degraded, on relatively flat ground.

Plan 17: Sensitivity Analysis

9.1.7 Aquatics

The Aquatics Impact Assessment is included as Appendix J.

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). The SQR within the WRTRP area are associated with the Wonderfonteinspruit, Mooirivierloop, Loopspruit and the Leeuspruit.

The majority of the rivers systems in the WRTRP area are largely modified with the Present Ecological Status (PES) of these systems ranging from Class D to Class E and an ecological importance and sensitivity ranging from Low to Moderate (DWA, 2013). 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.

High flow and low flow site surveys were undertaken for the project area to assess the baseline aquatic environment. The following aspects were assessed and are detailed below for the aquatic environments associated with the Driefontein Mining Right area activities:

- Water quality;
- Intermediate Habitat Integrity Assessment (IHIA); and
- Macroinvertebrate Assessment including:
  - Integrated Habitat Assessment System (IHAS);
  - South African Scoring System version 5 (SASS5); and
  - Macroinvertebrate Response Assessment Index (MIRAI).

9.1.7.1 Water Quality

The location of the aquatic sampling locations is provided in Plan 18. The results of the aquatic sampling has been provided for the locations associated with the Wonderfonteinspruit, as the Wonderfonteinspruit runs westwards to the north of Driefontein 3 an 5 TSFS and water from K10 shaft is discharged into the water resource. It must be noted that a section of the Wonderfonteinspruit has been piped and, as a result, is significantly modified. Sampling locations WON1 and WON4 occur upstream and downstream of the piped section respectively, with sampling site CAR1 located to the west of Driefontein 5 TSF.

The water quality results from the aquatic sampling are listed in Table 9-20.

Table 9-20: In Situ Water Quality Results

		High Flow Survey			Low Flow Survey		
Constituent	**Guideline**	**WON1**	**WON4**	**CAR1**	**WON1**	**WON4**	**CAR1**
Temperature (ºC)	5-25	16	13.8	17.6	9.5	13.8	7.5
pH	6-9	7.5	8.6	8.6	7.8	8.6	8.1
Conductivity (µS/cm)	<700	774	1 035	1 228	879	1 035	1164
Dissolved oxygen (mg/l)	>5	3.77	8.6	6.9	4.5	6.34	7.22
Dissolved oxygen saturation (%)	>50	38	81	61	40	61	63
	*Red colour denotes constituent exceeding recommended DWAF (1996) Aquatic guideline						

Plan 18: Aquatic Monitoring Locations

When considering the *in situ* results from the high flow survey, temperatures were observed to range between 13.8ºC at WON4 to 17.6ºC at CAR1. The pH levels obtained during the survey ranged between 7.5 at WON1 to 8.6 at WON4 and CAR1. The conductivity recordings obtained during the survey ranged from 774 µS per cm to 1 035 µS per cm at sampling sites WON1 and WON4 respectively and exceeded the DWAF aquatic guidelines (1996). Concentrations of dissolved oxygen ranged were within the recommended DWAF (1996) aquatic guidelines for sampling sites WON4 and CAR1, with WON1 exceeding the recommended guidelines.

The low flow survey indicated similar results as the high flow survey, with all sites exceeding the conductivity concentrations and sampling site WON1 exceeding the dissolved oxygen concentrations for the aquatic guidelines (DWAF, 1996). All sampling sites were within the DWAF (1996) aquatic guidelines for temperature and pH.

9.1.7.2 Intermediate Habitat Integrity Assessment

To define a general habitat the instream and riparian habitat was assessed and characterised according to “Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999”. The IHIA model was used to assess the integrity of the habitats from a riparian and instream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

The criteria utilised as part of the IHIA is detailed in Appendix J, with the scores placed into IHIA categories. The IHIA categories are detailed in Table 9-21, with the results of the instream and riparian IHIA provided in Table 9-22 and Table 9-23 respectively.

Within the SQR of the Wonderfonteinspruit, the IHIA results of the instream habitats are classified as class E or seriously modified, with the riparian habitat as class D or largely modified.

Table 9-21: Intermediate Habitat Integrity Assessment Categories (Kleynhans, 1996)

Category	Description	Score
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

Table 9-22: IHIA for Instream Habitats

	Wonderfonteinspruit	
Instream	**Average Score**	**Score**
Water abstraction	13.33	7.46
Flow modification	25	13
Bed modification	25	13
Channel modification	25	13
Water quality	11.66	6.53
Inundation	20.33	8.13
Exotic macrophytes	8	2.88
Exotic fauna	10	3.2
Solid waste disposal	11.66	2.8
Total Instream	**29.98**	
Category		**Class E**

Table 9-23: IHIA for Riparian Habitats

	Wonderfonteinspruit	
Riparian	**Average Score**	**Score**
Indigenous vegetation removal	13.33	7.46
Exotic vegetation encroachment	25	13
Bank erosion	25	13
Channel modification	25	13
Water abstraction	11.66	6.53
Inundation	20.33	8.13
Flow modification	8	2.88
Water quality	10	3.2
Total Riparian	**42.56**	
Category		**Class D**

9.1.7.3 Habitat Assessment

9.1.7.3.1 Integrated Habitat Assessment System

The IHAS was specifically designed to be used in conjunction with the SASS5, benthic macroinvertebrate assessment. The IHAS assesses the availability of the biotopes at each site and expresses the availability and suitability of habitat for macroinvertebrates, which is determined as a percentage, where 100% represents "ideal" habitat availability. A description based on the IHAS percentage scores is presented in Table 9-24.

Table 9-24: Description of IHAS scores with the respective percentage category (McMillan, 1998)

IHAS Score (%)	Description
>75	Very Good
65–74	Good
55–64	Fair/Adequate
<55	Poor

The results of the IHAS are presented in Table 9-25, with the invertebrate biotope diversity results provided in Table 9-26. The results of the IHAS show that invertebrate habitat is suitable or fair at monitoring locations WON1 and WON4 and poor at monitoring location CAR1.

Table 9-25: IHAS Results for the WRTRP

Site	WON1	WON4	CAR1
Flow	Moderate	Fast	Slow/Standing
Score	63	60	42
Suitability	Fair	Fair	Poor

Table 9-26: Invertebrate Biotope Diversity

Biotope	WON1	WON4	CAR1
Stones in current	4	4	2
Stones out of current	1	0	1
Bedrock	4	0	0
Aquatic Vegetation	1	3	0
Marginal Vegetation In Current	3	3	0
Marginal Vegetation Out Of Current	4	0	0
Gravel	3	0	0
Sand	3	2	3
Mud	2	3	3
Biotope Score	25	15	9
Biotope Score (%)	**56**	**33**	**20**
Biotope suitability	**Good**	**Fair**	**Poor**

9.1.7.3.2 South African Scoring System Version 5

The SASS5 is the current biological index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Muscidae and Psychodidae) to highly sensitive families (e.g. Oligoneuridae). SASS5 results are expressed both as an index score (SASS5 score) and the Average Score Per recorded Taxon (ASPT value).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Highveld lower ecoregion. This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database. Table 9-27 illustrates the biological banding and classification.

Table 9-27: Highveld Low Biological Banding

Class	SASS5 Score	ASPT	Condition
A	>123	>5.6	Natural/unmodified
B	83-122	5.5–5.8	Minimally modified
C	64–82	5.1–5.5	Moderately modified
D	51–63	4.6–5.1	Largely modified
E	<50	<4.6	Seriously modified

The results of the SASS5 assessments for the project area are provided in Table 9-28 and indicate that the sampling locations are largely to seriously modified.

Table 9-28: SASS5 Results for the Project Site

	High Flow Survey			Low Flow Survey		
Site	**WON1**	**WON4**	**CAR1**	**WON1**	**WON4**	**CAR1**
SASS5	35	62	47	36	56	39
Taxa	10	16	12	10	12	11
ASPT	3.5	3.8	3.9	3.6	4.6	3.5
Category	E	D	E	E	D	E

9.1.7.3.3 Macroinvertebrate Assessment Index

The MIRAI was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the Highveld Lower Ecoregion. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and
- Energy inputs from the watershed Riparian vegetation assessment.

The results of the MIRAI provide an indication of the current ecological category and therefore assist in the determination of the PES. The MIRAI scores are provided in Table 9-29.

Table 9-29: MIRAI Scores for the WRTRP

	Wonderfonteinspruit
Invertebrate Metric Group	**Score Calculated**
Flow modification	45.7
Habitat	52.5
Water Quality	40.1
Connectivity and seasonality	24.6
Ecological Score	**41**
Invertebrate Category	**Class D**

The results of the IHAS and SASS5 biotope assessment indicates that there is sufficient habitat to support a diverse community of macroinvertebrates at the sites considered in the Wonderfonteinspruit system.

Despite the available habitat, seriously and largely modified classes were derived for the SASS5 assessments. These low scores are expected to be related to poor water quality in the river systems and due to flow modification.

9.1.7.4 Present Ecological Status

The results of the ecological classification and PES for the considered water resources are provided in Table 9-30. The systems are considered to be Class D/E or largely to seriously modified.

Table 9-30: Present Ecological Status

	Wonderfonteinspruit	
Category	**Score**	**Ecological category**
Riparian Habitat Ecological Category	42	Largely modified
Macroinvertebrate Ecological Category	39	Largely modified
Ecostatus		**Largely/Seriously modified**

9.1.8 Wetlands

The Wetland Impact Assessment for the WRTRP is provided in Appendix K.

The WRTRP area spans over several quaternary catchments and therefore is characterised by several different watercourses as summarised in Section 9.1.5. The project 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 that occur within the area.

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 National Freshwater Ecosystem Priority Areas (NFEPA) wetlands within the Ultimate Project area are shown in Plan 19.

Plan 19: NFEPA Wetlands for the WRTRP

9.1.8.1 Wetland Delineation and Classification for Kloof Mining Right Area

Wetland delineations were undertaken for the Driefontein Mining Right area. A description of the identified wetland units is summarised in Table 9-31. The identified wetlands are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems and has contributed to the direct loss of wetland habitat.

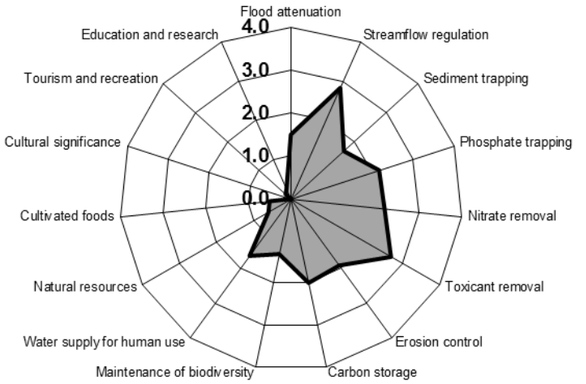
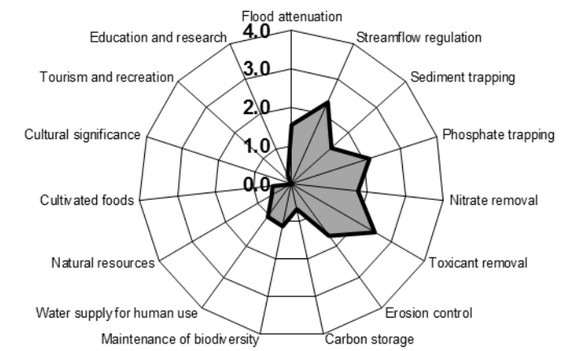
The WET-Health assessment was undertaken to determine the PES and Ecological Importance Sensitivity (EIA) for each delineated wetlands, as summarised in Plan 20. Table 9-32 correlates with the delineated wetlands illustrated in Plan 20.

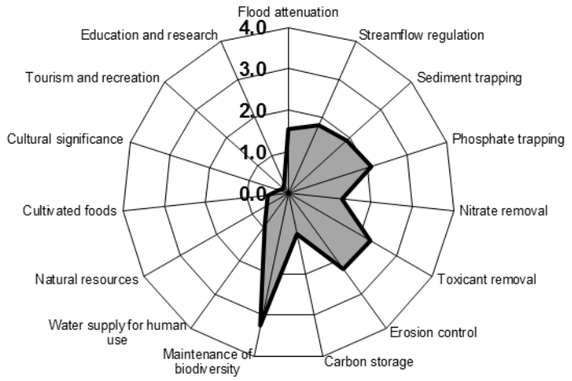
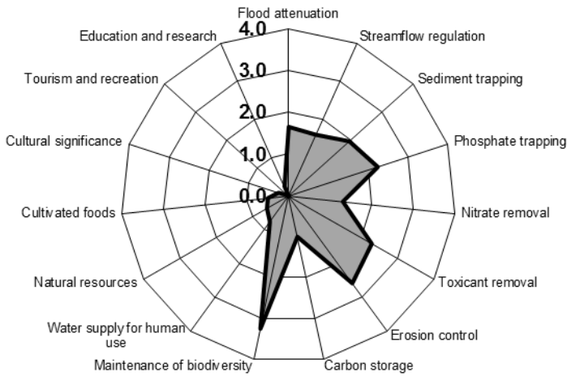
Table 9-31: Wetlands Units occurring in the Driefontein Mining Right Area

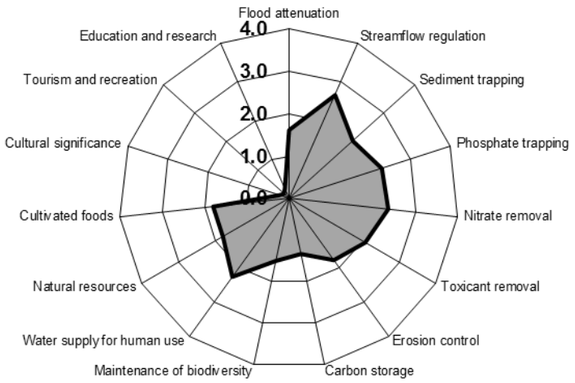
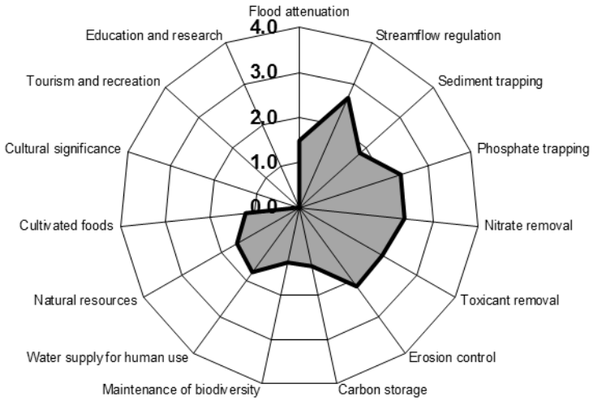
Wetland type	Description	Inputs	Throughputs	Outputs
Channelled Valley Bottom (CVB)	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. Water inputs are mainly from adjacent slopes while the channel itself is typically not a major source of water for the wetland.	Channel flow and adjacent hill slopes	Diffuse flow on elevated valley bottom and channel flow	Channel flow and evapotranspiration
Valley Bottom without a Channel (VB)	Valley bottom areas of low relief with no clearly defined stream and situated on alluvial fill	Channel entering the wetland and adjacent slopes.	Diffuse surface and subsurface flow	Channel outflow and evapotranspiration.
Depression / Pan	A basin shaped area with a closed elevation contour that usually is not connected via an outlet to the drainage network.	Variable	Insignificant	Evapotranspiration

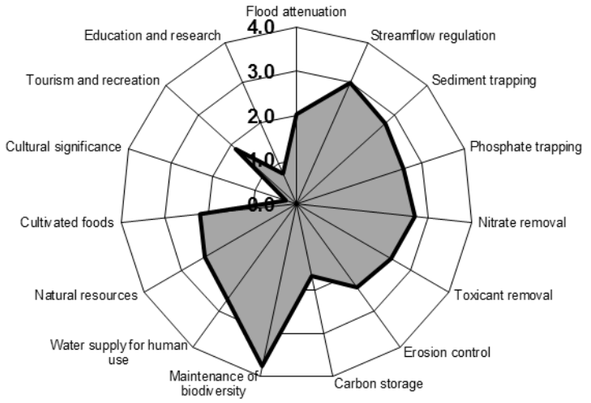
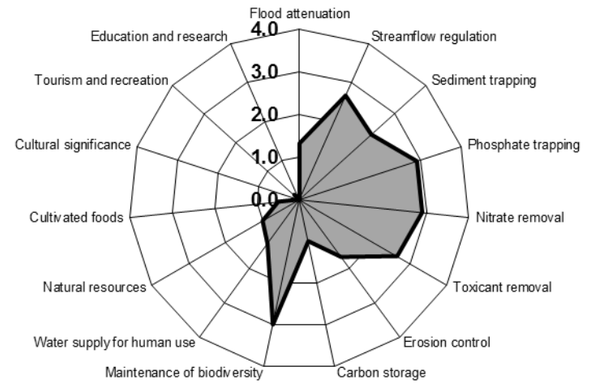
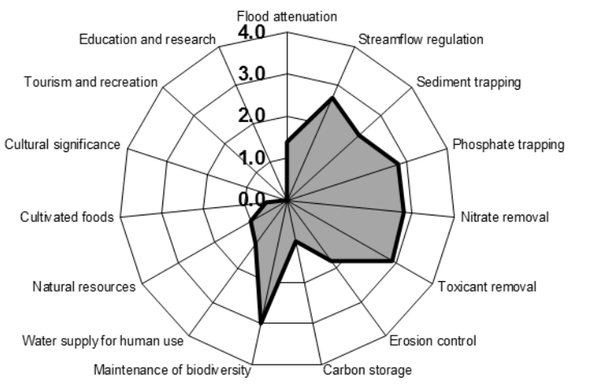
Plan 20: Delineated Wetlands

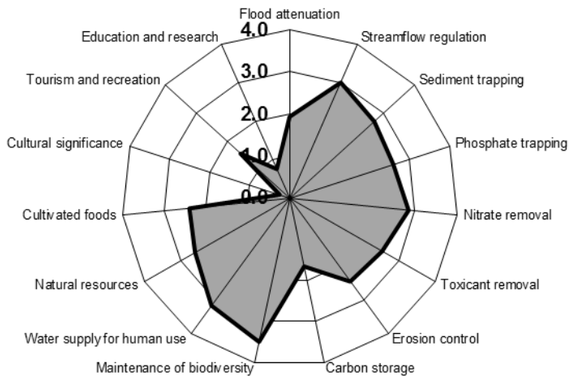
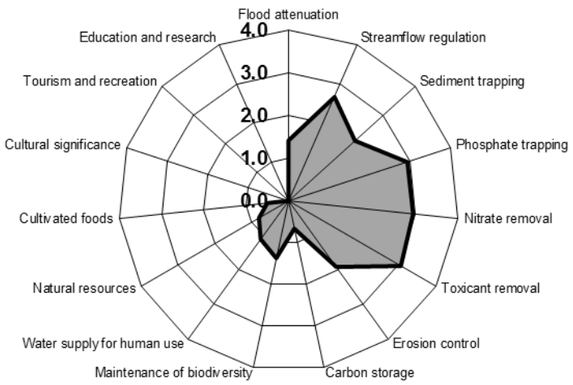
Table 9-32: Wetland Findings

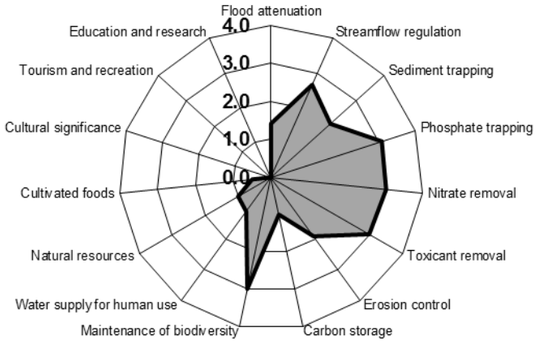
Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23E	1	CVB	40.9	This is a small unnamed stream flowing northwards past the western side of the Driefontein 5 TSF. This wetland has been significantly impacted upon by the mining 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	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. In addition, the EcoServices are not significant. This wetland would require significant rehabilitation measures to restore functionality. The pipeline from Driefontein 5 to Driefontein 3 TSF will cross this wetland. This pipeline then continues from Driefontein 3 TSF towards the WBT and follows along the R501 road. Coming from the opposite direction are two additional pipelines bringing water from the BWSF; these too will cross this 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	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	3a	**Pan**	4.7	This is a small pan found in the arc 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 a deeper depression than that which naturally occurred. Within the wetland and the immediate catchment, unnatural depressions due to the collapse of unconsolidated strata, present from historical underground mining. 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 pipelines between Driefontein 3 TSF and the WBT and BWSF complex will run along the farm road just south of the pan.	D 4.5	Low 1.0	
	3b	**Pan**	2.7	This, too, is a small pan found in the arc 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, along with the water, slurry and thickened slurry pipelines.	D 4.0	Low 1.0	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23D	4	VB	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 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	25.1	This wetland is a small unchannelled valley bottom wetland, which appears to be a leading towards the Wetland 4 associated with Bank Fault Spruit, 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 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 greater in extent down gradient of 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 thickened slurry pipeline from the WBT to the CPP.	E 6.1	Low 1.0	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C23J	6	CVB	50.3	This is a long and narrow channelled valley bottom wetland associated with the Loopspruit. 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)*. A spring was found in the stream of the wetland; the farmers have attempted to control this with a pump system. 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. A large dam exists just below the spring, 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 SSC 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 south of the N12 national road and one at the spring.	D 5.9	Moderate 2.0	
	7a	VB	12.6	This is a small unchannelled wetland leading to the Loopspruit, namely Wetland 6. At the confluence to the river, it is characterised by Common Bulrush (*Typha capensis*). This wetland appears to originate from a spring which, similarly to Wetland 6, has been controlled with some kind of pump and a small dam wall has been put in place to collect this 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 Loopspruit, is located along the farm road approximately 50m from the origin of this wetland.	D 5.2	Low 1.0	
	7b	VB	54.9	This is an unchannelled valley bottom wetland, similarly and in parallel to Wetland 7a that is designated as a tributary of the Loopspruit, 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	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C22J	8	CVB	754.3	This is a 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 due to erosion. This 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 plays an important role in water supply for human use. There is diversity 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.	D 5.3	Moderate 2.0	
	9a	VB	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.	E 6.5	Low 1.0	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	9b	**VB**	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 (26°25'6.25"S; 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.	D 5.2	Low 1.0	

9.1.9 Topography and Visual

The Topography and Visual Impact Assessment is provided in Appendix L.

The nearest settlement to the Driefontein Mining Right area activities is Carletonville situated approximately 3.8 km northeast of the proposed CPP. The nearest major town is Westonaria situated approximately 12.3 km north-northwest of the Driefontein 5 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 9-33. 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 9-33: Closest Towns and Settlements to the Driefontein Mining Right Area Activities

Name	Type	Direct Distance	Direction	Proposed Activity
Carletonville	Major Town	3.8 km	NNW	Driefontein 5 TSF
Oberholzer	Other Town	5.5 km	NW	Driefontein 5 TSF
East Driefontein	Other Town	6 km	SE	Driefontein 3 TSF
Bank	Settlement	7.9 km	NE	Driefontein 3 TSF
Leeudrif	Settlement	12.1 km	SE	Driefontein 3 TSF
Fochville	Other Town	12.4 km	SE	Driefontein 5 TSF
Welverdiend	Settlement	12.7 km	WNW	Driefontein 5 TSF
Libanon	Settlement	15.2 km	E	Driefontein 3 TSF
Glenharvie	Settlement	15.5 km	ESE	Driefontein 3 TSF
Hermina	Settlement	17 km	SE	Driefontein 3 TSF
Venterspos	Other Town	19.3 km	NE	Driefontein 3 TSF
Hillshaven	Settlement	19.4 km	E	Driefontein 3 TSF
Westonaria	Major Town	19.7 km	ENE	Driefontein 3 TSF

The N12 national route is situated 5.7 km south and 7.8 km south of the Driefontein 5 TSF and the Driefontein 3 TSF respectively. The R500 regional road runs east of the Driefontein 5 TSF and the R501 regional road runs adjacent to the north of the Driefontein 5 TSF. The Driefontein 3 and 5 TSFs cover an area of 125.7 ha and 101.2 ha respectively.

The Driefontein 3 TSF is situated on a relatively flat area with a ridge to the south, with the Driefontein 5 TSF situated almost entirely surrounded by ridges with the exception of a small area on the north-western side.

The receiving environment of the Driefontein Mining Right area can be described as having low scenic, cultural or historical significance and is characterised by a mixture of residential areas, small holdings, agriculture and open land interspersed with large areas disturbed by mining.

The topography of the Driefontein Mining Right area is undulating with ridges and valleys. The elevation of the Driefontein Mining Right area increases from 1 529 m above mean sea level (mamsl) on the upper slopes of the Mooirivierloop and Wonderfonteinspruit rivers in the north to 1 765 mamsl along the east-west ridge located in the centre of the Mining Right area. The elevation decreases again towards the southern sections of the Mining Right area to approximately 1 549 mamsl in the Loopspruit valley.

The majority of the Driefontein Mining Right area has gentle slopes less than 5.6°, with steeper slopes between 5.7° and 17.2° occurring in isolated areas along the ridges and valleys.

9.1.10 Noise

A Noise Impact Assessment is included in Appendix M.

9.1.10.1 Current Ambient Noise

The current noise soundscape of the WRTRP area has been characterised by means of baseline noise measurements near the major noise emitting components from the WRTRP. 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. The SANS 10103:2008 noise level guidelines for districts is provided in Table 9-34.

Table 9-34: 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.						
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.						

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]
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 noise monitoring locations are provided in Plan 21 and Table 9-35. The criteria used to site the measurement locations include:

- The locations nearest noise sensitive receptors to the proposed CPP and RTSF, as well as the Driefontein 3 and 5 TSFs; 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.

Table 9-35: 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

Plan 21: Noise Monitoring Locations

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 9-36.

Table 9-36: 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					

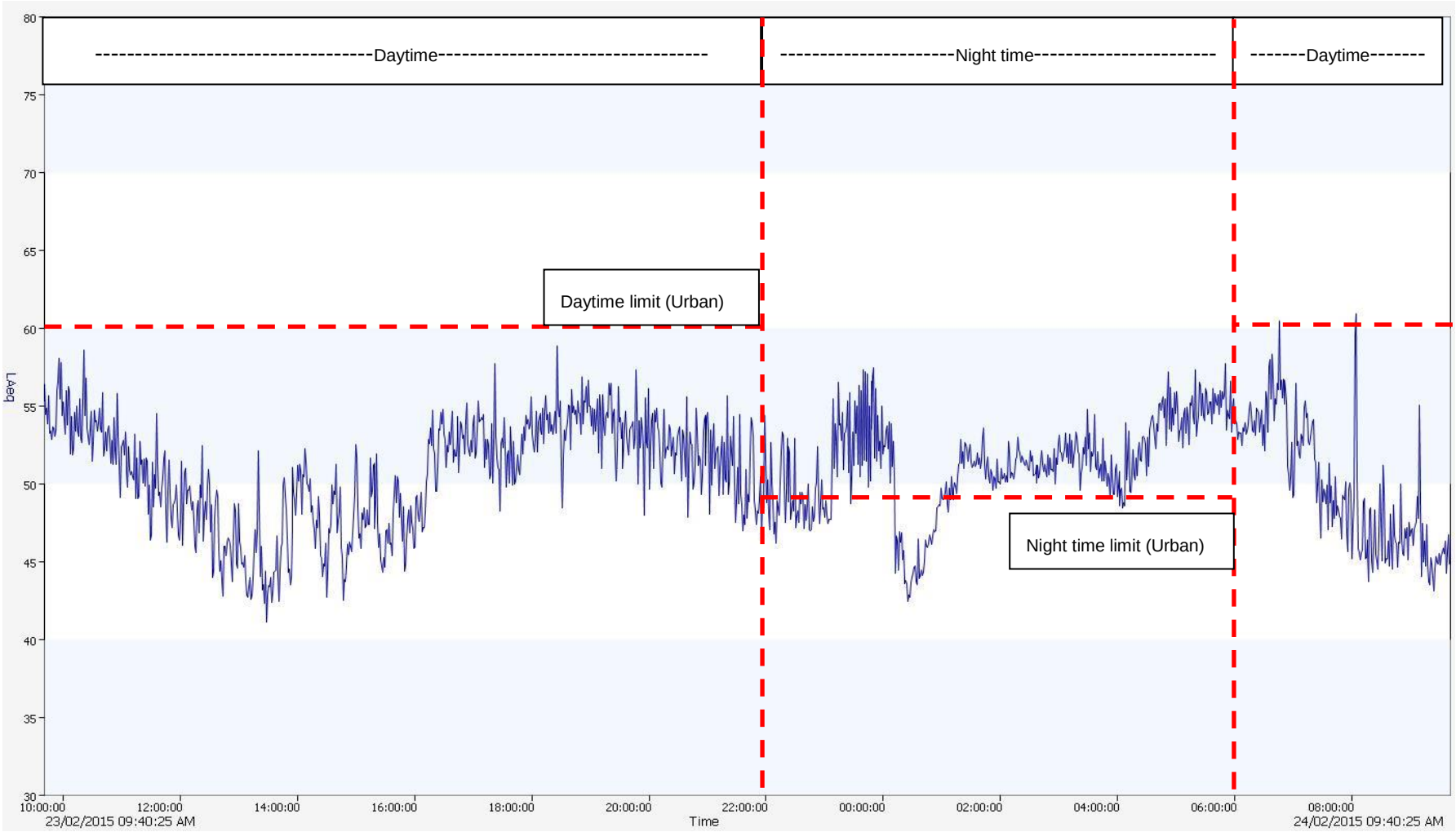


Figure 9-3: Noise Time History Graph for Monitoring Site N1

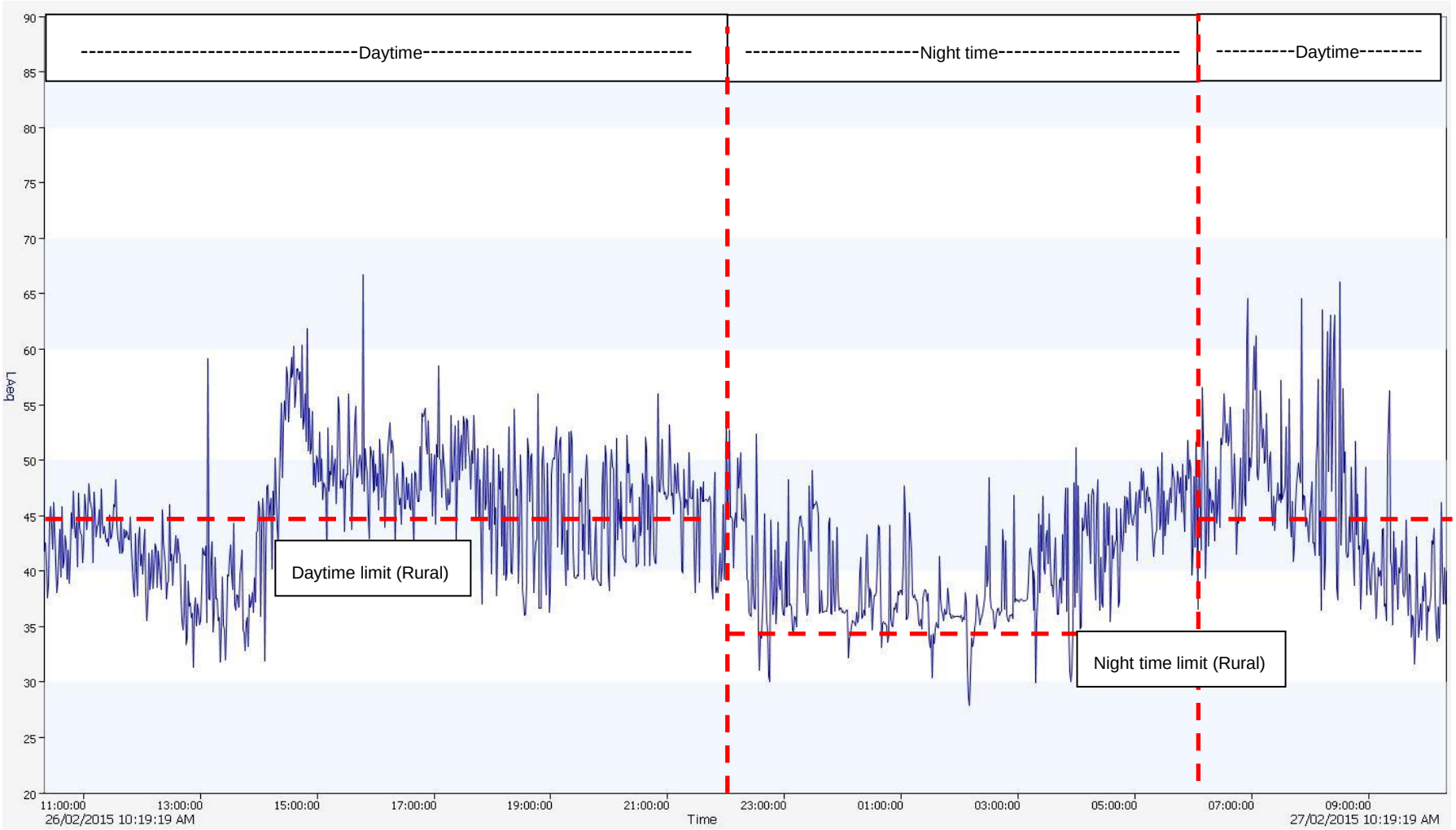


Figure 9-4: Noise History Graph for Monitoring Site N2

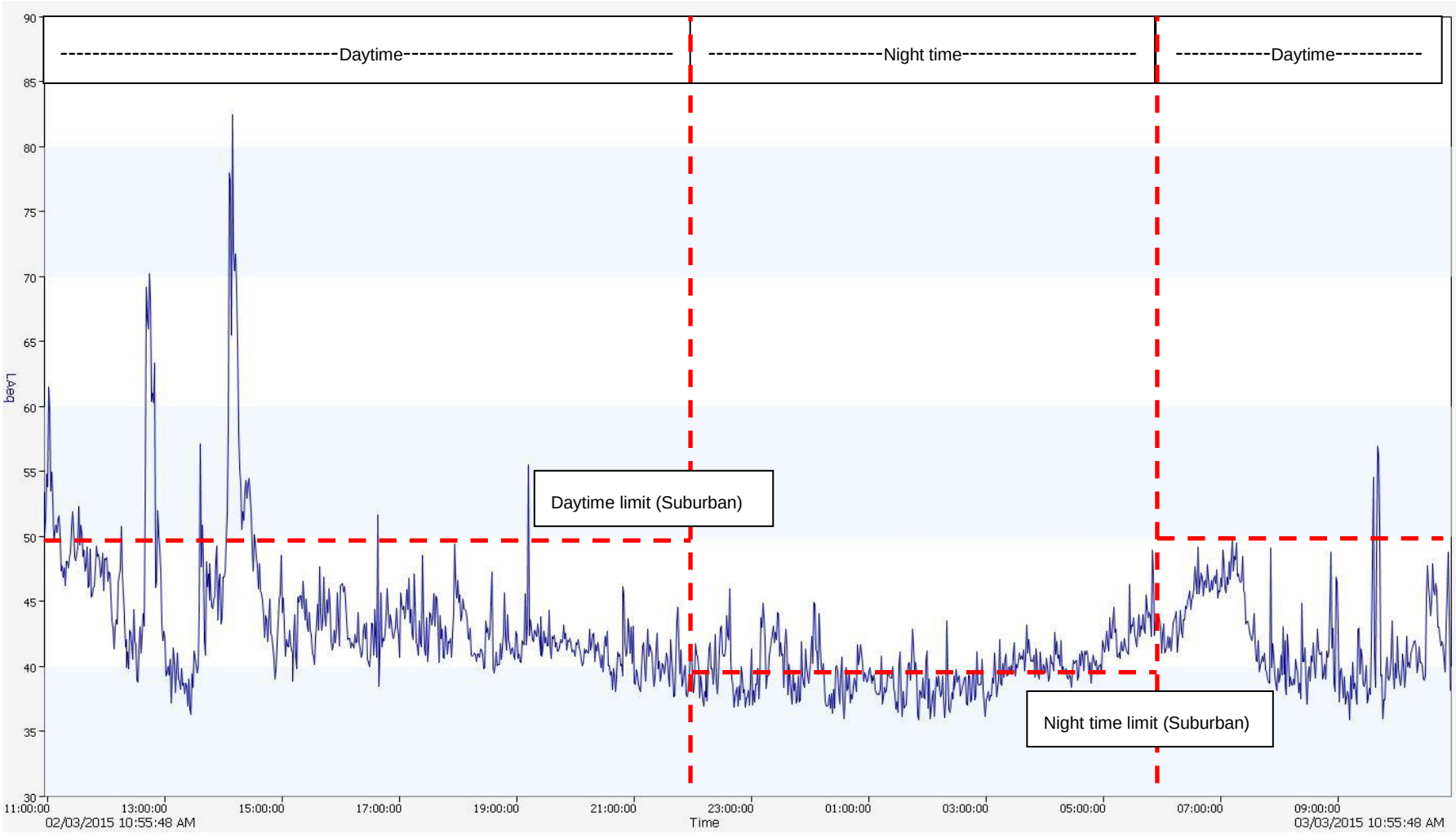


Figure 9-5: Noise History Graph for Monitoring Site N3

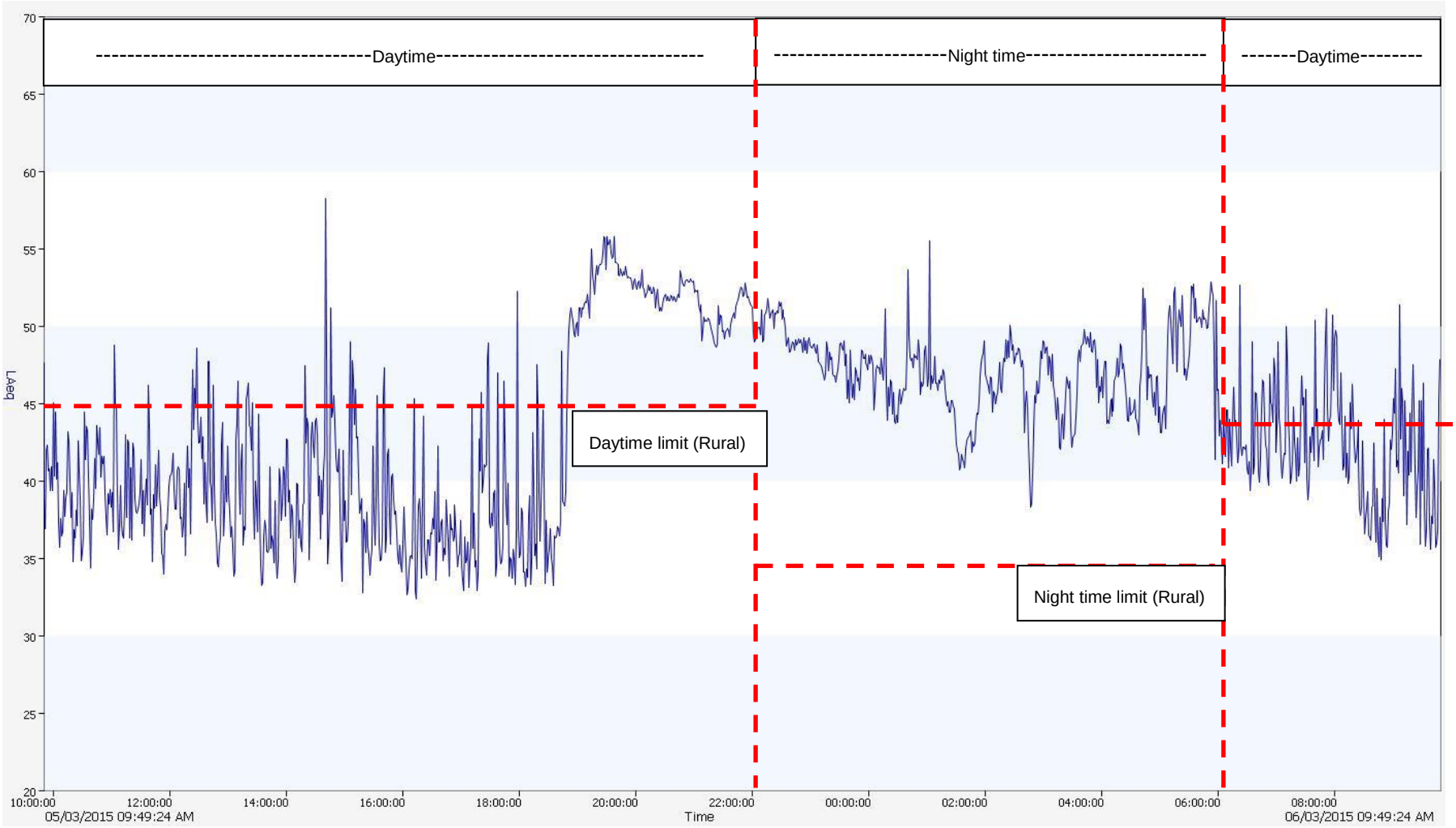


Figure 9-6: Noise History Graph for Monitoring Site N4

9.1.10.1.1 Ambient Noise at Driefontein 5 TSF (N1)

Noise monitoring at location N1 was taken at the nearest noise sensitive receptor, Leslie Williams Private Hospital, and was assumed to be within an industrial area as it is within the Driefontein Mining Right area.

Based on the daytime results, the existing ambient noise levels are below the SANS rating levels for the maximum allowable outdoor daytime limit for ambient noise in urban/industrial districts. The ambient noise levels are slightly above the SANS rating levels for the maximum allowable outdoor night time limit for ambient noise in urban/industrial districts. The day time and night time noise levels were impacted by mining operations at Driefontein Processing Plant across the R500 regional road, as well as vehicular traffic.

9.1.10.1.2 Ambient Noise at Driefontein 3 TSF (N3)

The measurement at N3 was taken at the nearest noise sensitive receptor, which is Letsatsing Village. The location is seen as urban industrial zone as it is located within the Driefontein Gold Mine.

The baseline results indicated that the existing ambient noise is below the daytime and night time noise guidelines for urban districts. The overall ambient noise levels at N3 were impacted by vehicle movement on the surrounding roads, children playing at the Letsatsing Combined School adjacent to the residential village and from intermittent train movement on the railway line running adjacent to the south of Letsatsing Village.

9.1.10.1.3 Ambient Noise Levels for the Proposed RTSF Complex and CPP (N2 and N4)

Noise monitoring location N2 (RTSF) and N4 (CPP) were taken at the nearest noise sensitive receptors, which was the farmstead of Mr Frans de Bruyn on Portion 6 of Wildebeestkuil 360 IQ and portion 42 of Rietfontein 349 IQ, leased by SGL, respectively. The locations were agricultural farmsteads and were determined to be rural.

The baseline noise results for N2 indicated that the ambient noise levels were above the daytime and night time noise guidelines for rural districts, with N4 noise monitoring location above the night time limits as well. The baseline results indicated that the existing ambient noise at monitoring location N4 was at the same level as the daytime noise guideline for rural districts The overall ambient noise levels at N2 were impacted by birdsong and vehicle movement on the Fochville Road 200 m south of the monitoring location. During the night time *Gryllidae* (crickets) were the main noise source. N4 monitoring location was impacted by operational activities at Kloof 4, birdsong and intermittent bird song during the day and *Gryllidae* (crickets) and *Cicada* during the night time.

9.1.11 Heritage

The Heritage Impact Assessment is included as Appendix N.

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 associated with the WRTRP.

Within regional, local and site specific contexts, the project is located in historically significant mining-industrial and agricultural-rural cultural landscapes. 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.

9.1.11.1 Driefontein Mining Right Area Heritage Resources

The identified heritage resources associated with the Driefontein Mining Right area are provided in Plan 22. Five heritage resources were found that may be impacted by the Driefontein Mining Right area infrastructure and activities. The resources identified have been deemed to have a negligible cultural significance (Appendix N) and no heritage resources identified were determined to have cultural significance; no burial grounds or graves are associated with the Driefontein Mining Right area.

The identified heritage resources, although deemed to have a negligible cultural significance, are protected under Section 34 of the NHRA and require a destruction permit should the resources be removed. It is not anticipated that the heritage resources will be required to be demolished as they are adjacent to the proposed pipeline routes and not within the footprint areas.

Plan 22: Identified Heritage Resources

9.1.12 Socio-Economic

The Social Impact Assessment for the WRTRP is provided in Appendix O.

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, where the CPP and RTSF will be situated, is bordered by the Randfontein LM, Johannesburg Metropolitan Municipality, Merafong City LM, Sedibeng DM, and Emfuleni LM. The Driefontein 3 and 5 TSFs, WBT and BWSF complex and associated infrastructure will be located within the Merafong City LM. 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 only significant business node occurs within Westonaria and Carletonville towns' Central Business District (CBD); the remainder of the LMs is characterised by scattered residential areas, agriculture 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 and Carletonville are 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.

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

- Fochville;
- Carletonville;
- Welverdiend;
- Greenspark;
- Wedela;
- Blyblank;
- Khutsong; and
- Kokosi.

Carletonville is located centrally in the Merafong City LM. 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 Carletonville, with the central part of the LM being characterised by mining activities and the associated scattered housing developments. As with the rest of the West Rand 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.

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 Merafong 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 Economy and Sectoral Structure

In 2013, the economies of the Westonaria and Merafong City LM's represented 35.8% of the total GDP of the West Rand DM, which was valued at R61 466 million (2013 prices). Between 2003 and 2013, the West Rand DM economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year.

The West Rand economy is primarily based on the tertiary services with 66.7% of its GDP being generated by industries in this sector. Finance and personal services, as well as government services are the major contributors to the Western Rand economy. Its dependency on mining though is also quite substantial as the mining sector contributed 11.2% of GDP in the district. It should be noted that manufacturing is also quite prominent in the West Rand economy with 15.7% contribution to its GDP.

The Westonaria and Merafong City economies though are far more dependent on the mining industry than the district in general.

9.1.12.4 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 share 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.

9.1.12.5 Driefontein Mining Right Area

Major land uses within the Driefontein Mining Right area mirror the land uses for the region and include agriculture, grazing, residential, mining and business uses. Residential land use

comprises both formal and informal uses. Formal structures are either occupied by land users who rent properties from mining companies and farm owners, or landowning families farming on privately owned property.

Agricultural activities within the area comprise commercial maize and soya farming, as well as livestock grazing. Livestock, mostly cattle, also graze throughout the Mining Right area. An overview of the land owners and land use within the affected properties associated with the Driefontein Mining Right area infrastructure are provided in Table 9-37.

Table 9-37: Farm Portions and Land Uses for the Driefontein Mining Right Area Infrastructure

Infrastructure	Affected Properties		Land Ownership								Current Land Use on Property within Buffer						Occupants			Structures					
	Farm name	Portion	South Deep	Private ownership	Kloof Gold Division	Rand Uranium/Sibanye	Kloof gold mining company	Far west rand dolomitic water association	Driefontein consolidated	If private, name of landowner/s	Residential	Business	Government	Commercial cultivation	Livestock (cattle)	Mining	Landowner households	Tenants	Vulnerable households	Formal residential	Informal residential	Business	Water infrastructure	Access roads	Mining infrastructure
Pipeline from K10 shaft to BWSF	Libanon 28	R			x						x	x	x			x		x	x	x	x	x		x	X
	Uitval 280	RE					x							x		x								x	X
		9					x							x										x	
		8					x							x										x	
	Driefontein 355	22					x							x										x	
Pipelines from the BWSF to Driefontein 3 and 5 TSFs	Driefontein 355	11							x																
		15							x																
		8							x																
		21							x							x								x	X
		2							x							x								x	X
	Driefontein 133	RE/1							x							x								x	
	Driefontein 133	RE/1							x		x	x				x		x	x		x	x		x	X
	Blyvooruitzicht 116	6							x							x								x	X
		7							x							x								x	
		8		x						Unknown						x									X
		24		x						Unknown						x									X
		9		x						Unknown						x									X
Pipeline from WBT to CPP	Doornkloof 350	R			x										x										X
		4			x										x										X
		12			x									x											
		33			x						x	x						x	x		x	x		x	
		21					x																	x	

Infrastructure	Affected Properties		Land Ownership							If private, name of landowner/s	Current Land Use on Property within Buffer						Occupants			Structures					
	Farm name	Portion	South Deep	Private ownership	Kloof Gold Division	Rand Uranium/Sibanye	Kloof gold mining company	Far west rand dolomitic water association	Driefontein consolidated		Residential	Business	Government	Commercial cultivation	Livestock (cattle)	Mining	Landowner households	Tenants	Vulnerable households	Formal residential	Informal residential	Business	Water infrastructure	Access roads	Mining infrastructure
		RE/1					x																		
		22		x						Unknown	x	x			x			x	x		x	x		x	
		34						x			x	x						x		x		x		x	
		RE/6		x						Unknown														x	
		5						x						x										x	
	Leeuwpoort 356	71						x						x											
		70												x										x	
	Leeudoorn 351	X			x																			x	
	Driefontein 355	22							x															x	
		4																							
	Rietfontein 349	14			x						x					x				x				x	X
		13			x						x														X
		12			x						x	x						x	x	x	x	x		x	
		47			x						x							x			x			x	
		21			x						x	x						x		x	x	x			
		2			x						x					x		x	x		x			x	X
	Uitval 280	RE					x							x										x	
		9					x							x										x	
		8					x							x										x	
	Driefontein 355	22												x										x	
Power line (East Driefontein Substation to WBT and BWSF complex)	Driefontein 355	11							x																
		10							x																
		15							x															x	

Infrastructure	Affected Properties		Land Ownership							If private, name of landowner/s	Current Land Use on Property within Buffer						Occupants			Structures					
	Farm name	Portion	South Deep	Private ownership	Kloof Gold Division	Rand Uranium/Sibanye	Kloof gold mining company	Far west rand dolomitic water association	Driefontein consolidated		Residential	Business	Government	Commercial cultivation	Livestock (cattle)	Mining	Landowner households	Tenants	Vulnerable households	Formal residential	Informal residential	Business	Water infrastructure	Access roads	Mining infrastructure
		2							x		x							x		x				x	
Power line (Driefontein 3 TSF to West Driefontein 6- substation)	Driefontein 113	RE/1							x							x									X
		2							x							x									X
Power line (West Driefontein gold substation to Driefontein 5TSF)	Blyvooruitzicht 116	7							x							x								x	
		6							x							x								x	X

9.1.13 Radiation

A Radiological Impact Assessment was undertaken by Dr. JJ van Blerk, a Radiation Protection Specialist, and is attached as Appendix P.

Many radioactive isotopes (or radionuclides) occur naturally throughout the Earth's crust and are present in rocks, soils, river water, as well as in seawater. Most of these naturally occurring radionuclides, which are also associated with the gold bearing reefs of the Witwatersrand, are members of three radioactive series identified as the uranium (U-238), actinium (U-235), and thorium (Th-232) series. In undisturbed environmental conditions, these radionuclides form part of the natural background radiation, to which all humans are exposed on a daily basis through the air, water, soil and food (Kathren, 1998).

As part of the regulatory process administrated by the NNR, SGL is required to characterise the radiological baseline for the areas potentially affected by the WRTRP. This process, which normally includes area gamma and dose rate surveys of the affected areas, full spectrum radioanalysis of soil, water and sediment, as well as measurements of airborne radon concentrations, was sub-contracted to the South African Nuclear Energy Corporation (Necsa). The purpose of the survey was to characterise the baseline radiological conditions of the potentially affected areas and to determine the levels of naturally occurring radionuclides.

The following sections present a summary of the gamma survey and dose rate measurement results.

9.1.13.1 Gamma Survey

Measurements were collected during July and August 2015 at all accessible areas within the proposed infrastructure footprints and immediate surroundings, such as the WBT and BWSF complex and pipeline routes. The readings included K-40, Ra-226 and Ra-228 nuclide concentrations in surface soil. The gamma survey results are based on comparing the measured activity concentration to the regulatory exclusion level for radioactive nuclides in the soil which is defined as the maximum activity concentration of 0.5 Bq per gram for uranium and thorium and 10 Bq per gram for K-40 (NNR, 1999). The average and median results for all measurement locations associated with the Driefontein Mining Right area infrastructure footprints were within the maximum concentrations, with 8 measurements exceeding the 0.5 Bq per gram for nuclides of the U-238 decay chain. The measurements exceeding the maximum concentrations were along the proposed pipeline route between the Driefontein 3 and 5 TSFs.

9.1.13.2 Gamma Dose Rate Measurements

Gamma dose-rate measurements were collected using a calibrated dose-rate monitor equipped with a Geiger Muller counter. Similarly with the gamma survey, majority of the measurements associated with the Driefontein Mining Right area infrastructure footprints

were within natural background concentrations, with four measurements associated with Driefontein 5 TSFs exceeding the maximum range.

9.2 Description of the Current Land Uses

The current land use for the region is dominated by agricultural and mining activities, with agriculture including both cultivation of crops and grazing. The proposed pipeline routes utilise existing servitudes, mine owned land and already disturbed areas which is associated with agricultural and mining land uses, as well as residential. The land use for the project area is illustrated in Plan 14, as discussed in Section 9.1.4.2.

9.2.1 Land Claims

A request to identify lands over affected farm portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Based on feedback from the Commission, there are land claims on the following properties associated with the Driefontein Mining Right area:

- Portion 5 of Doornkloof 350 (associated with the Driefontein pipeline);
- Portion 70 of Leeuwpoort 356 (associated with the Driefontein pipeline); and
- Portion 71 of Leeuwpoort 356 (associated with the Driefontein pipeline).

9.3 Description of Specific Environmental Features and Infrastructure on the Site

The environmental features within the WRTRP and Driefontein Mining Right area are discussed in detail in Section 9.1.

9.3.1 Water Resources

The WRTRP is situated in the Upper Vaal WMA 8 and within the quaternary catchments C23E, C23J, C23D, C22J and C22H, with the Driefontein Mining Right area falling within quaternary catchments C23E, C23D and C23J. The WRTRP area is drained by the Wonderfonteinspruit, Leeuspruit and the Loopspruit. The Wonderfonteinspruit flows westwards, north of the Driefontein 3 and 5 TSFs, and eventually becomes the Mooirivierloop before a confluence with the Mooi River downstream.

The overall surface water quality for the WRTRP area indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the Barrage WQO. This indicates that rivers within this area are already impacted; 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.

Wetlands within the WRTRP area are characterised by 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 identified wetlands are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems and has contributed to the direct loss of wetland habitat. The wetlands have been demarcated a PES of D (largely modified) and an EIS of low to moderate.

The aquatic ecosystems associated with the project area mirror the impacted nature of the surface water quality and wetlands functioning, with the aquatic systems determined to have PES of Class D and E, which is moderately to seriously modified. The conductivity concentrations exceeded the DWAF (1996) aquatic guidelines for all monitoring sites sampled, during the high and low flow surveys.

The groundwater within the Driefontein Mining Right area is typical of contaminated water emanating from historical TSFs and current mining operations, with elevated concentrations of sulfate, TDS and nitrates, as well as manganese and chloride. The pH values range between 4.1 and 8 and are indicative of AMD impacts associated with seepage from existing TSFs. The historical TSFs are located on dolomite which is dewatered to allow for dry and safe underground workings; the dewatering result in a low pressure within the dolomite and encourages drainage of mine affected water from the TSFs into the groundwater system and the seepage is expected to migrate downwards into the aquifers.

9.3.2 Terrestrial Landscape Habitat

The project area is comprised of various land uses which includes mining, historical TSFs, industrial areas, residential areas and agricultural activities. The regional vegetation of the WRTRP area consists of the Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Rand Highveld Grassland and Soweto Highveld Grassland, with the two former vegetation types being classified as Vulnerable and the Highveld Grassland vegetation types classified as Endangered.

The infrastructure associated with the Driefontein Mining Right area is located within grassland, wetland, ridges, agricultural (cultivation and grazing) and transformed areas. The grassland is composed of dominant and well developed graminoid components, as well as a healthy forb component. Within the grassland delineation, three sub communities were identified. The dominant grassland sub community associated with the WBT and BWSF complex and pipelines between the K10 shaft, WBT and BWSF complex and Driefontein 3 TSF is the *Eragrostis gummiflua – Themeda triandra* grassland, with the southern section of the pipeline towards the CPP being the *Themeda triandra – Hyparhennia hirta* grassland and the central section of the pipeline from the WBT to the CPP being delineated as *Cymbopogon excavates – Helichrysum regulosum* grasslands.

No Red Data mammal or bird SSC were identified during the field survey, although the Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder,

2008) and is expected to occur within the wetland habitats identified within the project area. This species has been allocated a status of Vulnerable. Reptile Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*) (Vulnerable) and the Striped Harlequin Snake (*Homoroselaps dorsalis*) (Rare). Invertebrate Red Data species expected to occur on site include the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey.

9.3.3 Cultural Heritage

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography which is characterised by underground drainage systems with sinkholes, dolines and caves. Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger, regional area. Stone Age lithics recorded have been found as surface scatters outside of any discernible context, limiting the 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.

The heritage resources identified within the Driefontein Mining Right area were three structures older than 60 years old and are protected under Section 34 of the NHRA. The identified structures do not occur within the proposed infrastructure footprints but are located between 30 m and 100 m from the pipeline route. The identified resources are considered to have a negligible cultural significance.

9.3.4 Infrastructure

The WRTRP area is located throughout the West Rand, with towns such as Carletonville, Westonaria and Randfontein located adjacent and within the Mining Right areas. The proposed pipelines between the K10 shaft and Driefontein 3 and 5 TSFs (via the WBT and BWSF complex) are located adjacent to the R501 regional road. The pipeline from the WBT to the CPP will cross the N12 national road and will utilise the servitudes of other farm and provincial roads. With the exception of the R501 regional road, there is no further infrastructure associated with the proposed WBT and BWSF complex location.

9.4 Environmental and Current Land Use Map

The environmental and land use features for the Driefontein Mining Right area are detailed in the respective plans included above, as referenced in Table 9-38.

Table 9-38: Environmental and Land Use Features Plans

Environmental Feature	Plan Number
Geology	Plan 11
Land Type	Plan 12
Land Use	Plan 14
Surface Water Resources	Plan 15
Vegetation Types	Plan 16
Sensitivity Analysis	Plan 17
NFEPA Wetlands	Plan 19
Delineated Wetlands	Plan 20
Heritage Resources	Plan 22

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 have been 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 has been 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 Driefontein 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.

Regarding the Ultimate WRTRP, it must be noted that the presence and activities associated with the RTSF complex and CPP may have negative and 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 Driefontein Mining Right area does not include the activities associated with the RTSF complex and CPP, 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 Driefontein Mining Right area, which may result in potential impacts, includes the following:

- The reclamation of Driefontein 3 and 5 TSFs;
- The construction and operation of the WBT and BWSF;
- Roads, power lines, pipelines and pump stations associated with the above listed infrastructure; and
- Employment and Procurement.

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.

The impacts ratings in the following sections do not constitute the entire array of impacts that have been assessed by the various specialists. The impacts ratings highlighted here are those considered significant; all low and medium-low negative and negligible and minor positive impacts ratings have not been included. Please refer to the individual specialist studies for a detailed impact assessment of all potential impacts identified.

Potential project risks, such as hydrocarbon spillages and pipeline leaks, 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

Table 10-1 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-1: Interactions and Impacts on Air Quality during the Construction Phase

Interaction	Impact
Site clearing	Generation of dust from vehicle wheels travelling on gravel roads and the reduction in the quality of ambient air due to airborne dust
Exposure of loose soils due to loss of vegetation cover	Increased particulate matter load in the atmosphere leading to deteriorated air quality

10.1.1.1 WBT and BWSF Complex and Pipelines and Roads

10.1.1.1.1 Impact Description

The removal of vegetation, stripping of soil and grading of the landscape in preparation for construction activities uses a range of construction equipment. These activities leads to the generation of fugitive dust, which comprises Total Suspended Particles (TSPs), PM_{10} and $PM_{2.5}$, from the equipment and during material handling. The movement of vehicles and equipment, contractors and permanent workforce and the levelling and compacting of the landscape all contribute to dust emissions.

10.1.1.1.2 Management Objectives

The management objective is to ensure that nuisance and contaminated dust emissions, associated with the construction of the WBT and BWSF complex and associated pipelines and roads, comply with regulatory guidelines and standards for the protection of the environment, human health and wellbeing; the management objective is to ensure that both on-site and off-site airborne dust concentrations comply with the relevant health protection criteria.

10.1.1.1.3 Management Actions and Targets

On-site monitoring must be undertaken daily to capture peak emissions. Monitoring will be undertaken upwind and downwind of active operations, as well as at the site of active operation. Fine particulate monitoring for public exposure will be undertaken at the closest public area downwind. All monitoring results must be maintained on a logging sheet for reference and proof of compliance to the air quality standards. All test results must be assessed against the relevant standards (NDCR and NAAQS) for PM_{10} (75 µg /m^3) and dust fallout (600 mg/m^2/day).

10.1.1.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-2.

Table 10-2: Potential Impacts on Air Quality due to the Construction Phase

Site Clearing for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in ambient air quality due to dust generation			
Prior to mitigation/ management			
Duration	Short term (1)	Dust generation will be limited to the disturbed area and only for a few days	Low (negative) – 12
Extent	Local (2)	Dust generated will be limited to the site and the immediate surroundings	

Site Clearing for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Minimal (1)	Minimal impact on ambient air quality	
Probability	Unlikely (3)	There is possibility that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on the dirt roads and exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.			
Post- mitigation			
Duration	Short term (1)	Dust generation will be limited to the area disturbed for a few days only.	Low (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 (1)	Generated dust will have a minimal impact to a small area and may result in a minimal social impact.	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low.	
Nature	Negative		

10.1.2 Groundwater Impacts

There are no anticipated impacts on groundwater during the construction phase of the project. Any infrastructure constructed, such as the WBT and BWSF and pipelines and roads, will take place above the water table which will not result in impacts to the groundwater. There is a possibility for diesel, fuel or other organic fluids and inorganic solvents that may be spilled or leak onto the ground surface during construction activities. Such substances have the potential to impact on groundwater quality. Such incidents are considered as project risks which may result in an impact and have not been assessed in terms of its significance. Mitigation measures for project risks are provided in Section 11.2.

10.1.3 Soil Impacts

The WBT and BWSF complex site will be stripped of vegetation and topsoil and the construction of the infrastructure will commence. The stripped soils will be stockpiled according to the rehabilitation plan recommendations. In addition, the major impacts to

consider in above ground pipeline construction will be the loss of topsoil as a resource through compaction and erosion. Whilst the construction takes place, vehicles will drive on the soil surface resulting in soil compaction. 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.

Table 10-3 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-3: Interactions and Impacts on Soil during the Construction Phase

Interaction	Impact
Site Clearing and stockpiling for the WBT and BWSF complex and pipelines and roads	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Exposure of soils due to loss of vegetation	Soil erosion due to wind and surface water runoff; Loss of land capability due to erosion
Use of vehicles and heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

10.1.3.1 WBT and BWSF Complex

10.1.3.1.1 Impact Description

Site clearing and stockpiling of soil will be undertaken for the WBT and BWSF complex, resulting in the susceptibility of soil erosion. The loss of topsoil as a resource will have a high negative impact as the natural regeneration of a few millimetres of topsoil takes hundreds of years. Cleared land increases the runoff potential over the area, which will increase the potential for erosion to occur.

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. When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted. Erosion and compaction of soil will result in the loss of topsoil as a resource. In addition, the land capability of the proposed WBY and BWSF footprints are considered Class II which is intensive cultivation. The land capability will be impacted from Class II to unusable due to the development of the WBT and BWSF complex.

10.1.3.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the site clearing and stockpiling activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

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 must be stripped by truck and shovel methods only.

There are no management objectives for the loss of land capability as the land use will change from agricultural to mining, impacting on the land capability.

10.1.3.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the footprints of the WBT and BWSF complex to an adequate end land use to be determined by a Closure Plan which will be updated in due course. To ensure that rehabilitation and eventual closure is effective and successful, the management of the soil resources is critical during the life of the project. The management of the soil throughout the project will directly influence the success of the rehabilitation activities. The soil will, thus, be stripped and stockpiled to prevent and minimise potential impacts with rehabilitation and long term use in mind.

A Rehabilitation Plan (Appendix Q) has been compiled and will detail the following:

- Following adequate stripping guidelines;
- The topsoil must be stripped by mechanical means, such as 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 (0.3 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;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be used for their designated final purposes; and
- The stockpiles must be vegetated to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

10.1.3.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on soils are provided in Table 10-4.

Table 10-4: Potential Impacts on Soils due to the WBT and BWSF Complex

Site Clearing and stockpiling for the WBT and BWSF complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion.			
Prior to mitigation/ management			
Duration	Project Life (5)	Topsoil will be stripped and stockpiled if this is done without following the mitigation measures the impact will have a long term affect.	Medium-high (negative) – 84
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project site.	
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	Certain (7)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; ▪ Ensure storm water management designs are in place; and ▪ Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state and vegetated, as per the Rehabilitation plan.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project infrastructure area.	
Intensity	Moderate (3)	Loss of topsoil may result in loss of land capability and land use.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

Loss of land capability due to site clearing and due to the WBT and BWSF Complex			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Removal of soil layers will impact on the land capability because vegetation can no longer be supported.			
Prior to mitigation/ management			
Duration	Project life (5)	The removal of soil from a profile reduces the land capability from a rateable index to non-existent; this impact will occur for the project life.	Medium-High (negative) – 77
Extent	Limited (2)	The impact will only occur on the project infrastructure area.	
Intensity	Serious (4)	Loss of topsoil results in the loss of land capability and use.	
Probability	Certain (7)	By removing the topsoil the impact on land capability is certain.	
Nature	Negative		
Mitigation/ Management actions			
No land capability mitigation is possible during the construction phase because the land capability will be reduced to unusable. As a result, there are no post mitigation measure impact ratings.			

10.1.3.2 Pipelines and Roads

10.1.3.2.1 Impact Description

The construction of the pipelines and roads may result in soil erosion due to exposed surfaces, as well as compacting soil resources due to the presence of vehicles and machinery. The loss of topsoil as a resource will have a high negative impact as the natural regeneration of a few millimetres of topsoil takes hundreds of years, although the impact will be limited to the linear footprints of the pipelines and roads.

10.1.3.2.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the site clearing and construction activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.1.3.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.1.3.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on soils are provided in Table 10-5.

Table 10-5: Potential Impacts on Soils due to Pipelines and Roads

Site Clearing and construction of the pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion.			
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.	Medium-low (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			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ Ensure storm water management designs are in place.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (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.	

Site Clearing and construction of the pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

10.1.4 Surface Water Impacts

Sedimentation of surface water resources due to potential soil erosion will impact on surface water quality. In addition, operational areas associated with the WBT and BWSF complex will be demarcated dirty water areas to ensure that potential contaminated water, due to water use and water runoff from operational areas, does not flow to clean water resources, thereby impacting on water quality. A SWMP will be implemented to manage and control clean and dirty water areas.

Table 10-6 details the project activities' interactions and the resultant impacts on surface water as a result of the proposed developments.

Table 10-6: Interactions and Impacts on Surface Water during the Construction Phase

Interaction	Impact
Site Clearing	Increased sedimentation on downstream watercourses due to exposed surfaces resulting in siltation of surface water resources.
	Mixing of upstream clean water runoff with dirty water runoff from cleared site areas.
Construction of infrastructures (WBT and BWSF complex).	Reduction in catchment yield

10.1.4.1 WBT and BWSF Complex

10.1.4.1.1 Impact Description

Site clearing activities increases the erosion potential of the soils due to the removal of vegetation and the compaction of the soil resources. Exposed surfaces are likely to result in increased sedimentation of surface water resources due to runoff from these areas which will be high in suspended solids. The areas cleared for the pipelines and roads are expected to be limited in extent, with the predominant impact resulting for the clearance of land for the WBY and BWSF complex.

The construction of the WBT and BWSF complex will include the establishment of dirty water areas. The SWMP will result in the reduction of catchment yield as the footprint area will no longer form part of the natural downstream catchment. The WBT and BWSF complex

occupies less than 1 % of the C23E quaternary catchment and this impact is considered to be negligible and has not been rated as a result.

10.1.4.1.2 Management Objectives

The management objectives adopted during the construction phase relate specifically to GN R704 of the NWA, which was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

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

- *Condition 4* which 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 flood-line;
- *Condition 6* which 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. Any dirty water dams must have a minimum freeboard of 0.8 m above full supply level; and
- *Condition 7* which describes the measures that must be taken to protect water resources. All dirty water or substances that may cause pollution must be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.

10.1.4.1.3 Management Actions and Targets

The runoff from the upstream clean water catchment is to be diverted away from the proposed infrastructures. Temporary surface water ditches/berms 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.

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.

10.1.4.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on surface water resources are provided in Table 10-7.

Table 10-7: Potential Impacts on Surface Water due to the WBT and BWSF Complex

Site clearing for the Construction of the WBT and BWSF complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Mixing of upstream clean water runoff with dirty water runoff from cleared site areas, along with surface water sedimentation.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	May continue beyond the project life if not managed correctly	Medium-high (negative) – 80
Extent	Region (5)	May affect 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 ditches must be constructed down-gradient of the cleared areas; ▪ The temporary ditches must be sized according to the 1:50 year rainfall event; ▪ Utilise water stored in the temporary ditches; ▪ Clean water upstream of the cleared and construction areas must be diverted around the site to nearby water courses. The diversion canals must be sized to accommodate a 1:50 year rainfall event; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas.			
Post- mitigation			
Duration	Short term (2)	Will only last for the duration of the construction phase	Low (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	

Site clearing for the Construction of the WBT and BWSF complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		

10.1.5 Fauna and Flora Impacts

The construction of surface infrastructure will require the clearing of vegetation and habitats within the proposed infrastructure footprints. The interactions and impacts on fauna and flora are provided in Table 10-8.

Table 10-8: Interactions and Impacts on 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 SSC (protected species).
	Alien vegetation recruitment.

10.1.5.1 WBT and BWSF Complex and Pipelines and Roads

10.1.5.1.1 Impact Description

The Driefontein Mining Right area consists of grasslands, wetlands, ridges and transformed areas, the latter of which includes agriculture and alien invasive vegetation. The WBT and BWSF footprint coincides within grassland and wetland areas, with the pipeline route from the WBT to the CPP crossing sensitive habitats, such as ridges, grassland and wetlands.

The Nationally protected *Boophone disticha* (Poison bulb) (Declining) was encountered throughout the grassland and ridges vegetation categories and the plant species *Hypoxis hemerocallidea* (Star Flower) (GDARD, Declining) was encountered in the grassland vegetation type. In addition, protected species as listed in Table 9-14 are expected to occur within the grassland vegetation type and must be managed accordingly.

Once vegetation has been cleared, disturbed and open areas will be colonised by alien invasive vegetation, which may impact on indigenous vegetation in the surrounding areas and increasing the alien invasive vegetation infestation. The infestation of alien invasive vegetation is considered to be a medium-low (negative) impact.

10.1.5.1.2 Management Objectives

Management objectives will be to prevent the loss of important/protected landscapes and species of plants and animals (such as those with Red Data Status, National and Provincial).

This is achieved by avoiding destruction of areas where these species are located. If this is not possible in the case of plants, relocation permits will be required.

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 and identifying species that can be removed, such as alien invasive vegetation.

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.

10.1.5.1.3 Management Actions and Targets

Red Data 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 Data plant species according to Red List Plant Guidelines (2012) and include:

- 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; and
- An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red Data plant species, and such Ecological Management Plans must conform with the Guidelines set out for buffer zone widths.

An Alien Invasive Management Plan has been developed and implemented as part of the Driefontein Mine. The Alien Invasive Management Plan must be extended to include activities associated with the WRTRP and implemented to preserve natural habitat. An Alien Invasive Management Plan must be implemented to preserve natural habitat and reduce current infestations, such as the 85 ha of alien invasive vegetation identified within the Driefontein Mining Right area. Such a strategy will entail the identification and extent of areas where such infestation occurs. Thereafter, specific eradication measures can be prescribed for species present. The Alien Invasive Management Plan must reduce the

number 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. Currently there are approximately 60.7 ha of alien invasive vegetation that will form part of the infrastructure areas: the aim will be to reduce this infestation to 0 ha.

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

Training must be given to onsite staff detailing 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. Records must be kept of any Red Data plant and animal species removal or death; this will ensure that management actions are adapted if they are not successful.

Destruction of vegetation must be limited to the areas essential for the development. Once construction activities are completed, any surrounding disturbed areas must be rehabilitated within one week and any potential areas of erosion must be marked and attended to before the following wet season starts. All exposed patches of soil must be vegetated with pioneer species which will colonise open and disturbed areas relatively quickly and prevent erosion and alien invasive vegetation from establishing.

10.1.5.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on fauna and flora are provided in Table 10-9.

Table 10-9: Potential Impacts on Fauna and Flora during the Construction Phase

Site clearing for the WBT and BWSF complex in and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Alien invasive vegetation infestation.			
Prior to mitigation/ management			
Duration	Long term (4)	Alien vegetation will colonise any area that is available.	Medium-low (negative) - 48
Extent	Municipal area (4)	Such an infestation can easily spread to the entire municipal area.	
Intensity	Moderate (4)	Serious loss of sensitive habitats due to alien vegetation colonisation.	
Probability	Probable (4)	It is unlikely that without mitigation measures, alien vegetation will establish.	
Nature	Negative		

Site clearing for the WBT and BWSF complex in and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Mitigation/ Management actions			
▪ Manage vegetation clearing to areas required for construction to limit the extent of disturbed and open areas; and ▪ Implement an Alien Invasive Management Plan and eradicate alien invasive vegetation.			
Post- mitigation			
Duration	Medium term (3)	Alien vegetation colonisation will be eradicated in accordance with the alien management plan.	Low (negative) - 24
Extent	Limited (2)	An infestation will not be allowed to spread beyond the site and its boundaries.	
Intensity	Minor (2)	Only limited areas will experience this for a short duration.	
Probability	Unlikely (3)	It is unlikely that alien vegetation will establish if mitigation is adhered to.	
Nature	Negative		
Site clearing for the WBT and BWSF complex in and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct loss of floral species/vegetation types and the resultant loss of habitats for fauna. This will result in the reduction of biodiversity.			
Prior to mitigation/ management			
Duration	Long term (4)	Loss floral species/vegetation will occur.	Medium-high (negative) - 72
Extent	Local (4)	Species/habitat loss will only occur within and immediately around the Project site.	
Intensity	High (5)	Sensitive sites occur throughout the pipeline and WBT, such as ridges and grasslands, all which have a high probability of containing SSC.	
Probability	High (6)	It is likely that destruction of vegetation types will occur without management measures.	
Nature	Negative		
Mitigation/ Management actions			

Site clearing for the WBT and BWSF complex in and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Limit degradation and destruction of the natural environment to the designated infrastructure footprints and immediate surrounds; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Demarcate and avoid sensitive landscapes, such as riparian and wetland areas; ▪ Where required, permits must be obtained for the removal of protected plants; ▪ Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation			
Post- mitigation			
Duration	Medium term (3)	With vegetation management including rehabilitation, vegetation can recover in 1-5 years.	Low (negative) - 24
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity	Moderate (3)	If protected plant species are managed in accordance with prescribed mitigation measures.	
Probability	Unlikely (3)	It is unlikely that habitat/vegetation types will be unnecessarily lost.	
Nature	Negative		

10.1.6 Aquatics Impacts

Soil compaction and erosion may result in the sedimentation of surface water resources, deteriorating the quality of the water quality. The sedimentation and deterioration of surface water quality can have a significant impact on the aquatic habitats and biota.

It must be noted that the aquatic habitats are moderately to largely modified in its current states. The no-go option of not implementing the project will result in continued impacts on the aquatic habitats due to the surrounding land uses. The potential impacts associated with the no-go option are detailed in Appendix J. The WBT and BWSF complex is not located near any surface water resources and are, thus, unlikely to have an impact on aquatic habitats.

Table 10-10 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-10: Interactions and Impacts on Aquatic Ecosystems during the Construction Phase

Interaction	Impact
Site clearing for WBT and BWSF complex and pipelines and roads.	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 WBT and BWSF Complex and Pipelines and Roads

10.1.6.1.1 Impact Description

Runoff high in dissolved/suspended solids from cleared areas could result in water quality impacts. In addition, through contaminated runoff, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Increased runoff and erosion caused through construction activities as well as movement of suspended materials in runoff may produce habitat quality impacts which may include sedimentation, bed, channel and flow modification. This impact may result from the site clearing and construction activities for the pipelines and roads.

10.1.6.1.2 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.

10.1.6.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. The removal of vegetative cover, as well as the construction of infrastructure, has been recognised as being responsible for increased runoff, sedimentation and subsequent water and habitat quality degradation in downstream portions of river systems (WRC, 2014). As such the careful management of vegetation removal and sedimentation control must be undertaken.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to improve the PES of the Wonderfonteinspruit and Carletonville Tributary. The monitoring for the presence of Hydropsychidae, Aeshnidae and Baetidae species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 25% as a result of activities related to the proposed project.

10.1.6.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic ecology are provided in Table 10-11.

Table 10-11: Potential Impacts on Aquatic Ecology during the Construction Phase

Site clearing for WBT and BWSF complex pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat 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	Medium-high (negative) - 42
Extent	Limited (2)	The impacts are anticipated to occur around the activities which are located in proximity to the Carletonville Tributary and subsequently with the Wonderfonteinspruit downstream.	
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			
▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive; slow deep/shallow habitats should be favoured; ▪ Pipelines that cross water courses should be incorporated into a bridge or culvert design if possible; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities 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.			

Site clearing for WBT and BWSF complex pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Post- mitigation			
Duration	Medium term (3)	The construction will be short term and if mitigated so will the impacts be short term.	Low (negative) - 21
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 Wetlands Impacts

The proposed WBT and BWSF complex is located over a pan wetland and the construction of the infrastructure will result in the loss of 1 ha of wetland habitat; the extent of the pan is 2.7 ha. Although wetlands and sensitive areas have been avoided as far as possible, the pans could not be avoided entirely for the WBT and BWSF complex.

The proposed pipelines will also be located within intermittent wetland areas, as illustrated in Plan 20. Wetlands are responsible for complex functions that include maintenance of water quality, toxicant assimilation, carbon storage, streamflow regulation and flood attenuation, as well as biodiversity maintenance.

Table 10-12 details the project activities' interactions and the resultant impacts on wetlands as a result of the proposed developments.

Table 10-12: Interactions and Impacts on Wetlands during the Construction Phase

Interaction	Impact
Site clearing for infrastructure placement (WBT and BWSF complex)	Direct loss of 1.0 ha of wetland habitat.
	Loss of ecosystem services
Site clearing and construction activity for infrastructure placement (Pipelines and roads)	Potential pollution and resultant negative impacts on wetlands and loss of ecosystem services.

10.1.7.1 WBT and BWSF Complex

10.1.7.1.1 Impact Description

The clearing of land for the WBT and BWSF complex will result in the destruction of 1 ha of pan wetlands. The loss of wetlands will have potential downstream impacts as the wetland functioning is lost. In addition to the direct impact on the wetlands due to site clearing, the remaining adjacent wetlands will be indirectly impacted upon due to potential contaminated runoff from the cleared areas.

10.1.7.1.2 Management Objectives

Management objectives are to inform SGL where there are wetland interactions with the proposed activities during the construction of the WBT and BWSF complex. 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).

10.1.7.1.3 Management Actions and Targets

A Wetland Management Plan has been provided in Appendix K and must be used as a guide to inform management actions. However, specific management actions are briefly discussed below:

- A Wetland Offset Strategy will need to be compiled for lost wetlands for the WBT and BWSF complex, as detailed in Appendix K;
- Minimise footprint area disturbed by construction activities; and
- Rehabilitation Plan for disturbed wetland must be in place.

10.1.7.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on wetlands are provided in Table 10-13.

Table 10-13: Potential Impacts on Wetlands due to the WBT and BWSF Complex

Site clearing for the WBT and BWSF complex in and adjacent to wetlands			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of 1 ha of wetland habitat.			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Wetland habitat will be impacted by the construction of the WBT and BWSF complex according to the current placement even after the project has ceased	High (negative) -112
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Irreplaceable loss (6)	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			
▪ A wetland offset strategy must be implemented for the wetland habitats lost; and ▪ The WBT and BWSF complex footprint must be rehabilitated as per the Rehabilitation Plan, following the conclusion of the Project.			
Post- mitigation			
Duration	Project Life (5)	Rehabilitation of the wetland will allow the impact to be mitigated and decreased; however the wetland will not be natural.	Medium-high (negative) -98
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted; mitigation will not decrease this.	
Intensity	Serious loss (5)	Loss of natural wetlands is a serious impact to highly sensitive environments.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		

10.1.7.2 Pipelines and Roads

10.1.7.2.1 Impact Description

The potential impacts on wetlands associated with the decommissioning phase may include runoff high in dissolved and suspended solids from exposed surfaces.

10.1.7.2.2 Management Objectives

Management objectives are to prevent 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).

10.1.7.2.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.1.7.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on wetlands are provided in Table 10-14.

Table 10-14: Potential Impacts on Wetlands due to Pipelines and Roads

Site clearing for pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat modification			
Prior to mitigation/ management			
Duration	Medium term (3)	The construction activities involving heavy machinery will be active in and around the wetlands. The construction will be short-term but the impacts can have a medium term impact.	Medium-high (negative) - 55
Extent	Local (3)	Local wetlands will be impacted	
Intensity	Serious long term (5)	Water quality deterioration is a serious impact to sensitive environments.	
Probability	Likely (5)	Pollution from the proposed activities is likely to occur as the pipeline is crossing wetlands, however the pipe is following existing servitudes and therefore probability is not certain.	
Nature	Negative		

Site clearing for pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Mitigation/ Management actions			
▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ Pipelines are to be supported on reclaimed railway sleepers placed at 9m intervals as it approaches the wetland; ▪ The pipeline will be unsupported across the 15 m wetland/ river span and this will also contain a continuous HDPE liner; ▪ The pipeline will not contain any flanges for the full length of the wetland crossing; ▪ 50 m before and after the wetland crossing, the pipeline will be supported on plinths (an in-situ cast concrete support) with foundations located at 9m intervals and also fitted with steel straps; ▪ The pipeline will be fitted with inspection points; ▪ All flanges within 100m of the wetland will be fitted with spray prevention plates; ▪ The spillage paddock will be located outside on the wetland; and ▪ Cleared areas must be minimised as far as possible.			
Post- mitigation			
Duration	Short term (2)	The construction will be short term and if mitigated so will the impacts be short term.	Low (negative) - 32
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a limited impacted extent.	
Intensity	Serious medium term (4)	Water quality deterioration is a serious impact to sensitive environments but can be lessened with mitigation measures.	
Probability	Probable (4)	Mitigation measures will decrease the probability; however given the high impact of the proposed project the impact is probably still likely to occur.	
Nature	Negative		

10.1.8 Visual Impacts

The site clearing and construction of infrastructure will add visual intrusions onto the landscape. The interactions and impacts associated with the construction phase are detailed in Table 10-15.

Table 10-15: Interactions and Impacts associated with the Visual Environment during the Construction Phase

Interaction	Impact
Site clearing and construction will add infrastructure to the visual landscape	The construction of the pipelines and roads and WBT and BWSF complex will have a negative visual impact on the environment as the facilities will be visible to surrounding receptors.

10.1.8.1 WBT and BWSF Complex and Pipelines and Roads

10.1.8.1.1 Impact Description

The pipelines and WBT and BWSF complex are only expected to be visible from close proximity. Site clearance and construction activities will have a negative impact on the visual environment. Once constructed, the pipelines and WBT and BWSF complex will remain *in situ* for the life of the project. Due to the limited extent of the infrastructure, this impact is considered to be medium-low (negative).

10.1.8.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the construction of pipelines.

10.1.8.1.3 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-16.

Table 10-16: Potential Impacts on the Visual Environment due to Construction Phase

Site Clearing and construction for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Infrastructure will impact the visual environment			
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.	Medium-low (negative) – 63
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	The negligible height of the pipelines will restrict the viewshed, with the WBT and BWSF complex limited in their extent	

Site Clearing and construction for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Definite (7)	Pipelines and roads and the WBT and BWSF complex will be constructed	
Nature	Negative		
Mitigation/ Management actions			
▪ Vegetation must only be removed from the infrastructure footprints or areas necessary for construction; ▪ Establish vegetation on disturbed areas following construction; ▪ The WBT and BWSF complex must be painted natural hues to blend into the surrounding landscape; and ▪ Down lighting must be used should construction take place during night time.			
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.	Medium-low (negative) – 48
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	The negligible height of the pipelines will restrict the viewshed, with the WBT and BWSF complex limited in their extent	
Probability	Almost Certain (6)	It is most likely that the impact will occur.	
Nature	Negative		

10.1.9 Noise Impacts

Noise will be generated from a variety of sources, such as equipment and machinery vehicles and pumps, throughout the project. Table 10-17 details the project activities' interactions and the resultant impacts due to the generation of noise as a result of the construction phase. Noise dispersion models were developed and indicated that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-17: Interactions and Impacts associated with Noise during the Construction Phase

Interaction	Impact
Site clearing and construction for WBT and BWSF complex and pipelines and roads	Generation of noise may increase ambient noise

10.1.9.1 WBT and BWSF Complex and Pipelines and Roads

10.1.9.1.1 Impact Description

Noise will emanate from machinery and vehicles operating during the site clearing and construction activities. The noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts are considered to be low (negative).

10.1.9.1.2 Management Objectives

The management objective is to minimise noise generation caused by machinery and vehicles used during site clearance and construction.

10.1.9.1.3 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on noise are provided in Table 10-18.

Table 10-18: Potential Impacts on Noise due to Construction Phase

Site Clearing and construction for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Vehicle and machinery use will generate noise			
Prior to mitigation/ management			
Duration	Immediate (1)	Noise will be produced for the duration of the construction phase.	Low (negative) – 18
Extent	Local (3)	It is expected that during construction noise will extend as far as development site area.	
Intensity	Minimal (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.	
Nature	Negative		
Mitigation/ Management actions			

Site Clearing and construction for the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must 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	Immediate (1)	Noise will be produced for the duration of the construction phase.	Low (negative) – 12
Extent	Local (3)	It is expected that during construction noise will be limited to site if mitigation measures are implemented.	
Intensity	Minimal (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 pumpstation are located in remote areas.	
Nature	Negative		

10.1.10 Heritage Impacts

A total of three heritage sites were identified within the Driefontein Mining Right area and associated infrastructure. The heritage resources identified are structures older than 60 years and are protected under Section 34 of the NHRA. Potential direct impacts to these resources are primarily associated with the construction phase activities, such as site clearing. The identified resources are not within the proposed footprints of the Driefontein Mining Right area infrastructure however, and, thus, no impacts are expected. Should the structures be demolished, altered or damaged in any way, a Section 34 Permit Application must be submitted to PHRA-G.

10.1.11 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 10-19.

Table 10-19: 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.

10.1.11.1 Employment and Procurement

10.1.11.1.1 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. It is estimated that R 2.87 billion (2015 prices) of the production output generated by the Driefontein Mining Right area construction activities will be as a result of consumption induced effects.

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.

10.1.11.1.2 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;
- Where feasible, 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;
- Utilise existing SGL programmes and initiatives to 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.

10.1.11.1.3 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-20.

Table 10-20: 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; ▪ Where feasible, 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; ▪ Utilise existing SGL programmes and initiatives to 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.			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Post- enhancement			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive) 96
Extent	National (6)	The resultant impacts will have a significant impact on a national scale.	
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		
Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct investment for goods and services will result in a multiplier effect on the local economy as a portion of these funds will stimulate regional economic growth.			
Prior to enhancement/ management			
Duration	Project life (5)	The LED will reach its peak during operation, but will commence during construction.	Minor (positive) 70
Extent	Municipal (4)	The local municipalities will benefit from the project, with the district municipality receiving benefits from taxes and royalties.	
Intensity	High (5)	The multiplier effect is likely to have a significant contribution to the region's economy.	
Probability	Likely (5)	Without the appropriate enhancement measures, benefits may be ad hoc and unsustainable	
Nature	Positive		
Enhancement/ Management actions			
▪ Where feasible, utilise existing SLP, LED and related stakeholder engagement processes to determine the need and viability for infrastructure and service-related projects; ▪ Supporting housing development through promoting house ownership for employees; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Local labour, local construction contractors and local and small businesses should be prioritised;			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Identify students from local schools to participate in company bursaries and internship programmes; ▪ 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; and ▪ Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL.			
Post- enhancement			
Duration	Beyond project life (6)	The impacts will last beyond the life of the project.	Major (positive) 119
Extent	Provincial (5)	The correct implementation of enhancement measures will result in benefits throughout the province.	
Intensity	Very high (6)	Living standards will be improved through the region.	
Probability	Certain (7)	The positive impact will definitely occur.	
Nature	Positive		

10.1.11.1.4 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.

10.1.11.1.5 Management Objectives

Management objectives will be to minimise and manage the potential negative impacts associated with disruption of movement for people and livestock.

10.1.11.1.6 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-21.

Table 10-21: Pre-Mitigation and Post-Mitigation Potential Impacts on the Socio-Economic Environment

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Disruption of people and livestock daily movements			
Prior to mitigation/ management			
Duration	Medium term (3)	Mainly during construction phase with some disturbance during operation	Medium-low (negative) - 56
Extent	Local (3)	Project area and surrounding communities	
Intensity	Low (2)	Disruption may be intense for local farmers	
Probability	Certain (7)	Impact will definitely occur	
Nature	Negative		
Mitigation/ Management actions			
▪ 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.			
Post- mitigation			
Duration	Medium term (3)	Mainly during construction phase with some disturbance during operation	Medium-low (negative) - 42
Extent	Limited (2)	Project area and surrounding communities	
Intensity	Very low (1)	Nuisance factor for road users. Disruption may affect productivity of farming businesses	
Probability	Certain (7)	Mitigation will reduce disruption and provide alternative routes	
Nature	Negative		

10.1.11.1.7 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.

10.1.11.1.8 Management Objectives

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

10.1.11.1.9 Impact Description

The significance of the potential socio-economic impacts associated with the construction phase of the project are outlined in Table 10-22.

Table 10-22: 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	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Highly probable (6)	The impact will likely occur	
Mitigation/ Management actions			
▪ 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 that are already in place, such as the community police forum, must be strengthened 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 operational phase includes the following activities associated with the Driefontein Mining Right area:

- The WBT and BWSF complex, including:
  - The storage of mine affected water from K10 shaft in the BWSF; and
  - The thickening of the reclaimed slurry using flocculants at the WBT.
- The reclamation activities at the Driefontein 3 and 5 TSFs including the collection of the slurry in temporary sumps;
- Pipelines and roads including:
  - Pumping of water from K10 shaft to the BWSF;
  - Pumping of water from the BWSF to Driefontein 3 and 5 TSFs;
  - Pumping of slurry from the Driefontein 3 and 5 TSFs to the WBT;
  - Pumping of thickened slurry from the WBT to the CPP; and
  - Use of roads for maintenance and monitoring of pipelines and transmission lines.
- Employment and Procurement

10.2.1 Air Quality Impacts

Dispersion models were simulated to determine the predicted impacts of PM_{10}, $PM_{2.5}$ and dust for the current impacts associated with Driefontein 3 and 5 TSFs. The reclamation activities will utilise hydraulic methods; the use of water during reclamation will suppress potential dust generation. As a result, the current impacts associated with the TSFs, in their current form and footprint, are also considered to be the worst case scenario impacts on air quality during the reclamation activity. Hydraulic reclamation, as well as the reduction in the footprint size, will reduce the air quality impacts that the TSFs are currently having on the surrounding environment. The dispersion model predictions were then used to determine and assess the significance of the potential impacts on the ambient air quality. The reclamation of the Driefontein 3 and 5 TSFs were modelled separately as the reclamation of Driefontein 5 TSF will occur subsequent to the complete reclamation of Driefontein 3 TSF. The predicted PM_{10}, $PM_{2.5}$ and dust fallout emissions were modelled.

The maximum predicted 24-hour concentration of PM_{10} occurred at the centre of the TSFs with predicted concentration of 621 µg per m³ and 170 µg per m³ for Driefontein 3 (Plan 23) and 5 (Plan 24) TSFs respectively, which exceeded the NAAQS limit of 75 µg per m³. The periphery of the TSFs were within the NAAQS recommended limits, with the nearest receptors at Carletonville, Mponeng and Letsatsing having concentrations of 2.8 µg per m³, 8.5 µg per m³ and 7.4 µg per m³, respectively. The maximum annual concentration for PM_{10} for Driefontein 5 TSF was within the NAAQS standard of 40 µg per m³, with a concentration

of 20 µg per m³. Driefontein 3 TSF exceeded this limit with an annual maximum concentration of 69 µg per m³. PM_{10} concentrations from Driefontein 3 and 5 TSFs are likely to be a burden on surrounding air quality, as opposed to cumulative air quality impacts form surrounding land uses.

The daily and annual $PM_{2.5}$ concentrations for Driefontein 3 TSF are within the NAAQS limits with maximum concentrations of 52 µg per m³ and 5.7 µg per m³ respectively. Similarly, the $PM_{2.5}$ concentrations for Driefontein 5 TSF are also within the daily and annual NAAQS limits with concentrations of 14 µg per m³ and 1.7 µg per m³ respectively.

Dust fallout emissions from Driefontein 5 TSF are not anticipated to exceed the NDCR (2013) residential or non-residential rates as the maximum dust deposition of 692 mg per m^2 per day reduces to 100 mg per m^2 per day 600 m from the TSF. The maximum predicted deposition rates for Driefontein 3 TSF are 92 mg per m^2 per day and are well within the NDCR (2013) limits.

A summary of the predicted dispersion model results are provided in Table 10-23.

Table 10-23: Summary of Dispersion Modelling Results

Air Contaminant	Averaging Period	Ambient Air Quality Standard (µg/m^3)	Maximum Ground Level Concentration (µg/m^3)		Levels at receptors (µg/m^3)		
			Driefontein 3 TSF	Driefontein 5 TSF	Carletonville	Letsatsing	Mponeng
Inhalable Particulates (PM_{10})	24 hour	75	621	170	2.8	7.4	8.5
	Annual	40	69	20	0.21	1.2	4.9
Fine Particulate ($PM_{2.5}$)	24 hour	65	52	14	0.01	0.29	0.18
	Annual	25	5.7	1.7	0.02	0.12	0.41
Dust fall (mg/m^2/day)							
Dust Deposition	Monthly	600	92	692	0.18	31	16.7

Plan 23: Maximum 24-Hour PM_{10} Concentrations for Driefontein 3 TSF

Plan 24: Maximum 24-Hour PM_{10} Concentrations for Driefontein 5 TSF

Table 10-24 details the activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-24: Interactions and Impacts on Air Quality during the Operational Phase

Interaction	Impact
Reclamation activities	Dust generation
	Reduction in the quality of ambient air due to increased pollutants loading
Wind erosion of exposed surfaces	Dust generation
	Reduction in the quality of ambient air due to increased pollutants loading

10.2.1.1 Reclamation of Driefontein 3 and 5 TSFs

The Driefontein 3 and 5 TSFs will be hydraulically reclaimed during the operational phase. The resultant slurry will flow to temporary sumps where it will be pumped, via pipelines and the WBT, to the CPP.

10.2.1.1.1 Impact Description

The hydraulic reclamation of the TSFs are not expected to be dust generating activities as the tailings material will form a slurry due to the use of water, suppressing any potential dust emissions. The transportation of personnel on and off site is likely to have a greater impact on air quality than the reclamation activities, although this impact is expected to be low (negative).

10.2.1.1.2 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the reclamation activities comply with the NDCR standards for the protection of the environment, human health and wellbeing.

10.2.1.1.3 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NDCR and NAAQS standards of 600 mg per m^2 per day for dust fallout, 75 µg per m^3 for PM_{10} and 65 µg per m^3 for $PM_{2.5}$. Monitoring of dust fallout levels must be undertaken upwind and downwind of the reclamation activities.

10.2.1.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-25.

Table 10-25: Potential Impacts on Air Quality due to the WBT and BWSF Complex

Reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Medium term (3)	Dust will be produced in the medium term	Low (negative) – 10
Extent	Very Limited (1)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Limited (1)	Limited impact on ambient air quality during reclamation	
Probability	Rare (2)	Possibility of dust generation is very low.	
Nature	Negative		
Mitigation/ Management actions			
▪ Vehicle travel speeds and distances must be reduced when transporting personnel on site; and ▪ Dust suppressants must be used on gravel roads.			
Post- mitigation			
Duration	Medium term (3)	Dust will be produced in the medium term	Low (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 (1)	Limited impact on ambient air quality during reclamation	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Negative		

10.2.2 Groundwater Impacts

The reclamation of the historical TSFs will remove a permanent pollution source from the landscape which is expected to have a positive long term impact on the environment. Impacts on groundwater quality may, however, occur during the reclamation activities. The project activities' interactions and impacts on groundwater during the operational phase are provided in Table 10-26.

Table 10-26: Interactions and Impacts on Groundwater during the Operational Phase

Interaction	Impact
Hydraulic reclamation of the historical TSFs	The water used during hydraulic reclamation may seep through the TSF footprint and deteriorate groundwater quality.
Tailings exposure to oxygen and water	The potential for AMD generation increases during reclamation as tailings material is exposed to water and oxygen.

10.2.2.1 Reclamation of Driefontein 3 and 5 TSFs

10.2.2.1.1 Impact Description

The groundwater impacts associated with the reclamation of the historical TSFs are expected to be positive since the source of contamination will be removed. Although the site specific hydrogeological conditions of the TSFs may differ, the identified impacts will essentially be the same and a positive outcome for the groundwater systems associated with all of the historical TSFs.

The historical TSFs are not lined and seepage is expected to drain into the underlying groundwater system. The current hypothesis is that if there were no TSFs located directly over the dolomite, it is likely that the dolomitic water (also called fissure water by the mines) pumped from the underground chambers would be of better quality compared to the current status. The positive long terms impacts, however, will only be realised once the historical TSFs have been reclaimed in their entirety.

AMD could be generated in the short-term due to the exposure of the tailings to oxygen and water during the reclamation phase. This is expected to be short lived (spanning the period of reclamation) and buffered by the dolomitic carbonates underneath. Furthermore, the impact to groundwater may occur during reclamation due to increased seepage of the mine affected water. The impact of the AMD generation and seepage is considered to be medium-low (negative) as the sites are already considered to be contaminated due to the presence of the historical TSFs and the pollution plumes are local.

10.2.2.1.2 Management Objectives

To realise the positive impacts on the groundwater quality due to the reclamation of the historical TSFs, the TSF must be reclaimed in its entirety and the footprint rehabilitated according to the Closure and Rehabilitation Plans. Mine affected water must be managed effectively to minimise the potential for seepage to occur.

10.2.2.1.3 Management Targets and Actions

All tailings material must be removed from the footprint of the historical TSFs to ensure that no pollution or contaminant sources remain. Mine affected water must be diverted to the TSF sumps and pooling of mine affected water must be avoided to ensure increased seepage does not occur.

10.2.2.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on groundwater are provided in Table 10-27.

Table 10-27: Potential Impacts on Groundwater due to the Reclamation of the Driefontein 3 and 5 TSFs

Reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Groundwater contamination due to seepage during hydraulic reclamation			
Prior to mitigation/ management			
Duration	Project Life (5)	Seepage of contaminated water could occur during the operation phase	Medium-low (negative) – 44
Extent	Local (3)	The impact is expected to be local	
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			
▪ Vegetation must only be cleared on faces that are being actively reclaimed; and ▪ Groundwater quality monitoring must be undertaken.			
Post- mitigation			
Duration	Medium term (3)	Dust will be produced in the medium term	Low (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 (1)	Limited impact on ambient air quality during reclamation	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Negative		

10.2.3 Soil Impacts

During the operational phase, the pipelines will be monitored and maintained, resulting in site access along the pipeline route and use of the associated roads. The monitoring and maintenance of the pipelines may result in soil compaction due to vehicle and personnel movements.

Table 10-28 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-28: Interactions and Impacts on Soil during the Operational Phase

Interaction	Impact
Use of vehicles and heavy machinery	Loss of topsoil as a resource – Erosion and Compaction

10.2.3.1 Pipelines and Roads

10.2.3.1.1 Impact Description

The movement of personnel, vehicles and machinery during the monitoring and maintenance of the pipelines may result in soil compaction. Soil compaction prevents vegetation from being established and increases the velocity of water runoff which may result in soil erosion. The compaction and erosion of the soils leads to a loss of topsoil resources.

10.2.3.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the monitoring and maintenance activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.2.3.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.2.3.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on soils are provided in Table 10-29.

Table 10-29: Potential Impacts on Soils due to Pipelines and Roads

Pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion from maintenance activities.			
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.	Medium-low (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			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; and ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (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		

10.2.3.2 Reclamation of Driefontein 3 and 5 TSFs

10.2.3.2.1 Impact Description

The contamination of surrounding soil resources, as a result of the mobilisation of tailings material by wind and water, may take place. However, as discussed in Section 10.2.1, the current dust emissions are considered a worst case scenario; the hydraulic reclamation, as well as reduction in footprint, of the TSFs will reduce the generation of dust from the TSFs and its impacts. As a result, the potential to impact surrounding soil resources is likely to reduce during the hydraulic reclamation of the TSFs and subsequent footprint reduction. The no-go option will therefore likely to continue impacting surrounding soil resources.

10.2.3.2.2 Management Objectives

The management objectives are to limit the mobilisation and erosion of contaminants on the RTSF that could impact on surrounding soil resources around the Driefontein 3 and 5 TSFs.

10.2.3.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils.

10.2.3.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on soils are provided in Table 10-30.

Table 10-30: Potential Impacts on Soils due to the Reclamation of Driefontein 3 and 5 TSFs

Reclamation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resources due to contamination from windblown tailings material and runoff			
Prior to mitigation/ management			
Duration	Project Life (5)	Contamination if unmitigated could last for many years.	Medium-low (negative) – 70
Extent	Limited (2)	The impact will occur within and immediately around the Project site.	
Intensity	On-going (3)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	It is certain that this impact will occur	
Nature	Negative		
Mitigation/ Management actions			

Reclamation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Maintain wind breaks and vegetation surrounding the TSFs; ▪ Monitor the TSFs' side walls for erosion potential; and ▪ Ensure storm water management designs are in place.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	If mitigation measures are followed the impact area can be reduced	
Intensity	Minor (3)	If contamination occurs, it will still be a serious negative impact.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

10.2.4 Surface Water Impacts

Potential impacts to surface water resources may arise during the reclamation process of Driefontein 3 and 5 TSFs. The TSFs will be reclaimed and slurry will form which will drain into a temporary sump. From the sump the slurry will be pumped to the WBT and then to the CPP for processing. The sumps have the potential to overflow due to failure of pumps or leaks and spills during the reclamation process which will impact on the surface water resources as the slurry will contaminate water. The failure of pumps and/or overflow of sumps are project risks and the impact has not been assessed as a result. The mitigation and management measures to prevent such impacts from occurring are provided in Table 11-1.

10.2.5 Fauna and Flora Impacts

There are no additional impacts anticipated on fauna and flora during the operational phase. The mitigation measures provided for the management of alien invasive vegetation must continue throughout the project life.

10.2.6 Aquatics Impacts

The reclamation of the historical TSFs may mobilise contaminants which may seep or flow into surrounding water resources. Table 10-31 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-31: Interactions and Impacts on Aquatic Ecosystems 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 Reclamation of Driefontein 3 and 5 TSFs

10.2.6.1.1 Impact Description

Mobilised contaminants from the Driefontein 3 and 5 TSFs may report to the water resources, through seepage into groundwater from the temporary sumps (potential contaminated runoff due to pump failure or sump overflow is discussed in Table 11-1). Should the contaminants make its way into the water resources, this could result in water quality impacts and may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, through contaminated seepage, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances.

10.2.6.1.2 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.

10.2.6.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to improve the PES of the Wonderfonteinspruit and Carletonville Tributary. The monitoring for the presence of Hydropsychidae, Aeshnidae and Baetidae species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 25% as a result of activities related to the proposed project.

10.2.6.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic habitats are provided in Table 10-32.

Table 10-32: Potential Impacts on Aquatic Habitats due to the Reclamation of Driefontein 3 and 5 TSFs

Reclamation of Driefontein 3 and 5 TSFs			
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.	Medium-high (negative) - 78
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 historical TSFs 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			
▪ Silt traps placed within clean water return channels; and ▪ The planting of indigenous trees around the historical TSFs and temporary sumps.			
Post- mitigation			
Duration	Project life (5)	The impact will occur for the duration of the project.	Medium-low (negative) - 39
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)	Seepage and runoff from the RTSF will contain pollutants and will potentially negatively influence downstream water quality.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		

10.2.7 Wetlands Impacts

There are limited interactions and impacts associated with wetlands during the operational phase, as majority of the impacts are likely to occur during the construction phase. However, personnel and vehicle activity around the WBT and BWSF complex may impact on surrounding wetlands. The interactions and resultant impacts on wetlands during the operational phase are provided in Table 10-33.

Table 10-33: Interactions and Impacts on Wetlands during the Operational Phase

Interaction	Impact
Operation of the WBT and BWSF complex.	This will have some impact on the identified wetlands due to increased activity in the area, where wind and water may mobilise sediments and pollutants which can impact on wetlands.

10.2.7.1 WBT and BWSF Complex

10.2.7.1.1 Impact Description

This phase constitutes the operation of the WBT and the BWSF. The WBT and BWSF complex is located within a pan wetland, the impacts of which have been discussed in Section 10.2.7. The remaining pan wetland will be adjacent to the infrastructure area and will be susceptible to further impacts related to personnel and vehicle movement on site. Further impacts to the pan wetland must be avoided.

10.2.7.1.2 Management Objectives

These objectives are to prevent 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).

10.2.7.1.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.2.7.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on Wetlands are provided in Table 10-34.

Table 10-34: Potential Impacts on Wetlands due to the WBT and BWSF Complex

Operation of the WBT and BWSF complex			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Sediment and pollution impacting the integrity of adjacent wetlands.			
Prior to mitigation/ management			
Duration	Project Life (5)	Impact will only occur during the operation of the WBT and BWSF complex.	Medium-high (negative) -84
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Serious (5)	This represents serious damage to highly sensitive environments.	
Probability	Highly probable (6)	This is highly probable due to the nature of the activity.	
Nature	Negative		
Mitigation/ Management actions			
▪ Alien Invasive Management Plan for disturbed areas and the project site; ▪ Dust suppressants must be used on gravel roads and exposed areas; and ▪ The WBT and BWSF complex footprints must be fully contained and a Storm Water Management Plan implemented.			
Post- mitigation			
Duration	Project Life (5)	Mitigation will not decrease the duration of the operation of the CPP and RTSF.	Low (negative) -30
Extent	Local (3)	The mitigation measures will allow the impacts to be kept to a local extent.	
Intensity	Minor effects (2)	The wetlands will be subjected to minor impacts with mitigation measure employed.	
Probability	Unlikely (3)	Mitigation will decrease the likelihood of impacts significantly.	
Nature	Negative		

10.2.8 Visual Impacts

The visual impacts associated with the infrastructure commenced during the construction phase and will continue through the operational phase. The only new visual impact during the operational phase is due to the hydraulic reclamation of the Driefontein 3 and 5 TSFs should dust be generated. However, as detailed in the Air Quality Impact Assessment

(Appendix E), the reclamation of the TSFs using hydraulic activities will suppress the potential dust generation from the sites. As reclamation of the TSFs continues, the height and visual intrusion of the TSFs will decrease on the visual landscape. The potential positive impact of this activity will only be realised following the complete reclamation of the TSFs and subsequent rehabilitation of the TSF footprints.

The interactions and impacts associated with the operational phase are provided in Table 10-35

Table 10-35: Interactions and Impacts of the RTSF of the Visual Environment

Interaction	Impact
Operation of the WBT and BWSF complex	The WBT and BWSF complex will have a negative visual impact on the environment as the facilities will be visible to surrounding receptors.

10.2.8.1 WBT and BWSF Complex

10.2.8.1.1 Impact Description

The WBT and BWSF complex is only expected to be visible from close proximity. The WBT and BWSF complex will remain *in situ* for the life of the project. Due to the limited extent of the infrastructure, this impact is considered to be medium-low (negative).

10.2.8.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the construction of pipelines.

10.2.8.1.3 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-36.

Table 10-36: Potential Impacts on the Visual Environment due to the WBT and BWSF Complex

Operation of the WBT and BWSF complex			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Infrastructure will impact the visual environment			
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.	Medium-low (negative) – 63
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	

Operation of the WBT and BWSF complex			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Minor (2)	The negligible height of the pipelines will restrict the viewshed, with the WBT and BWSF complex limited in their extent	
Probability	Definite (7)	Pipelines and roads and the WBT and BWSF complex will be constructed	
Nature	Negative		
Mitigation/ Management actions			
▪ Vegetation must only be removed from the infrastructure footprints or areas necessary for construction; ▪ Establish vegetation on disturbed areas following construction; ▪ The WBT and BWSF complex must be painted natural hues to blend into the surrounding landscape; and ▪ Down lighting must be used should construction take place during night time.			
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.	Medium-low (negative) – 48
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minimal (1)	The negligible height of the pipelines will restrict the viewshed, with the WBT and BWSF complex limited in their extent	
Probability	Almost Certain (6)	It is most likely that the impact will occur.	
Nature	Negative		

10.2.9 Noise Impacts

Table 10-37 details the project activities' interactions and the resultant impacts due to noise generation as a result of the proposed developments. Noise dispersion models were developed and indicated that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-37: Interactions and Impacts associated with Noise during the Operational Phase

Interaction	Impact
Operation of the WBT and BWSF and associated pumps, as well as reclamation of Driefontein 3 and TSFs.	Generation of noise may increase ambient noise

10.2.9.1 WBT and BWSF Complex and Reclamation of Driefontein 3 and 5 TSFs

10.2.9.1.1 Impact Description

Noise will emanate from machinery and equipment associated with the operation of the WBT and BSWF, as well as the operation of the associated pump stations for the pipelines. Based on the noise model (Appendix M), the noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts are considered to be low (negative).

10.2.9.1.2 Management Objectives

The management objective is to minimise noise generation caused by the reclamation activities and pump stations.

10.2.9.1.3 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on noise are provided in Table 10-38.

Table 10-38: Potential Impacts on Noise during the Operational Phase

Operation of the WBT and BWSF complex and reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Noise will emanate from the reclamation activities and pump stations during the operational phase			
Prior to mitigation/ management			
Duration	Long term (4)	Noise will be produced for the duration of the reclamation activities of between 5 to 6 years for each TSF.	Low (negative) – 24
Extent	Local (3)	It is expected that during operation noise will be limited to site.	
Intensity	Minor (1)	It is expected that during operational phase noise will have a minor social impact	

Operation of the WBT and BWSF complex and reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding communities as the pump stations and WBT and BWSF complex are remotely located.	
Nature	Negative		
Mitigation/ Management actions			
▪ 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; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Long term (4)	Noise will be produced for the duration of the reclamation activities of between 5 to 6 years.	Low (negative) – 16
Extent	Local (3)	Noise will be produced for the duration of the reclamation activities of between 5 to 6 years for each TSF.	
Intensity	Minor (1)	It is expected that during operational phase noise will have a minor social impact	
Probability	Unlikely (2)	It is unlikely that noise will impact on the surrounding communities as the pump stations and WBT and BWSF complex are remotely located.	
Nature	Negative		

10.2.10 Socio-Economic Impacts

As detailed in Section 10.1.11, 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 10-39.

Table 10-39: 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.

10.2.10.1 Employment and Procurement

10.2.10.1.1 Impact Description: Job Creation 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. The business sales generated by the project over its lifespan through direct and spin-off effects will translate into R 36 billion (2015 prices) of GDP per region.

10.2.10.1.2 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;
- Where feasible, 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;

- Utilise existing SGL programmes and initiatives to 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.

10.2.10.1.3 Impact Description

The significance of the potential socio-economic impacts associated with the operational phase of the project are outlined in Table 10-40.

Table 10-40: 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			
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)	Approximately 500 jobs will be created during the operational phase, with additional indirect jobs created as a result.	
Probability	Likely (5)	Without the appropriate enhancement measures, potential for local recruitment and procurement will not be realised.	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Positive		
Enhancement/ Management actions			
▪ 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; ▪ Where feasible, 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; ▪ Utilise existing SGL programmes and initiatives to 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) 96
Extent	National (6)	The resultant impacts will have a significant impact on a national scale.	
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		
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)

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	National (7)	Exports will affect the balance of the national accounts.	96
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.			

10.2.11 Radiation Impacts

The WBT will be located within a secured area and no releases to the environment will take place. As a result, the WBT and BWSF complex are not regarded as sources of radiation exposure and no impacts are expected. The interactions and impacts associated with radiological impacts during the operational phase are provided in Table 10-41.

Table 10-41: Interactions and Impacts due to Radionuclides during the Operational Phase

Interaction	Impact
Reclamation of Driefontein 3 and 5 TSFs	The reclamation of Driefontein 3 and 5 TSFs are potential sources of public radiation due to exposure of radionuclides that may have become airborne.

10.2.11.1 Reclamation of Driefontein 3 and 5 TSFs

10.2.11.1.1 Impact Description

The reclamation of the Driefontein 3 and 5 TSFs are sources for radiation exposure as radionuclides may become airborne or mobilised during the reclamation process. The mobilisation of radionuclides will be limited, however, as the reclamation process will utilise hydraulic methods; the wet reclamation conditions will reduce the radon exhalation rate from the TSFs. Based on experience with reclamation of TSFs, moderate doses are associated with the atmospheric pathway during reclamation, with radon exhalation the main contributor (Appendix P). The doses are highest closest to the TSFs and decrease significantly with distance and the impact, with the impact occurring as long as the TSF remains. The ratings of the gamma dose rate may exceed maximum concentrations for atmospheric impacts.

In addition, the use of water during the reclamation process may result in seepage of contaminated water and enhance the contamination plume associated with the historical TSFs. The abstraction and use of contaminated groundwater may introduce secondary radiation exposure pathways. This impact is considered to occur during the operational phase. The radiological impacts associated with the groundwater pathways are not expected to exceed the maximum gamma dose rate measurements.

No additional mitigation measures are required, aside from the measures to be implemented as part of the air quality and groundwater impacts, as well as operating according to the Radiation Management Programme for Certificate of Registration (CoR) 69.

10.2.11.1.2 Impact Rating

The impact ratings, prior to and post mitigation measures, associated with radiological impacts during the operational phase are provided in Table 10-42.

Table 10-42: Potential Impacts due to Radiological Impacts

Reclamation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Radon exhalation and groundwater contamination during the reclamation activities of the historical TSFs resulting in radiation exposure.			
Prior to mitigation/ management			
Duration	Permanent (7)	Although moderate, the impact will continue to occur for as long as the TSF remain as a source.	Medium-low (negative) - 52
Extent	Local (3)	The impact is highest close to the TSFs, but then decrease significantly with distance away from the TSFs.	
Intensity	Moderate (3)	The intensity is rated is moderate, since the radiological impact through the atmospheric pathway resulted in moderate doses, especially in close proximity of the TSFs (with radon exhalation as the main contributor).	
Probability	Probable (4)	The probability that the radiological impact will occur during the operational period is good	
Nature	Negative		
Mitigation/ Management actions			
No mitigation measures are required from a radiological perspective. The mitigation measures provided from an Air Quality perspective will have a direct influence in the potential radiological impacts.			

10.3 Decommissioning Phase

The decommissioning phase will entail the demolition and removal of infrastructure, including the WBT and BWSF complex and pipelines and roads, as well as the rehabilitation of all infrastructure and TSF footprints. The footprints will be rehabilitated to a final land use.

10.3.1 Air Quality Impacts

Table 10-43 details the activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-43: Interactions and Impacts on Air Quality during the Decommissioning Phase

Interaction	Impact
Wind erosion	Reduction in the quality of ambient air due to increased dust loading from vehicle wheels and wind erosion
	Improved air quality; availability of land for alternative uses

10.3.1.1 WBT and BWSF Complex and Pipelines and Roads

10.3.1.2 Impact description

The dismantling of old infrastructure, including the WBT and BWSF complex and pipelines and roads involve the use of heavy machinery and vehicles similar to the construction phase. Wind erosion of soils may occur until the rehabilitation is complete and vegetation has been fully established, binding the soil particles. The impacts on the atmospheric environment during this phase will result in the release of fugitive dust emissions containing TSP, PM_{10} and $PM_{2.5}$.

10.3.1.3 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the demolition activities and subsequent rehabilitation are not in exceedance of the NAAQS and NDCR standards for the protection of the environment, human health and wellbeing.

10.3.1.4 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NDCR standards. Ambient pollutant monitoring should include particulate emissions at upwind and downwind locations and monitors must be place discretely at the nearest receptor area to assess public exposure. Ambient levels of dust will be assessed against the relevant standards.

10.3.1.4.1 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-44.

Table 10-44: Potential Impacts on Air Quality due to the Decommissioning Phase

Decommissioning and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Reduction in ambient air quality due dust generation from decommissioning and rehabilitation activities.			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration demolition	Low (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor (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			
▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading rubble should be minimised; and ▪ Dust suppressants or wetting agents must be used on gravel roads and exposed areas.			
Post- mitigation			
Duration	Short term (2)	Dust will be generated for the duration of the demolition	Low (negative) – 10
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minimal (1)	Minimal impact on ambient air quality during demolition	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Negative		

10.3.1.5 Reclamation of Driefontein 3 and 5 TSFs

10.3.1.6 Impact description

The rehabilitation of Driefontein 3 and 5 TSFs will involve the use of heavy machinery and vehicles similar to those used during the construction phase. Wind erosion of the exposed soils may occur until the rehabilitation is complete and vegetation has been fully established, binding the soil particles. The impacts on the atmospheric environment during this phase will result in the release of fugitive dust emissions containing TSP, PM_{10} and $PM_{2.5}$.

The predicted impacts are considered to be low before the implementation of the mitigation measures, with the completion of rehabilitation having a moderate (positive) impact on air quality as the TSFs have been removed from the landscape.

10.3.1.7 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the rehabilitation activities are not in exceedance of the NAAQS and NDCR standards for the protection of the environment, human health and wellbeing.

10.3.1.8 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NDCR standards. Ambient pollutant monitoring should include particulate emissions at upwind and downwind locations and monitors must be place discretely at the nearest receptor area to assess public exposure. Ambient levels of dust will be assessed against the relevant standards.

10.3.1.8.1 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-45.

Table 10-45: Potential Impacts on Air Quality due to the Reclamation of the Driefontein 3 and 5 TSFs

Reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Improvement in air quality once rehabilitation has been complete of the TSF footprints			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration rehabilitation process	Low (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor (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 exposed areas; ▪ The area of disturbance must be kept to a minimum; and ▪ Vegetation establishment must be monitored.			

Reclamation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Post- mitigation			
Duration	Long term (4)	Dust will be eliminated in the area on a long-term	Moderate (positive) 78
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	Positive		

10.3.2 Soil Impacts

Table 10-46 details the activities' interactions and the resultant impacts due to the decommissioning activities associated with the proposed developments.

Table 10-46 Interactions and Impacts on Soils and Land Capability during the Decommissioning Phase

Interaction	Impact
Demolition of infrastructure and use of heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

10.3.2.1 WBT and BWSF Complex and Pipelines and Roads

10.3.2.1.1 Impact Description

The movement of personnel, vehicles and machinery during the demolition and removal of the WBT and BWSF complex and pipelines and roads may result in soil compaction. Soil compaction prevents vegetation from being established and increases the velocity of water runoff which may result in soil erosion. The compaction and erosion of the soils leads to a loss of topsoil resources.

10.3.2.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the monitoring and maintenance activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.3.2.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.3.2.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on soils are provided in Table 10-47.

Table 10-47: Potential Impacts on Soils due to the Decommissioning Phase

<table>
<tr><th colspan="4">Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Impact Description: Loss of topsoil resources due to compaction and erosion</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>When the soil has eroded the impact will be permanent and is potentially irreversible even with management.</td><td rowspan="5">Medium-low (negative) – 36</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.</td></tr>
<tr><td>Intensity</td><td>Very Serious (5)</td><td>Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>The maintenance vehicles will remain on existing access routes</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">▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs;
▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and
▪ The pipeline routes and roads must be rehabilitated and vegetation established.</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
</table>

Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (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		

10.3.2.2 Reclamation of the Driefontein 3 and 5 TSFs

10.3.2.2.1 Impact Description

The complete reclamation of the Driefontein 3 and 5 TSFs will have been completed. The reclamation of the TSF sites would have improved the soil quality by reducing the impacts on the surrounding soils by removing the contamination source. The TSF footprint areas will be remediated and the land use and land capability can be improved as alternative land uses will be identified as opposed to the TSF.

10.3.2.2.2 Management Objectives

The management objectives are to ensure the efficient remediation of the TSF footprint areas and to rehabilitate the underlying soils to allow for alternative land uses to be realised.

10.3.2.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the footprints of the TSFs to an adequate end land use. To ensure that rehabilitation and eventual closure is effective and successful, the management of the soil resources, as well as ensuring all residual tailings is removed, is critical. A Rehabilitation Plan (Appendix Q) has been compiled details the following:

- Ensure storm water management is implemented;
- Corrective actions, such as erosion berms, must be undertaken to minimise any further erosion;
- Compacted areas must be ripped to loosen the soil structure and vegetation cover established;
- Implement land rehabilitation measures as defined in the rehabilitation report;

- Vegetation establishment must be monitored on rehabilitated areas.

10.3.2.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-48.

Table 10-48: Potential Impacts on Soils due to the Reclamation of the Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The complete removal of the residual tailings and rehabilitation of the footprints to a final land use.			
Prior to mitigation/ management			
Duration	Permanent (7)	The rehabilitation of the TSF footprints will improve the land capability and land use from being a mine dump.	Moderate (positive) 105
Extent	Limited (2)	The impact will only occur within the TSF footprints.	
Intensity	Great improvement (6)	The rehabilitation of these areas will have a positive impact on the land capability and possibly the land use.	
Probability	Certain (7)	If the mitigation is followed it will certainly increase the land use and land capability.	
Nature	Positive		

10.3.3 Surface Water Impacts

The decommissioning phase of the project will include the demolition and removal of infrastructure. There are no direct anticipated impacts on surface water resources associated with the decommissioning phase; however, spillages of residual material may take place from the decommissioning of the WBT and BWSF complex and pipelines. Should residual material report to the catchment, this will have an impact on the surface water quality. These are considered as project risks (Table 11-1) and have not been rated as a result.

10.3.4 Fauna and Flora Impacts

The decommissioning phase will include the demolition of infrastructure and the rehabilitation of all footprints associated with the Driefontein Mining Right area. The interactions and impacts on fauna and flora during the decommissioning phase are detailed in Table 10-49.

Table 10-49: Interactions and Impacts on Fauna and Flora during the Decommissioning Phase

Interaction	Impact
Rehabilitation of the infrastructure: including the WBT and BWSF footprints, as well as the series of pipelines.	This will potentially have a positive impact on the vegetation and habitat types that could be restored over time.
Decommissioning of the reclaimed Driefontein 3 and 5 TSF footprints.	With rehabilitation of the footprints, this will have a positive impact to vegetation and habitat types present.

10.3.4.1 Reclamation of Driefontein 3 and 5 TSFs

10.3.4.1.1 Impact Description

Although all infrastructure footprints will be rehabilitated, these cannot be seen as positive impacts due to the direct site clearing undertaken during the construction phase. The rehabilitation of the infrastructure footprints will aim to emulate the environment prior to any developments being undertaken. This is considered a neutral impact.

The rehabilitation of the Driefontein 3 and 5 TSFs will have a positive impact on the fauna and flora of the region as previously inhospitable areas will be suitable for indigenous vegetation establishment, which will provide suitable habitats for fauna. This will increase the biodiversity of the region.

10.3.4.1.2 Management Objectives

The objective for this phase will be to maximise the success of the rehabilitation that will occur once infrastructure is removed and to furthermore reduce any impacts that may occur during this phase.

10.3.4.1.3 Management Actions and Targets

Rehabilitation activities 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 before the first rains fall so as to make use of the rainfall to assist in plant recruitment and establishment.

10.3.4.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on fauna and flora are provided in Table 10-50.

Table 10-50: Potential Impacts on Fauna and Flora due to the Reclamation of the Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The complete removal of the residual tailings and rehabilitation of the footprints to a final land use.			
Prior to mitigation/ management			
Duration	Short term (2)	If rehabilitation is not completed effectively it will not last.	Negligible (positive) 18
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		
Mitigation/ Management actions			
▪ Rehabilitation must be undertaken as outlined in the Rehabilitation Plan; ▪ Rehabilitation to be completed prior to the rainy season (October to March); and ▪ Vegetation establishment must be monitored and areas where rehabilitation has not been successful must be ripped, vegetated and, if necessary, a fertiliser applied.			
Post- mitigation			
Duration	Permanent (7)	If rehabilitation is completed successfully this impact will be permanent	Moderate (positive) 84
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		

10.3.5 Aquatics Impacts

The pipelines and roads will be demolished, depending on the final land use, and the footprints rehabilitated. The WBT and BWSF complex will also be demolished and the footprints rehabilitated, although this is not expected to impact on aquatic ecosystems due to the WBT and BWSF complex not being located within close proximity to surface water

resources. The footprints of the Driefontein 3 and 5 TSFs will be rehabilitated to a suitable end land use.

Table 10-51 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-51: Interactions and Impacts on Aquatic Ecosystems during the Decommissioning Phase

Interaction	Impact
Demolition and removal infrastructure such as the WBT and BWSF complex and pipelines and roads	Increased runoff as a result of exposed surfaces 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.
Rehabilitation of the Driefontein 3 and 5 TSF footprints	This will have a positive impact as a permanent source of pollution will be removed from the landscape, preventing continued impacts on the surrounding aquatic ecosystems.

10.3.5.1 WBT and BWSF Complex and Pipelines and Roads

10.3.5.1.1 Impact Description

Contaminated runoff and from exposed footprints of the pipelines and roads could result in water quality impacts and may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, through contaminated runoff, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Increased runoff and erosion caused through decommissioning activities as well as movement of suspended materials in runoff may produce habitat quality impacts which may include sedimentation, bed, channel and flow modification.

10.3.5.1.2 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.

10.3.5.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to improve the PES of the Wonderfonteinspruit and Carletonville Tributary. The monitoring for the presence of Hydropsychidae, Aeshnidae and Baetidae species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 25% as a result of activities related to the proposed project.

10.3.5.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic ecology are provided in Table 10-52.

Table 10-52: Potential Impacts on Aquatic Ecology during the Decommissioning Phase

Demolition and rehabilitation of WBT and BWSF complex pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat modification			
Prior to mitigation/ management			
Duration	Medium term (3)	The site clearing and infrastructure removal will occur and potentially recover within a three-five year period	Medium-high (negative) - 42
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			
▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of pipelines and road footprints as soon as possible; ▪ Soils adjacent to the river that has been compacted must be loosened to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.			

Demolition and rehabilitation of WBT and BWSF complex pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Post- mitigation			
Duration	Short term (2)	The impact will only occur during the construction and decommissioning phase.	Low (negative) - 30
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		

10.3.5.2 Reclamation of Driefontein 3 and 5 TSFs

10.3.5.2.1 Impact Description

The rehabilitation of the Driefontein 3 and 5 TSF footprints will have a positive impact as a permanent source of pollution will be removed from the landscape, preventing continued impacts on the surrounding aquatic ecosystems. This will be a positive impact on aquatic ecosystems associated with the Driefontein Mining Right area in comparison to the current baseline environment. The failure to reclaim the TSFs, or rehabilitate the footprints, will continue to have negative impacts on aquatics. The complete removal of tailings material and the rehabilitation of the footprints will have a minor (positive) impact following the implementation of enhancement measures.

10.3.5.2.2 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.

10.3.5.2.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to improve the PES of the Wonderfonteinspruit and Carletonville Tributary. The monitoring for the presence of

Hydropsychidae, Aeshnidae and Baetidae species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 25% as a result of activities related to the proposed project.

10.3.5.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic ecology are provided in Table 10-53.

Table 10-53: Potential Impacts on Aquatic Ecology due to Rehabilitation of Driefontein 3 and 5 TSFs

Rehabilitation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat modification			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	The impact will remain for some time after the project has been completed.	Medium-high (negative) - 60
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	Negative		
Mitigation/ Management actions			
▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of footprints as soon as possible; ▪ Erosion prevention mechanisms must be employed to prevent instream sedimentation; and ▪ Rehabilitation according to the Rehabilitation Plan.			
Post- mitigation			
Duration	Short term (2)	The impact will only occur during the construction and decommissioning phase.	Low (negative) - 30

Rehabilitation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
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		

10.3.6 Wetlands Impacts

The decommissioning phase will have similar impacts compared to the construction phase, although the interactions of the activities will be different. The interactions and impacts associated with wetlands during the decommissioning phase are provided in Table 10-54

Table 10-54: Interactions and Impacts on Wetlands during the Decommissioning Phase

Interaction	Impact
Decommissioning of the infrastructure, including the WBT and BWSF complex and pipelines and roads.	This will have some impact to the identified wetlands habitat and functionality due to activity has direct contact with wetlands
Rehabilitation of the Driefontein 3 and 5 TSFs footprints	With rehabilitation of the footprints, this will have a positive impact to surrounding wetlands as a significant and permanent pollution source in the historical TSFs is being removed and rehabilitated.

10.3.6.1 WBT and BWSF Complex and Pipelines and Roads

10.3.6.1.1 Impact Description

The potential impacts on wetlands associated with the decommissioning phase may include runoff high in dissolved and suspended solids from exposed surfaces. The impacts on wetlands during the decommissioning phase are considered to be medium-low (negative).

10.3.6.1.2 Management Objectives

Management objectives are to prevent 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).

10.3.6.1.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.3.6.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on wetlands are provided in Table 10-55.

Table 10-55: Potential Impacts on Wetlands due to the Decommissioning Phase

Decommissioning and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Wetland habitat and functioning impacts			
Prior to mitigation/ management			
Duration	Medium term (3)	Impact will only occur during the short lived decommissioning phase.	Medium-low (negative) – 66
Extent	Local (3)	The local wetland could be impacted.	
Intensity	Serious (5)	This represents serious damage to highly sensitive environments.	
Probability	Highly probable (6)	This is highly probable due to the nature of the activity.	
Nature	Negative		
Mitigation/ Management actions			
▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The WBT and BWSF complex and pipelines and roads footprints must be rehabilitated according to the Rehabilitation Plan; and ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal.			
Post- mitigation			
Duration	Short Term (2)	Mitigation may decrease the potential impact	Low (negative)

Decommissioning and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a limited extent.	– 18
Intensity	Minor effects (2)	The wetlands will be subjected to minor impacts with mitigation measure employed.	
Probability	Unlikely (3)	Mitigation will decrease the likelihood of impacts significantly.	
Nature	Negative		

10.3.6.2 Reclamation of Driefontein 3 and 5 TSFs

10.3.6.2.1 Impact Description

Following the reclamation of Driefontein 3 and 5 TSFs, the footprints will be rehabilitated. Should the footprints not be rehabilitated, the wetlands will continue to be impacted upon as is *status quo*. The footprints will be rehabilitated to a suitable end land use, to be identified in the SGL updated Closure Plans and as per the Rehabilitation Plan. The complete removal of tailings material and rehabilitation of the footprints will have a positive impact on surrounding wetlands as the permanent pollution source will be removed from the landscape.

10.3.6.2.2 Management Objectives

Management objectives are to completely remove tailings material associated with the Driefontein 3 and 5 TSFs and to rehabilitate the land to a suitable end land use, removing the pollution source from the landscape. 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).

10.3.6.2.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.3.6.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on wetlands are provided in Table 10-56.

Table 10-56: Potential Impacts on Wetlands due to the Reclamation of the Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The complete removal of the residual tailings and rehabilitation of the footprints will have a positive impact on surrounding wetlands as the permanent pollution source will be removed from the landscape. Should the TSF not be reclaimed, or the footprints adequately rehabilitated, a negative impact on wetlands will persist.			
Post- mitigation			
Duration	Beyond project Life (6)	Remediation will have a long lasting positive impact beyond the project life.	Moderate (positive) 105
Extent	Municipal (4)	Removal of these pollutant sources will have a positive impact in the municipal catchment	
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		

10.3.7 Visual Impacts

The decommissioning phase will result in the demolition and removal of infrastructure associated with the project. The WBT and BWSF complex and pipelines' footprints will be rehabilitated according to the Closure Plan for the project which will be compiled approximately 15 years prior to closure. The demolition and removal of the infrastructure will aim to restore the impacted areas to the pre-mining conditions.

The interactions and impacts associated with the decommissioning phase are provided in Table 10-57.

Table 10-57: Interactions and Impacts associated with the Visual Environmental during the Decommissioning Phase

Interaction	**Impact**
Demolition and removal of infrastructure.	Although the demolition and removal of the infrastructure, such as the WBT and BWSF complex and pipeline, will reduce the visual impact of the area, there will still be a visual disturbance until rehabilitation activities have been complete.

10.3.7.1 WBT and BWSF Complex and Pipelines and Roads

10.3.7.1.1 Impact Description

The demolition and removal of the WBT and BWSF complex infrastructure and pipelines will improve the visual environment in comparison to the operational phase of the project as the visual disturbances will be removed from the landscape. However, the demolition and rehabilitation activities will continue to impact on the visual environment until rehabilitation activities have concluded, although the significance of the visual impact will be greatly reduced.

10.3.7.1.2 Management Objectives

The management objectives are to reduce the visual impact of infrastructure by demolishing and removing infrastructure from site, as well as to minimise the short term visual impact of the decommissioning activities.

10.3.7.1.3 Management Actions and Targets

The rehabilitation of the footprints must ensure that the surfaces are free draining and no surface water pools on the surface.

10.3.7.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-58.

Table 10-58: Potential Impacts on the Visual Environment due to the WBT and BWSF Complex and Pipelines and Roads

Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Demolition and rehabilitation activities will have a visual impact on the environment.			
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.	Medium-low (negative) – 42
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	

Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
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)	Demolition and rehabilitation activities will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ The WBT and BWSF complex and pipelines and roads footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.			
Post- mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Low (negative) – 30
Extent	Very Limited (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 (6)	It is likely that the demolition and rehabilitation activities will result in visual impacts.	
Nature	Negative		

10.3.8 Noise Impacts

Table 10-59 details the project activities' interactions and the resultant impacts due to noise generation as a result of the proposed developments. Noise dispersion models were developed and indicate that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-59: Interactions and Impacts associated with Noise during the Decommissioning Phase

Interaction	Impact
Demolition and removal of infrastructure	Generation of noise may increase ambient noise

10.3.8.1 WBT and BWSF Complex and Pipelines and Roads

10.3.8.1.1 Impact Description

Noise will emanate from machinery and equipment associated with the decommissioning of the WBT and BWSF complex and pipelines and roads. Based on the noise model (Appendix M), the noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts are considered to be low (negative).

10.3.8.1.2 Management Objectives

The management objective is to minimise noise generation caused by the demolition and rehabilitation activities.

10.3.8.1.3 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on noise are provided in Table 10-60.

Table 10-60: Potential Impacts on Noise during Decommissioning

Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Vehicle and machinery use will generate noise			
Prior to mitigation/ management			
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase	Low (negative) – 18
Extent	Local (3)	It is expected that during decommissioning noise will extend as far as development site area.	
Intensity	Minimal (1)	It is expected that during decommissioning noise will have a minimal impact	

Demolition and rehabilitation of the WBT and BWSF complex and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors due to remote locations.	
Nature	Negative		
Mitigation/ Management actions			
▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase.	Low (negative) – 12
Extent	Local (3)	It is expected that during decommissioning noise will be limited to site if mitigation measures are implemented.	
Intensity	Minimal (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 receptors.	
Nature	Negative		

10.3.9 Socio-Economic Impacts

As detailed in Section 10.1.11 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 10-61.

Table 10-61: 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.

10.3.9.1 Employment and Procurement

10.3.9.1.1 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.

10.3.9.1.2 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.

10.3.9.1.3 Impact Description

The significance of the potential socio-economic impacts associated with the decommissioning of the project are outlined in Table 10-62.

Table 10-62: 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 mitigation/ 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	
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, should it not already be established, 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	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
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 Groundwater Impacts

Following the complete reclamation of the historical TSFs, the TSF footprints will be rehabilitated to a suitable end land use according to the Closure and Rehabilitation Plan to be compiled for the TSFs. The interactions and impacts on groundwater following the reclamation of the historical TSFs are provided in Table 10-63.

Table 10-63: Interaction and Impacts on Groundwater Post-Closure

Interaction	Impact
Absence of the historical TSFs	Removal of the permanent source of pollution will have a positive impact on groundwater quality.

10.4.1.1 Reclamation of Driefontein 3 and 5 TSFs

10.4.1.1.1 Impact Description

The historical TSFs are not lined and seepage is expected to drain into the underlying groundwater system. The current hypothesis is that if there were no TSFs located directly over the dolomite, it is likely that the dolomitic water (also called fissure water by the mines) pumped from the underground chambers would be of better quality compared to the current status. In addition, the pumping cost would be substantially less if the TSF seepage could be 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 reduced. 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. The impact as a result of the reclamation is therefore anticipated to be positive in the long run since the TSFs, which are sources of contamination, will be removed.

10.4.1.1.2 Management Objectives

The management objectives are to remove the historical TSFs in their entirety and to rehabilitate the footprints to ensure that all tailings material has been removed which will improve the groundwater quality.

10.4.1.1.3 Management Actions and Targets

The historical TSF footprints must be rehabilitated according to the Closure and Rehabilitation Plan that will be developed prior to the conclusion of the reclamation activities for the historical TSFs. The complete removal of tailings material and contaminants from the TSF footprints will ensure that the pollution sources will be removed and the groundwater quality is expected to improve. Groundwater monitoring must continue to take place.

10.4.1.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on groundwater are provided in Table 10-64.

Table 10-64: Potential Impacts on Groundwater due to the Reclamation of the Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The complete removal of the residual tailings and rehabilitation of the footprints will have a positive impact on the groundwater quality as the permanent pollution source will be removed from the landscape.			
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 as the sites are already contaminated	
Intensity	Serious (5)	Serious environmental advantages once the unlined TSFs are removed	
Probability	Definite (7)	There are sound scientific reasons to expect that the positive impact will definitely occur	
Nature	Positive		
Mitigation/ Management actions			
▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation Plan.			

10.4.2 Surface Water Impacts

The TSF footprints will be rehabilitated to a suitable end land use. The interactions and impacts are provided in Table 10-65.

Table 10-65: Interaction and Impacts on Surface Water Post-Closure

Interaction	Impact
Absence of the historical TSFs	Removal of the permanent source of pollution will have a positive impact on surface water quality, as well as increase catchment yields.

10.4.2.1 Reclamation of Driefontein 3 and 5 TSFs

10.4.2.1.1 Impact Description

There will be no major impacts that will directly impact the surface water resources as rehabilitation is carried out during the decommissioning phase. Rehabilitation is critical to ensure that there are no residual surface water impacts associated with the reclaimed footprints. The reclamation of the Driefontein 3 and 5 TSFs and subsequent rehabilitation will ultimately have a positive impact on the surrounding surface water resources as the source of pollution will be removed from the landscape.

In addition, 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.

10.4.2.1.2 Management Objectives

The management objectives are to remove the historical TSFs in their entirety and to rehabilitate the footprints to ensure that all tailings material has been removed and the natural drainage patterns are restored.

10.4.2.1.3 Management Actions and Targets

The historical TSF footprints must be rehabilitated according to the Closure and Rehabilitation Plan that will be developed prior to the conclusion of the reclamation activities for the historical TSFs. The complete removal of tailings material and contaminants from the TSF footprints will ensure that the pollution sources will be removed and the groundwater quality is expected to improve. The following actions and targets must be implemented:

- Ensure that the surface inspection is continuously undertaken to allow runoff to drain onto the natural water bodies;
- Ensure that monitoring is in place as per WUL requirements and the Rehabilitation and Closure Plan; and

- Monitor parameters such as pH, electrical conductivity, sulfate, and metals (or as required by the WUL) to enable detection of surface water impacts and determine the trend or fluctuation of the water quality compared to the baseline water quality.

10.4.2.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts surface water are provided in Table 10-64.

Table 10-66: Potential Impacts on Surface Water due to the Reclamation of the Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The complete removal of the residual tailings and rehabilitation of the footprints will have a positive impact on the surface water as catchment yields are increased, as well as removing the permanent pollution source from the landscape.			
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		
Mitigation/ Management actions			
▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation and Closure Plan and continued monitoring of rehabilitated areas and surface water.			

10.4.3 Visual Impacts

The complete reclamation of the historical TSFs and subsequent rehabilitation of the footprints will remove the permanent visual intrusion on that exists on the landscape and enable a suitable end land use to be implemented within the footprint areas. The interactions and impacts on the visual environment are provided in Table 10-67.

Table 10-67: Interactions and Impacts on the Visual Environment associated with the Reclamation of Driefontein 3 and 5 TSFs

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.

10.4.3.1 Reclamation of Driefontein 3 and 5 TSFs

10.4.3.1.1 Impact Description

This is a positive impact as the TSFs will have been reclaimed and the footprints rehabilitated to a suitable end land use identified as per the Closure Plan to be developed for the sites which will take into consideration the surrounding land uses. The removal of the TSFs is a positive visual impact.

10.4.3.1.2 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-68.

Table 10-68: Potential Impacts on the Visual Environment due to the Reclamation of Driefontein 3 and 5 TSFs

Rehabilitation of the Driefontein 3 and 5 TSFs			
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 positive impact is permanent as the TSF will be removed.	Moderate (positive) 105
Extent	Local (3)	The positive impact will extend only as far as the development site area.	
Intensity	Very Serious (5)	On-going and widespread benefits to local communities and natural features of the landscape.	
Probability	Definite (7)	Should the project proceed, the TSFs will be reclaimed.	

Rehabilitation of the Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Positive		

10.4.4 Radiation Impacts

The interactions and impacts associated with radiological impacts during post closure are provided in Table 10-69.

Table 10-69: Interactions and Impacts due to Radionuclides during Post Closure

Interaction	Impact
Reclamation of Driefontein 3 and 5 TSFs	The soils underneath the historical TSFs are possible secondary sources of radiation exposure. The complete removal of the TSFs will have a positive impact however.

10.4.4.1 Reclamation of Driefontein 3 and 5 TSFs

10.4.4.1.1 Impact Description

The reclamation and removal of the historical TSFs will have a positive impact on public radiation exposure conditions within proximity of the Driefontein 3 and 5 TSFs, provided that the footprints are rehabilitated and that no residual tailings material remains. The rehabilitation of the TSF footprints will immediately eliminate any contribution to the atmospheric pathways over the area of impact, with a permanent benefit to the surrounding public.

The complete removal of tailings material is essential to realise the positive impact of the reclamation of the historical TSFs as contaminants are likely to have seeped into the underlying soils, as well as possibly the aquifer system. This results in the formation of secondary sources of contamination beneath the footprint areas.

10.4.4.1.2 Impact Rating

The impact ratings, prior to and post mitigation measures, associated with radiological impacts during post closure are provided in Table 10-70.

Table 10-70: Potential Impacts due to Radiological Impacts

Reclamation of Driefontein 3 and 5 TSFs			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Complete reclamation of contaminants resulting in the removal of radiation exposure			
Prior to mitigation/ management			
Duration	Permanent (7)	Although minimal, the impact that will occur is permanent.	Low (negative) - 27
Extent	Limited (1)	The impact during the operational period will be limited to the site itself.	
Intensity	Minimal impact (1)	The intensity is rated is minimal, since a radiological impact through the groundwater pathway will in all likelihood not occur during the operational period, due to the slow leaching and migration processes.	
Probability	Unlikely (3)	The probability that the radiological impact will occur during the operational period is unlikely	
Nature	Negative		
Mitigation/ Management actions			
▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation and Closure Plan; and ▪ The TSFs must be managed and operated within the Radiation Management Programme for CoR-69.			
Post- mitigation			
Duration	Permanent (7)	The elimination of radionuclides distributed into the environment that may contribute to radiation exposure is expected to be permanent.	Moderate (positive) 105
Extent	Local (3)	The impact is expected to be local	
Intensity	Serious (5)	Serious radiological benefits can be expected once the TSFs are removed as sources of radiation exposure	
Probability	Definite (7)	There is a strong possibility that the positive impact will definitely occur	
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 10-71.

Table 10-71: Potential Cumulative Impacts

Environmental Aspect	Cumulative Impacts
Air Quality	Air quality data from the existing dust monitoring network (Kloof, Driefontein, Cooke and Ezulwini) indicates deposition rates that are within the recommended residential limit (600 mg/m^2/day), with the Driefontein PM_{10} monitoring data for 2013 and 2014 being within the regulatory 75 µg/m^3 with occasional exceedances of these limits taking place. The Driefontein monitoring network recorded much higher deposition rates than the remaining Mining Right monitoring networks. The operational phase of the Project at the different Mining Right areas will exacerbate localised impacts in the immediate vicinities of the activities. However, due to the existing mining operations currently taking place, as well as the limited distances between the respective Mining Right areas, the cumulative regional air quality impact might be diluted to within regulatory requirements. It is not envisaged that the proposed project will exacerbate the current ambient air quality scenario in the area.
Groundwater	The groundwater within the Driefontein Mining Right area is typical of contaminated water emanating from historical TSFs and current mining operations, with elevated concentrations of sulfate, TDS and nitrates, as well as manganese and chloride. The pH values range between 4.1 and 8 and are indicative of AMD impacts associated with seepage from existing TSFs. The reclamation of the historical TSFs may result in short term AMD generation and seepage of the contaminated water as the tailings material is exposed to oxygen and water. However, following the complete reclamation of the historical TSFs and subsequent rehabilitation of the TSF footprints, it is expected that there will be a positive cumulative impact on the groundwater in the region as the pollution sources are removed from the landscape.
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.

Environmental Aspect	Cumulative Impacts
	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 sulfate, nitrate, fluoride, manganese and ammonia in a number of streams in the project area. This indicates that rivers within this area 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 historical TSFs may mobilise and expose sulfide minerals such a pyrite (FeS_2) that, when exposed to air and water, will oxidise and release large quantities of iron and sulfate into solution, and generate AMD. Therefore, without adequate and effective mitigation measures, the proposed project may further deteriorate the quality of water in the natural water courses. In the long run it is anticipated that post closure, with the implementation of mitigation and management measures, the surface water environment will benefit by eliminating a long term source of contaminants presented by the present position and contents of the dumps. Monitoring should be implemented post closure to check for residual impacts. The reclamation of historical TSFs, processing of the tailings material, removal of sulfides and deposition on a proposed RTSF will have an overall 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 pipeline to the CPP, as well as the construction of the WBT and BWSF complex, are the only activities that will remove vegetation and habitat types. A positive impact to the vegetation and habitat types present will occur following the rehabilitation and remediation of the Driefontein 3 and 5 TSF's. It is expected that 65.3 ha of natural grassland, 6.7 ha of wetlands and 7.4 ha of ridge vegetation will be removed to facilitate construction. Total cumulative impact will be 79.4 ha.
Aquatics	Positive impacts within the Wonderfonteinspruit can be expected due to the project. The positive impacts would be expressed

Environmental Aspect	Cumulative Impacts
	through the removal of large sources of contaminated seepage and runoff, resulting in potential water quality improvement within the river system. Short term cumulative impacts, specifically on aquatic ecology would involve impacts arising from potential increased concentrations of dissolved and suspended solids. Specifically, contaminated runoff or seepage from reclamation activities may temporarily increase the conductivity of the Wonderfonteinspruit, especially during rainfall periods. However, due to the currently largely modified status of the ecology within the river system, the presence of largely tolerant species exist and therefore this increase in dissolved solids may have a potentially lower effect than would be expected in an aquatic ecosystem with largely sensitive species.
Wetlands	The activities associated with the Driefontein Mining Right area will result in the direct loss of 1 ha of pan wetlands due to the WBT and BWSF complex footprint. SGL will need to investigate an offset strategy for the loss of these wetlands, as well as the wetlands associated with the Ultimate WRTRP. 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 neutral visual impact because the negative visual impact of mining created by the TSFs will be removed. This neutral visual impact will be increased as the number

Environmental Aspect	Cumulative Impacts
	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 low (negative) 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. The existing Driefontein, Kloof, Ezulwini and Cooke Mining Right areas 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 a neutralising cumulative impact to the local and regional study area. These 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.
Radiological	Due to the nature of most mining and mineral processing operations, a cumulative radiological impact may be expected between different facilities within the same CoR, especially where facilities are closely (spatially) associated with each other. Viewed from a radiation protection perspective, each CoR is licensed separately, which means that the cumulative effect between all potential sources included in the scope of that CoR should be within the compliance criteria set for public exposure. Within the Driefontein Mining Right area, the cumulative effect as far as the WRTRP is concerned is anticipated to result in the reduction in the total effective dose, since the Driefontein 3 and 5 TSFs are major pollution sources that will be removed from the system, with a significant reduction in the radiological impact near these facilities.

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[6] x PROBABILITY[7] x NATURE[8]

The matrix (Table 10-73) calculates the rating out of 147 points, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 10-72. 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 10-74).

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.

[6] Consequence = Intensity + Extent + Duration

[7] Probability = Likelihood of and impact occurring

[8] Nature = Positive (+1) or Negative (-1) impact

Table 10-72: 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.
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 10-73: Probability/Consequence Matrix

| | | Significance | | |

Table 10-74: 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	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	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, Ezulwini and Cooke, 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 predominant layout concerns raised by I&APs is the location and resultant impacts of the proposed RTSF site. The RTSF has been discussed as part of the Kloof Mining Right area EIA and is not included in this report. The location of the WBT and BWSF complex has been determined based on the central location from the K10 shaft, Driefontein 3 TSF and CPP. The WBT and BWSF complex has also been located within the R501 arc where the regional road avoids depressions and sinkholes in the landscape. The WBT and BWSF complex is located adjacent to these depressions and sinkholes which has limited the potential land uses for the area.

I&APs have expressed concern over the location of the pipeline routes and the potential impacts associated with person and animal movement restrictions and possible visual impacts, as well as impacts to the environment in the event of a pipeline leak or spill. The pipeline routes have been determined premised on the primary requirement of the shortest distance between the respective project activities, as well as capitalising on the following:

- Following existing routes where possible;
- Avoiding identified environmental sensitive areas, predominantly wetland areas;
- Crossing existing impacted land;
- Maximising mine owned land; and
- Assessing the operating costs pertaining to topographical considerations on pumping costs.

Utilising existing mine owned land, servitudes and impacted land ensures that potential impacts to landowners, land occupiers and the environment are prevented or reduced. The pipelines are critical for the reclamation of the historical TSFs; without the pipelines the historical TSFs cannot be reclaimed and the positive impacts associated with the project will not be realised.

10.8 Item 3(g)(viii): The Possible Mitigation Measures that could be applied and the Level of Risk

This section discusses the potential mitigation measures that have been recommended to accommodate or address issues and concerns raised by I&APs. One of the predominant concerns raised by I&APs is the generation of dust and the resultant deterioration on ambient air quality. Dispersion models were developed as part of the Air Quality Impact Assessment (Appendix E) and modelled the reclamation process associated with Driefontein 3 and 5 TSFs. The historical TSFs are currently a source of air pollution and the TSFs will be hydraulically reclaimed. The dispersion models indicated that the dust generated from the historical TSFs will reduce as the TSFs are reclaimed due to the decreasing size of the TSFs. In addition, the hydraulic reclamation will act as a natural dust suppressant during the reclamation activities. It is also vital that vegetation removal on the TSFs only takes place on the areas being directly reclaimed, preventing dust generation from exposed surfaces not directly being reclaimed. The source of dust emissions will be completely removed, provided the historical TSFs are reclaimed in their entirety and rehabilitated according to the Rehabilitation and Closure Plan. The complete removal of the historical TSFs and subsequent rehabilitation of the footprints has been included as a condition of authorisation in this EMP.

I&APs have also raised the concerns over the pipeline routes in terms of the location and impact to directly affected persons, as well as the potential restriction of movement for people and animals, as well as the potential for environmental impacts should a pipeline leak or spill. Based on the location determinants above, by optimising existing servitudes and mine owned land, the potential impacts to directly affected persons and the movement of animals and people will be significantly reduced. The use of existing impacted land and the avoidance of sensitive areas, predominantly wetlands, ensures that potential visual impacts are reduced, as well as limiting potential impacts to the environment in the event of a pipeline leak or spill. In addition, mitigation measures are provided in Section 11.2 to prevent and manage pipeline leaks and spills. Such precautionary measures include the electronic monitoring of pipeline pressure to identify potential leaks or bursts, emergency valves to immediately shut down pumping of slurry or mine impacted water, no flanges will be utilised in floodline areas and all pipelines will be constructed outside of the 1:100 year floodline. In addition, SGL has established an Emergency Response Plan to contain and clean up any spills and leaks to prevent environmental degradation.

During the PPP, the predominant impacts raised were regarding the RTSF and its potential impacts on the environment and directly and indirectly affected landowners and land occupiers. The RTSF has been assessed and discussed as part of the Kloof Mining Right area EIA and is not included in this report.

10.9 Item 3(g)(ix): Motivation where No Alternatives Sites were Considered

Alternatives sites were considered for the WBT and BWSF complex, as well as the pipeline routes. A comprehensive site selection process was undertaken for the CPP and RTSF complex, as detailed in Section 8.1.1. The pipeline route alternatives were determined based on existing routes and servitudes, avoiding wetland and sensitive areas, crossing impacted and mine owned land and assessing operating costs pertaining to topographical considerations on pumping costs. The pipeline routes alternatives haven been detailed in Section 8.1.2.

10.10 Item 3(g)(x): Statement Motivating the Alternative Development Location within the Overall Site

10.10.1 WBT and BWSF Complex

The WBT and BWSF have been located adjacent to each other to minimise the required footprints, as well as optimising and aiding in the operational and maintenance efficiency during the Operational Phase. The footprint of the WBT and BWSF complex has been optimised and the alteration of the footprint shape will reduce the operational efficiency. As a result, the block footprint has been utilised to select suitable locations.

The WBT and BWSF complex has been located adjacent to the R501 regional road, where the road alters direction and arcs to avoid depressions and sink holes in the landscape. The presence of the depressions and sink holes limits the potential land use adjacent to the R501 regional road arc. The identified location is also situated approximately midway between the K10 shaft abstraction point and Driefontein 3 TSF, as well as where the slurry pipeline heads southwards to the CPP, making the location the central point for the pipeline routes.

10.10.2 Pipe routes

As outlined in section 8.1.2, the interconnecting pipeline routes shown in Plan 9 have been well considered and are the preferred pipeline routes for the project.

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 Driefontein Mining Right area was informed by various environmental, technical and engineering studies, as well as the location of existing infrastructure and historical TSFs. The location of the proposed CPP and RTSF has been detailed in the Kloof Mining Right area EIA and has undergone comprehensive site selection and feasibility studies. The Driefontein Mining Right area infrastructure has been selected based on the locations of the CPP and RTSF, as well as taking cognisance of the historical TSFs for reclamation and existing servitudes and infrastructure. The Scoping phase of the project identified potential impacts that may arise as a result of the proposed project and detailed the plan of study for specialist studies to determine the sensitives and 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. The potential impacts assessed are based on the preferred site layout (Plan 4).

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 10, 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 Prior to Mitigation	Mitigation Type	Significance Post Mitigation
Construction Phase						
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Loss of topsoil as a resource	Soils	Construction Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Loss of land capability	Soils and land capability	Construction Phase	Medium-high (negative)	N/A	Medium-high (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Medium-high (negative)	Manage through: ▪ Storm Water Management Plan.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management.	Low (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	High (negative)	Manage through: ▪ Wetland offset strategy. Remedy through: ▪ Rehabilitation Plan.	Medium-high (negative)
	Visual intrusion on the landscape	Visual Environment	Construction Phase Operational Phase	Medium-low (negative)	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
	Damage or alteration to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Low (negative)	Manage through: ▪ Section 34 destruction permit	Low (negative)
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	Low (negative)
	Loss of topsoil as a resource	Soils	Construction Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management.	Low (negative)
	Siltation of wetlands impacting on ecosystem services	Wetlands	Construction Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management.	Low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	Low (negative)
	Visual intrusion on the landscape	Visual Environment	Construction Phase Operational Phase	Medium-low (negative)	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-low (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
	Direct investment and multiplier effect.	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	Moderate (positive)
	Population influx and associated impacts	Socio-economic	Construction Phase Operational Phase	Medium high (negative)	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	Medium low (negative)
Operational Phase						
Reclamation of Driefontein 3 and 5 TSFs	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Operational Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Contamination and deterioration of soils	Soils	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Erosion control and storm water management.	Medium-low (negative)
	AMD generation and seepage into groundwater	Groundwater	Operational Phase	Medium-low (negative)	Monitor and manage through: ▪ Exposed tailings material minimisation. ▪ Groundwater quality monitoring.	Low (negative)
	Modification of instream habitat	Aquatic ecology	Operational Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management.	Medium-low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Radiation impacts to environment and public	Radiological	Operational Phase	Medium-low (negative)	Manage through: ▪ Radiation Management Programme for CoR-69; and ▪ NNR approval.	Medium-low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
WBT and BWSF Complex	Contamination and sedimentation of wetlands	Wetlands	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Alien Invasive Management Plan; ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
Pipelines and Roads	Soil compaction and erosion	Soils	Operational Phase	Medium-low (negative)	Manage through: ▪ Erosion control. ▪ Site access restriction.	Low (negative)
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	Moderate (positive)
	Contribution to country's economy	Socio-economic	Operational Phase	Moderate (positive)	N/A	Moderate (positive)
Decommissioning Phase						
Reclamation of Driefontein 3 and 5 TSFs	Removal of a pollution source will improve the ambient air quality.	Air quality	Decommissioning Phase Post-Closure	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Vegetation establishment.	Moderate (positive)
	Improvement of land capability due to the removal of the TSFs.	Soil and land capability	Decommissioning Phase	Moderate (positive)	Enhance through: ▪ Rehabilitation Plan.	Moderate (positive)
	Increased biodiversity of the area due to the removal of unfavourable habitats.	Fauna and Flora	Decommissioning Phase Post-Closure	Negligible (positive)	Enhance through: ▪ Rehabilitation Plan.	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
	Increased aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	N/A	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	Minor (positive)
	Reduced impacts to surrounding wetlands	Wetlands	Decommissioning Phase	N/A	Enhance through: ▪ Rehabilitation Plan.	Moderate (positive)
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Visual intrusion on the landscape	Visual Environment	Decommissioning Phase	Medium-low (negative)	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	Low (negative)
	Generation of noise	Noise	Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	Low (negative)
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Visual intrusion on the landscape	Visual Environment	Decommissioning Phase	Medium-low (negative)	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	Low (negative)
	Generation of noise	Noise	Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Decommissioning Phase	Medium-high (negative)	Manage through: ▪ Closure Plan. ▪ Future Forum.	Medium-low (negative)
Post-Closure						
Reclamation of Driefontein 3 and 5 TSFs	Improvement of groundwater quality	Groundwater	Post Closure	N/A	Enhance through: ▪ Rehabilitation Plan.	Moderate (positive)
	Increase in catchment yields and improved surface water runoff	Surface water	Post Closure	N/A	Enhance through: ▪ Rehabilitation Plan.	Moderate (positive)
	Improvement of visual landscape and change of land use from mining	Visual Environment	Post Closure	Moderate (positive)	N/A	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance Prior to Mitigation	Mitigation Type	Significance Post Mitigation
	Removal of radiation impacts to environment and public	Radiological	Post Closure	Low (negative)	Manage through: ▪ Radiation Management Programme for CoR-69; and ▪ NNR approval.	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.

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	Although the reclamation of the historical TSFs will result in dust generation, the use of the hydraulic monitoring gun will suppress dust emissions. The impact on air quality due to the historical TSFs will reduce over time as the TSFs are reclaimed and the footprints reduced. It is imperative that the TSFs are reclaimed in their entirety. Dust monitoring must continue on a monthly basis.	All recommendations have been considered and included.	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	The reclamation of the historical TSFs will improve the groundwater quality in the region of the TSFs. During the reclamation activities, however, there is the potential for AMD generation due to increased exposure of tailings material to oxygen and water. The water used during reclamation, which may be acidic, may seep through the TSF footprint into the groundwater. Capped and vegetated surfaces must not be disturbed until such walls will be mined. Groundwater monitoring must be undertaken.	All recommendations have been considered and included.	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 and the monitoring provided in Section 9.
Soil Impact Assessment	The removal of the historical TSFs will improve on the land capability of the TSF footprints, as well as alter the land use to a suitable end land use other than a mine dump. The Rehabilitation and Closure Plan will be paramount to ensure the complete rehabilitation of the historical TSF footprints.	All recommendations have been considered and included.	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	The Nationally protected *Boophone disticha* (Poison bulb) (Declining) was encountered throughout the grassland and ridges vegetation categories and the plant species *Hypoxis hemerocallidea* (Star Flower) (GDARD, Declining)	All recommendations have been considered and included.	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 and the monitoring provided in Section 9.
Fauna and Flora Impact Assessment	The WBT and BWSF complex and pipeline routes are located in sensitive areas, such as grasslands, ridges and wetlands. Nationally protected species occur throughout the region and must not be destroyed. Plant species such as *Boophone disticha* (Poison bulb) and *Hypoxis hemerocallidea* (Star Flower) must be identified. Relocation permits must be applied for all protected plants species that fall within the infrastructure footprints.	All recommendations have been considered and included.	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.

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
Aquatics Impact Assessment	The sedimentation of water resources is a significant threat to the quality of aquatic ecosystems. Sediment must be collected through silt traps and buffers implemented from all water resources where possible.	All recommendations have been considered and included.	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.
Wetlands Impact Assessment	The sedimentation of wetlands will inhibit their ecological functioning. Impacts to wetlands must be mitigated through the implementation of storm water management, management of alien invasive vegetation and the offset of destroyed wetlands due to the construction of the WBT and BWSF complex.	All recommendations have been considered and included.	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.
Visual and Topography Impact Assessment	The construction of infrastructure will result in visual intrusions on the landscape which are unavoidable should the project proceed. The complete reclamation of the Driefontein e and 5 TSFs, however, will have a positive impact on the visual environment; it is imperative that the TSFs are reclaimed in their entirety to ensure the positive impacts are achieved.	All recommendations have been considered and included.	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	Noise impacts are considered to be low (negative) due to the baseline noise levels for the region. The impacts can be further mitigated through the maintenance of machinery and operating equipment and limiting activities to daylight hours.	All recommendations have been considered and included.	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.
Heritage Impact Assessment	There are heritage resources located within close proximity to the pipeline routes associated with the Driefontein Mining Right area. The heritage resources are not expected to be impacted upon, however, should the resources be impacted, a Section 34 permit must be applied for in accordance with the NHRA.	All recommendations have been considered and included.	The Heritage Impact Assessment has been included in Appendix N. The mitigation and management measures included in this report were recommended by the Heritage Specialist, although no impacts to heritage resources are expected.
Social Impact Assessment	There are positive and negative socio-economic impacts associated with the project. The positive impacts can be enhanced and the negative impacts mitigated through the recommendations provided by the specialists and all positive impacts should be focused on the local municipalities and receiving communities.	All recommendations have been considered and included.	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.

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
Economic Impact Assessment		All recommendations have been considered and included.	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.
Radiation Impact Assessment	The radiological impacts are anticipated to be medium-low and the reclamation thereof will have long term positive impacts. The operations must operate within the Radiation Management Programme of CoR-69 and mitigation measures associated with air quality and groundwater must be implemented.	All recommendations have been considered and included.	The Radiation Impact Assessment has been included in Appendix P. All mitigation and management measures included in this report were recommended by the Radiation 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.

14 Item 3(k): Environmental Impact Statement

14.1 Item 3(k)(i): Summary if the Key Findings of the Environmental Impact Assessment

The Environmental Impact Statement is utilised to summarise all of the potential significant environmental and social 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 Prior to Mitigation	Significance Post Mitigation
Construction Phase				
WBT and BWSF Complex	Loss of topsoil as a resource	Soils	Medium-high (negative)	Low (negative)
	Loss of land capability	Soils and land capability	Medium-high (negative)	Medium-high (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	Medium-high (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Minor (positive)	Moderate (positive)
	Direct investment and multiplier effect.	Socio-economic	Minor (positive)	Moderate (positive)
	Population influx and associated impacts	Socio-economic	Medium high (negative)	Medium low (negative)
Operational Phase				
Reclamation of Driefontein 3 and 5 TSFs	Contamination and deterioration of soils	Soils	Medium-high (negative)	Medium-low (negative)
	Modification of instream habitat	Aquatic ecology	Medium-high (negative)	Medium-low (negative)
WBT and BWSF Complex	Contamination and sedimentation of wetlands	Wetlands	Medium-high (negative)	Low (negative)

Activity	Potential Impact	Aspects Affected	Significance Prior to Mitigation	Significance Post Mitigation
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Minor (positive)	Moderate (positive)
	Contribution to country's economy	Socio-economic	Moderate (positive)	Moderate (positive)
Decommissioning Phase				
Reclamation of Driefontein 3 and 5 TSFs	Removal of a pollution source will improve the ambient air quality.	Air quality	Low (negative)	Moderate (positive)
	Improvement of land capability due to the removal of the TSFs.	Soil and land capability	Moderate (positive)	Moderate (positive)
	Increased biodiversity of the area due to the removal of unfavourable habitats.	Fauna and Flora	Negligible (positive)	Moderate (positive)
	Reduced impacts to surrounding wetlands	Wetlands	N/A	Moderate (positive)
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Medium-high (negative)	Medium-low (negative)
Post Closure				
Reclamation of Driefontein 3 and 5 TSFs	Improvement of groundwater quality	Groundwater	N/A	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Significance Prior to Mitigation	Significance Post Mitigation
	Increase in catchment yields and improved surface water runoff	Surface water	N/A	Moderate (positive)
	Improvement of visual landscape and change of land use from mining	Visual Environment	Moderate (positive)	Moderate (positive)
	Removal of radiation impacts to environment and public	Radiological	Low (negative)	Moderate (positive)

14.2 Item 3(k)(ii): Final Site Map

The infrastructure layout plan for the Driefontein Mining Right area is illustrated Plan 4b of this Report and in Appendix A. A composite plan is provided in Plan 25 below and in Appendix A.

Plan 25: 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 Driefontein Mining Right area are due to the site clearing for and construction of the WBT and BWSF complex. The construction of the WBT and BWSF complex will potentially impact on soil and surface water resources due to the clearance of vegetation and resultant soil erosion and compaction. Eroded soils may report to surface water resources due to runoff from the site which can lead to sedimentation of water and deterioration of water quality. In addition, the WBT and BWSF complex has been partially located within a pan which has a high (negative) impact due to the loss of wetland habitat; the partial location within the pan was unavoidable due to the presence of sinkholes and depressions, the R501 road to the north and future construction to the south. A wetland offset strategy will be implemented to compensate for the loss of wetlands, subject to a WUL.

The positive impacts associated with the project are predominantly part of the Kloof Mining Right area as significant capital expenditure will take place which will boost the local economy and have a multiplier effect. Job creation and skills development will also result from the project.

The significant positive impacts associated with the Driefontein Mining Right area activities will be realised following the complete reclamation of the historical TSFs and the rehabilitation of the footprints. The removal of the historical TSFs will have a positive visual impact on the landscape, as well as positive impacts on air quality, surrounding wetlands and aquatic ecology and surface water and groundwater quality as the permanent source of pollution will be removed from the landscape. In addition, surface water yield to the catchment will increase as runoff is not restricted by the TSFs, fauna and flora biodiversity will increase due to the removal of unfavourable habitats and the visual environment will improve due to the removal of the visual intrusion on the landscape.

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 layout for the WRTRP and Driefontein Mining Right area infrastructure was informed by environmental and technical studies, as discussed in detail in Section 8.1 and Section 10.10. Where impacts cannot be avoided, mitigation and management measures have been provided. Although sensitive areas have been avoided as far as possible, sections of the WBT and BWSF complex and pipelines are located in wetland areas; the wetlands cannot be avoided. A wetland offset strategy has been proposed and developed to offset the loss of wetland areas for the WBT and BWSF complex, along with the CPP and RTSF area as part of the Kloof Mining Right area.

17 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

The following aspects must be included as part of the conditions for authorisation:

- A wetland offset strategy must be implemented for the loss of wetland habitat associated with the WRTRP, particularly the RTSF complex. The wetland offset strategy must be implemented within 1 year of a wetland being impacted upon;
- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, SGL may apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority;

- All historical TSFs as part of the WRTRP must be completely reclaimed and their footprints rehabilitated according to closure plans to be compiled;
- The treatment of mine affected water at the AWTF must continue beyond the operational phase. Liability of the AWTF may be transferred to a third party upon agreement;
- 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).

18 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken.

18.1 Air Quality Impact Assessment

It must be noted that modelled data was utilised for site-specific meteorological data in the Air Quality Impact Assessment.

18.2 Soil Impact Assessment

The assumptions and limitations associated with the Soil Impact Assessment include:

- A field survey was undertaken for the RTSF complex only, with land type data used for the remaining WRTRP area.

18.3 Surface Water Impact Assessment

Additional water quality data provided by the client was used in the baseline water quality description. The assumption and limitation applicable to the Surface Water Impact Assessment includes:

- No flow measuring equipment was installed on site. All flow data was obtained from existing DWS flow gauging stations.

18.4 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, were 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.

18.5 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 WBT and BWSF 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.

18.6 Visual Impact Assessment

A Visual Impact Assessment is open to subjectivity. This subjectivity is due to the different opinions receptors have of a proposed project. A receptor may be partial to the fact that the proposed project is occurring in an area, which becomes a source of economic upliftment for a community, whereas another receptor may view a proposed project as a negative factor which could hamper tourism or recreational activities.

Many factors can enhance or reduce the visual impact of the proposed project. It is, therefore, difficult to determine the visual impact of the proposed project from the viewpoint of each individual receptor. Consequently, this report focuses on the size of the viewshed area. Some infrastructure heights were not available for this study and assumptions were made. These assumptions were based on the heights of infrastructure from similar projects.

The 5 metre contour relief data from CD: NGI did not include contours for any of the mining activities (TSFs) for the project area and surrounds. These TSFs could potentially provide some screening of the proposed project. Lidar data (0.5 metre contours) from SGL was used where available to add the TSFs. For other areas, the contour data was edited and contours were added for these mining activities to produce a more representative topographical model.

18.7 Noise Impact Assessment

The assumptions and limitations associated with the Noise Impact Assessment include:

- Only daytime scenarios were modelled for the construction phase as it is assumed that construction activities will only be undertaken during daytime hours (06:00-22:00); and
- The resulting noise contours represent worst case (unmitigated), L_{Aeq} 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.

18.8 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

It must be noted that the Driefontein 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. As a result, the following section has been discussed taking into account the Ultimate WRTRP as well as the Driefontein Mining Right area.

19.1 Item 3(p)(i): Reasons why the Activity should be Authorised or not

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, improving the ambient air quality, groundwater quality and having positive impacts on the surrounding surface water resources, wetlands and aquatic ecology. Furthermore, mine affected water being discharged into the environment, as part of the Kloof and Cooke Mining Right areas, 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. 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.

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 aspects must be included as part of the conditions for authorisation:

- A wetland offset strategy must be implemented for the loss of wetland habitat associated with the WRTRP, particularly the RTSF complex. The wetland offset strategy must be implemented within 1 year of a wetland being impacted upon;

- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, SGL may apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority;
- All historical TSFs as part of the WRTRP must be completely reclaimed and their footprints rehabilitated according to closure plans to be compiled;
- The treatment of mine affected water at the AWTF must continue beyond the operational phase. Liability of the AWTF may be transferred to a third party upon agreement;
- 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

The Closure Cost Report is included in Appendix Q. The financial provision for the Driefontein Mining Right area for planned closure is **R 23 423 521.70**, with the closure cost after 1 year calculated as **R 9 686 963.27**, as summarised in Table 22-1.

Table 22-1: Summary of the Closure Cost Liability for the Driefontein Mining Right Area

Description	Closure Cost After 1 year of Mining	Planned Closure Cost	Closure Cost After 10 years of Mining
West block Thickener	R 2,186,501.57	R 2,186,501.57	All infrastructure and dump footprints would have been rehabilitated during year 10 of mining
Dams and pump stations	R 2,464,143.68	R 2,464,143.68	
Linear Infrastructure	R 1,210,027.93	R 1,210,027.93	
Driefontein TSFs	R 952,722.82	R 10,429,807.72	
Total	**R 6,813,396.00**	**R 16,290,480.90**	
Monitoring Costs (groundwater)	R 798,950.00	R 798,950.00	
Monitoring Costs (vegetation)	R 7,109.90	R 43,964.90	
Maintenance Costs (vegetation)	R 198,560.24	R 1,966,220.09	
Radiation Clearance	R 370,000.00	R 740,000.00	
Project Management (12%)	R 817,607.52	R 1,954,857.71	
Contingency (10%)	R 681,339.60	R 1,629,048.09	
GRAND TOTAL	**R 9,686,963.27**	**R 23,423,521.70**	

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 submitted Scoping Report to 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 were discussed in Sections 10.1.11 and 10.2.10. The WBT and BWSF complex is located on portions 10 and 11 of the farm Driefontein 355 which is owned by Driefontein Consolidated which is, in turn, held by SGL. There are no land occupiers, potential beneficiaries or directly affected persons associated with the WBT and BWSF complex.

The proposed pipeline routes have been determined taking into account mine owned land, existing impacted land, environmental sensitivities, existing routes and servitudes and operating costs. The pipeline routes may impact on landowners or land occupiers where the pipeline does not make use of mine owned land or existing servitudes. Where the pipelines cross private ownership, namely portions 8, 9 and 24 of the farm Blyvooruitzicht 116 and portion 22 and the remaining extent of portion 6 of the farm Doornkloof 350, agreements with the landowners will be concluded to establish servitudes, wayleaves or right of access.

The Social Impact Assessment is included in Appendix O and it is hereby confirmed that the mitigation measures are provided in Table 5-1 and Table 6-1, Part B of this 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.

The potential impacts on heritage resources have been investigated and assessed in detail. The Heritage Impact Assessment is included in Appendix N to this report. In summary, structures older than 60 years were identified throughout the project area, although these structures were not located within the WBT and BWSF complex and pipeline footprints. Structures older than 60 years require a destruction permit in accordance with Section 34 of the NHRA should these structures be altered, damaged or require destruction even though the structures are deemed to have negligible cultural significance. The structures older than 60 years that may be impacted upon due to the Driefontein Mining Right area activities, and may require a Section 34 destruction permit, are listed in Table 24-1 and displayed in Plan 22.

Table 24-1: Structures that may require a Section 34 Destruction Permit

Resource ID	Type	Description	Cultural Significance Motivation	Latitude	Longitude
Wf-009	Werf	Werf in a state of ruin. Remnant foundations and reservoir of werf remain.	The werf can be considered in particular dimensions against aesthetic and social criteria. This is a resource that is common and well represented throughout diverse cultural landscapes. The fabric of this resource is poorly preserved and there is extensive encroachment on setting.	26.404 °S	27.414 °E
Ste-010	Structure	Stone foundations and stone enclosure	The structure no longer exists, only stone foundations remain. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.379 °S	27.527 °E

Resource ID	Type	Description	Cultural Significance Motivation	Latitude	Longitude
Ste-011	Structure	Stone foundations of four individual structures.	The structure no longer exists, only stone foundations remain. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.381 °S	27.528 °E
Wf-012	Werf	Werf that is currently occupied. Werf comprises of residential structure and outbuildings.	The werf can be considered in particular dimensions against aesthetic and social criteria. This is a resource that is common and well represented throughout diverse cultural landscapes. The fabric of the resource is well preserved and the meaning is well established.	26.421 °S	27.551 °E
Wf-013	Werf	Werf that is currently occupied. Werf comprises of residential structure and outbuildings.	The werf can be considered in particular dimensions against aesthetic and social criteria. This is a resource that is common and well represented throughout diverse cultural landscapes. The fabric of the resource is well preserved and the meaning is well established.	26.423 °S	27.549 °E

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.

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 Driefontein Mining Right area is illustrated in Plan 25, 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;
- 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.

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

4.2.1 Ecological Degradation due to Listed Activities

Listed and specified activities associated with the Driefontein Mining Right area will result in ecological degradation and environmental damage and pollution. The potential impacts associated with such activities have been identified and assessed for each environmental aspect in Sections 10.1 to 10.4. Mitigation measures have been provided to mitigate the potential impacts associated with the project's activities to reduce the significance of such impacts. In addition, monitoring programmes have been provided in Section 9.5 to monitoring potential impacts which will allow alternative mitigation measures to be implemented if necessary.

The predominant impacts that may result in ecological degradation are due to the loss of topsoil resources and destruction of wetland associated with the construction of the WBT and BWSF complex, which in turn may impact on surface water resources through sedimentation and deterioration of water quality. The potential ecological degradation will be managed by implementing storm water management designs to separate clean and dirty water from the WBT and BWSF complex footprint area, as well as implementing corrective actions, such as berms, should topsoil erosion occur. In addition, a wetland offset strategy will be implemented to compensate for the loss of wetland habitat due to the construction of the WBT and BWSF complex within a delineated pan area.

4.2.2 Process for Managing Ecological Degradation

SGL has established environmental preparedness procedures for any emergencies that may result in ecological degradation. These procedures applicable to the activities associated with the Driefontein Mining Right area of the WRTRP have been categorised into the following:

- Water spillages;
- Tailings spillages;
- Oil spillages; and
- Chemical spillages.

4.2.2.1 Water Spillages

Water spillages include spillages from all water bearing pipelines and include potable and non-potable water sources. Water spillages have been included as an emergency procedure to ensure that valuable resources are not wasted, as aligned to the companies' policy statement. In the event of a water spillage occurring, the following actions will apply:

- The spillage of water from any pipeline, reservoir, dam or other water conveyance or storage medium into the environment must be immediately reported to the control room;
- The control room official must establish and record the following information before contacting the relevant persons to repair the leak:
  - Name of person reporting the emergency and their contact details;
  - Location of the emergency; and
  - Brief description of the emergency.
- The control room official will instruct the official that is to repair the leak as to the following:
  - To ascertain the source of the water;
  - To immediately shut off the water supply to the leak;
  - To check to see whether any water could enter the storm water system or report to the environment; and
  - Should water be reporting to the environment, the estimated volume of water.
- Should non-potable water be reporting to the environment, the control room official will notify the environmental department who will report any major incident to the relevant authorities; and
- An investigation into the incident and an applicable non-conformance and corrective action report will be completed by the environmental department and submitted to the relevant head of department.

4.2.2.2 Tailings Spillage

As a result of the nature of the tailings material, pipelines transporting the material have the potential to fail. SGL will implement operational control procedures to inspect, maintain and replace pipelines to prevent spillages from occurring. However, should a spillage occur, the tailings material has the potential to cause significant environmental impacts. In the event of a spillage being detected, the following actions will apply:

- The spillage of tailings material must be immediately reported to the control room;
- The control room official must establish and record the following information:

- Name of person reporting the emergency and their contact details;
- Location of the emergency; and
- Brief description of the emergency.

- The control room official will contact the relevant persons to repair the leak;
- The control room official will instruct the official that is to repair the leak as to the following:
  - To ascertain the source of the tailings material;
  - To immediately shut off the supply to the leak;
  - To check to see whether any tailings material could enter the storm water system or report to the environment or if the tailings material is confined to a paddock, berm or other structure designed to contain accidental spillages. All reasonable precautions must be taken to prevent the tailings material from entering the storm water or clean water systems; and
  - The estimate quantity that has been spilled.
- The control room official will notify the environmental department who will report any major incident to the relevant authorities;
- An investigation into the incident and an applicable non-conformance and corrective action report will be completed by the environmental department and submitted to the relevant head of department;
- The security personnel must be notified where a need occurs for the diversion of traffic or guarding of livestock or wildlife from drinking from or near the spill; and
- Necessary sampling must be conducted by the Assistant Supervisor in the contaminated media.

4.2.2.3 Hydrocarbon or Chemical Spill

The spillage of hydrocarbons or chemicals can have significant impacts on various components of the environment. Operational control procedures have been developed for the correct handling and storage of hydrocarbons and chemicals at the various management units. These procedures include actions to be taken in the event of a spill or leak. The below procedure, however, details the actions to be undertaken for spills larger than 20 litres which are anticipated to potentially occur during transportation:

- The spillage of hydrocarbon or chemical must be immediately reported to the control room;
- The control room official must establish and record the following information:
  - Name of person reporting the emergency and their contact details;

- Location of the emergency; and
- Brief description of the emergency.

- In the case of a spill on a road, the control room official must instruct the person reporting the spill to take actions to divert traffic around the spill and to take preventative action to contain and stop the spill and to prevent it from reporting to any water systems;
- The control room official must immediately contact the contracted environmental pollution clean-up consultants to clean up the spill;
- The control room official will notify the environmental department who will report any major incident to the relevant authorities; and
- An investigation into the incident and an applicable non-conformance and corrective action report will be completed by the environmental department and submitted to the relevant head of department.

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.

The historical tailings samples underwent small scale SPLP leach tests and showed that there were nine contaminants likely to be of concern, namely, arsenic, iron, manganese, molybdenum, nickel, nitrate, sodium, sulfate and uranium.

AMD could be generated in the short-term due to the exposure of the tailings material at Driefontein 3 and 5 TSFs to oxygen and water during the reclamation phase. This is expected to be short lived (spanning the period of reclamation) and buffered by the dolomitic carbonates underneath. The impact of the AMD generation and seepage is considered to be medium-low (negative) as the sites are already considered to be contaminated due to the presence of the historical TSFs and the pollution plumes are local

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 Driefontein 3 and 5 TSFs will be hydraulically reclaimed. As the TSF is reclaimed, the tailings material is exposed to air and water which may result in the formation of AMD. The resultant slurry will flow to collection sumps where it will be pumped to the WBT and then 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

The reclaimed tailings material, in slurry form, will be diverted and flow towards the temporary sumps before being pumped to the CPP, via the WBT, for processing. There is a potential that AMD may seep through the historical TSF or sumps and impact on groundwater resources. A groundwater monitoring programme has been developed for the Driefontein Mining complex and the monitoring programme will continue. Should it become evident that the groundwater resources are impacted due to the reclamation activities, SGL will implement measures to ensure that impacts are mitigated.

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.

Table 5-1: Impacts to be mitigated

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Construction Phase						
WBT and BWSF Complex	Air quality	Construction Phase	Immediate surrounds	▪ Application of wetting agents or dust suppressant on exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to the commencement of the activity and for the duration of the project life.
	Soils	Construction Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; ▪ Ensure storm water management designs are in place; and ▪ Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state and vegetated, as per the Rehabilitation Plan.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ During the construction phase
	Surface water	Construction Phase	Municipal Area	▪ Temporary ditches must be constructed down-gradient of the cleared areas; ▪ The temporary ditches must be sized according to the 1:50 year rainfall event; ▪ Utilise water stored in the temporary ditches; ▪ Clean water upstream of the cleared and construction areas must be diverted around the site to nearby water courses. The diversion canals must be sized to accommodate a 1:50 year rainfall event; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas.	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)	▪ During the construction phase
	Aquatic ecology	Construction Phase	Footprint area	▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; and ▪ Diversion trenches and berms should convey dirty	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				water to temporary ditches so as to contain runoff.		
	Wetlands	Construction Phase	Footprint area	▪ A Wetland Offset Strategy will need to be compiled for lost wetlands for the WBT and BWSF; ▪ Minimise footprint area disturbed by construction activities; and ▪ Rehabilitation Plan for disturbed wetland must be in place.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Prior to the commencement of the activity and for the duration of the project life.
	Visual	Construction Phase	Limited	▪ Vegetation must only be removed from the infrastructure footprints or areas necessary for construction; ▪ Establish vegetation on disturbed areas following construction; ▪ The WBT and BWSF complex must be painted natural hues to blend into the surrounding landscape; and ▪ Down lighting must be used should construction take place during night time.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During construction phase
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint area	▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must 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.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
	Heritage	Construction Phase	Site specific	▪ Apply for Section 34 destruction permits for structure older than 60 years.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).	▪ Prior to the site clearing activities associated with the construction phase.
Pipelines and Roads	Air quality	Construction Phase	Local	▪ Application of wetting agents or dust suppressant on exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to the commencement of the activity and for the duration of the project life.
	Soils	Construction Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Ensure storm water management designs are in place.		
	Surface water	Construction Phase	N/A	▪ Pipeline routes will be located above the 1:100 year modelled floodline elevation.	▪ GN R704 of the National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase
	Aquatic ecology	Construction Phase	Footprint area	▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive; slow deep/shallow habitats should be favoured; ▪ Pipelines that cross water courses should be incorporated into a bridge or culvert design if possible; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; and ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase
	Wetlands	Construction Phase	Footprint area	▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ Pipelines are to be supported on reclaimed railway sleepers placed at 9m intervals as it approaches the wetland; ▪ The pipeline will be unsupported across the 15 m wetland/ river span and this will also contain a continuous HDPE liner; ▪ The pipeline will not contain any flanges for the full length of the wetland crossing; ▪ 50 m before and after the wetland crossing, the pipeline will be supported on plinths (an in-situ cast concrete support) with foundations located at 9m intervals and also fitted with steel straps; ▪ The pipeline will be fitted with inspection points; ▪ All flanges within 100m of the wetland will be fitted with spray prevention plates; ▪ The spillage paddock will be located outside on the wetland; and ▪ Cleared areas must be minimised as far as possible.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Throughout the project life.
	Visual	Construction Phase	Immediate surrounds	▪ Vegetation must only be removed from the pipeline routes or areas necessary for the construction of the	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During construction phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				pipeline; ▪ Establish vegetation on disturbed areas following construction; and ▪ Down lighting must be used should construction take place during night time.		
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must 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.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the construction phase.
	Heritage resources	Construction Phase	Site specific	▪ Apply for Section 34 destruction permits for structure older than 60 years that may be impacted.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).	▪ Prior to the site clearing activities associated with the construction phase.
Employment and Procurement	Socio-economic	Construction Phase Operational Phase	Municipal	▪ 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; ▪ Where feasible, 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; ▪ Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.		
	Socio-economic	Construction Phase Operational Phase	Municipal	▪ Where feasible, utilise existing SLP, LED and related stakeholder engagement processes to determine the need and viability for infrastructure and service-related projects; ▪ Supporting housing development through promoting house ownership for employees; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Identify students from local schools to participate in company bursaries and internship programmes; ▪ 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; and ▪ Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.
	Socio-economic	Construction Phase Operational Phase	Municipal	▪ 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 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;	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ SPLUMA, 2013 (Act No. 16 of 2013).	▪ Prior to construction and through operation.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Construction and operational personnel must be dressed in uniform to clearly identify non-employed personnel from entering restricted areas; ▪ Liaison structures and forums that are already in place, such as the community police forum, must be strengthened 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.		
	Socio-economic	Construction Phase	Municipal	▪ The sales agreement must reflect the full value of the land and must consider the potential relocation cost of commercial farms and business operations; ▪ The responsibility for the resettlement of vulnerable households and compensation must be agreed upon prior to the finalisation of the sales agreement. Should SGL be responsible, a Resettlement Action Plan must be developed in consultation with the affected households; and ▪ An exclusion zone must be established from the RTSF where no households will be allowed.	▪ Constitution of South Africa; and ▪ King Report on Corporate Governance for South Africa, 2009.	▪ Prior to construction.
Operational Phase						
Reclamation of Driefontein 3 and 5 TSFs	Air quality	Operational Phase	Site specific	▪ Vehicle travel speeds and distances must be reduced when transporting personnel on site; and ▪ Dust suppressants must be used on gravel roads.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Throughout the project life.
	Soils	Operational Phase	Immediate surrounds	▪ Maintain wind breaks and vegetation surrounding the TSFs; ▪ Monitor the TSFs' side walls for erosion potential; and ▪ Ensure storm water management designs are in place.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout the project life.
	Groundwater	Operational Phase	Immediate surrounds	▪ Vegetation must only be cleared on faces that are being actively reclaimed; and ▪ Groundwater quality monitoring must be undertaken.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During the operational phase.
	Aquatic ecology	Operational Phase	Local	▪ Silt traps placed within clean water return channels; ▪ The planting of indigenous trees around the TSFs and temporary sumps.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During the operational phase.
	Noise	Construction Phase Operational Phase Decommissioning	Footprint Area	▪ 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	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
		Phase		slurry; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.		
WBT and BWSF Complex	Wetlands	Operational Phase	Immediate surrounds	▪ Alien Invasive Management Plan for disturbed areas and the project site; ▪ Dust suppressants must be used on gravel roads and exposed areas; and ▪ The WBT and BWSF footprints must be fully contained and a Storm Water Management Plan implemented.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Throughout project life.
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ 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; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
Pipelines and Roads	Soils	Operational Phase	Footprint Area	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; and ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ 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.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
Employment and Procurement	Socio-economic	Construction Phase Operational Phase	Municipal Area	▪ 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; ▪ Where feasible, reserve a percentage of, and	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				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 NQF accredited; ▪ Utilise existing SGL programmes and initiatives to 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.		
Decommissioning Phase						
Reclamation of Driefontein 3 and 5 TSFs	Air quality	Decommissioning Phase	Limited	▪ Application of wetting agents or dust suppressant on exposed surfaces; ▪ The area of disturbance must be kept to a minimum; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ During the decommissioning phase.
	Soil and land capability	Decommissioning Phase	Footprint area	▪ Soil handling, amelioration and rehabilitation must be undertaken as outlined in the Rehabilitation Plan.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ During the decommissioning phase.
	Fauna and Flora	Decommissioning Phase	Local	▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation Plan.	▪ South African National Biodiversity Index.	▪ During the decommissioning phase.
	Aquatic ecology	Decommissioning Phase	Local	▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of pipelines and road footprints as soon as possible; ▪ Soils that have been compacted must be ripped to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase
	Wetlands	Decommissioning Phase	Local	▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation Plan.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ During the decommissioning phase.
WBT and BWSF Complex	Air quality	Decommissioning Phase	Limited	▪ Application of wetting agents or dust suppressant on exposed surfaces and gravel roads; ▪ The area of disturbance must be kept to a minimum; and	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ During the decommissioning phase.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				▪ Reduce vehicle travel speed and distances.		
	Soils	Decommissioning Phase	Footprint area	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ The pipeline routes and roads must be rehabilitated and vegetation established.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Wetlands	Decommissioning Phase	Immediate surrounds	▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The WBT and BWSF footprints must be rehabilitated according to the Rehabilitation Plan; and ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Throughout the project life.
	Visual	Decommissioning Phase	Immediate surrounds	▪ The WBT and BWSF complex footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning phase
	Noise	Decommissioning Phase	Footprint area	▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ During decommissioning phase
Pipelines and Roads	Air quality	Decommissioning Phase	Local	▪ Application of wetting agents or dust suppressant on exposed surfaces and gravel roads; ▪ The area of disturbance must be kept to a minimum; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ During the decommissioning phase.
	Soils	Decommissioning Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ The pipeline routes and roads must be rehabilitated and vegetation established.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Aquatic	Decommissioning	Footprint area	▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of pipelines and road footprints as	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	ecology	Phase		soon as possible; ▪ Soils adjacent the river that has been compacted must be ripped to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.		
	Wetlands	Decommissioning Phase	Surrounding and downstream wetlands	▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The pipelines and roads footprints must be rehabilitated according to the Rehabilitation Plan; and ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Throughout the project life.
	Visual	Decommissioning Phase	Immediate surrounds	▪ The pipelines and roads footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning phase
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint area	▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ During decommissioning phase
Employment and Procurement	Socio-economic	Decommissioning Phase	Municipal area	▪ Develop a Closure Plan 15 years prior to planned closure and review the Closure Plan every 5 years; ▪ Establish a Future Forum, should it not already be established, 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.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002).	▪ 15 years prior to decommissioning.
Post Closure						
Reclamation of Driefontein 3 and 5 TSFs	Groundwater	Post Closure	Local	▪ Complete removal, remediation and rehabilitation of the TSF footprints according to the Rehabilitation Plan.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase
	Surface water	Post Closure	Local	▪ Complete removal, remediation and rehabilitation of the TSF footprints according to the Rehabilitation	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				Plan.		
	Visual Environment	Post Closure	Local	▪ Complete removal, remediation and rehabilitation of the TSF footprints according to the Rehabilitation Plan.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning phase
	Radiological	Post Closure	Local	▪ Remediation and rehabilitation of the TSF footprints according to the Rehabilitation and Closure Plan; and ▪ The TSFs must be managed and operated within the Radiation Management Programme for CoR-69.	▪ National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).	▪ During 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					
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource	Soils	Construction Phase	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Manage through: ▪ Storm Water Management Plan.	To maintain the PES of the aquatic ecosystems and habitats.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Manage through: ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	Manage through: ▪ Wetland offset strategy. Remedy through: ▪ Rehabilitation Plan.	To offset the loss of wetland and wetland functioning within the catchment.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To minimise the visual impact on the landscape.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
	Damage or alteration to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Manage through: ▪ Section 34 destruction permit	To ensure compliance with Section 34 of the NHRA.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource	Soils	Construction Phase	Manage through: ▪ Erosion control and storm water management. ▪ Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Manage through: ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.
	Siltation of wetlands impacting on ecosystem services	Wetlands	Construction Phase	Manage through: ▪ Erosion control and storm water management.	To maintain the PES and EIS of the surrounding wetlands.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To minimise the visual impact on the landscape.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Direct investment and multiplier effect.	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Population influx and associated impacts	Socio-economic	Construction Phase Operational Phase	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	To manage potential impacts associated with population influx.
	Physical and economic displacement	Socio-economic	Construction Phase	Manage and remedy through: ▪ Sales agreement. ▪ Exclusion zones.	To ensure that compensation is received for physical and economic displacement impacts.
Operational Phase					
Reclamation of Driefontein 3 and 5 TSFs	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Operational Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Contamination and deterioration of soils	Soils	Operational Phase	Monitor and manage through: ▪ Erosion control and storm water management.	To prevent the loss and contamination of topsoil resources.
	AMD generation and seepage into groundwater	Groundwater	Operational Phase	Monitor and manage through: ▪ Exposed tailings material minimisation. ▪ Groundwater quality monitoring.	To ensure no further deterioration of groundwater quality and prevent AMD formation.
	Modification of instream habitat	Aquatic ecology	Operational Phase	Manage through: ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
WBT and BWSF Complex	Contamination and sedimentation of wetlands	Wetlands	Operational Phase	Monitor and manage through: ▪ Alien Invasive Management Plan; ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme.	To maintain the PES and EIS of the surrounding wetlands.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Pipelines and Roads	Soil compaction and erosion	Soils	Operational Phase	Manage through: ▪ Erosion control. ▪ Site access restriction.	To prevent the loss of topsoil resources.
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Contribution to country's economy	Socio-economic	Operational Phase	N/A	To enhance the positive impacts associated with the project to benefit the local communities and economy.
Decommissioning Phase					
Reclamation of Driefontein 3 and 5 TSFs	Removal of a pollution source will improve the ambient air quality.	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Vegetation establishment.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Improvement of land capability due to the removal of the TSFs.	Soil and land capability	Decommissioning Phase	Enhance through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources and improve the land capability of the TSFs' footprints.
	Increased biodiversity of the area due to the removal of unfavourable habitats.	Fauna and Flora	Decommissioning Phase Post-Closure	Enhance through: ▪ Rehabilitation Plan.	To increase the biodiversity and available habitats in the project area.
	Increased aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	To improve the PES of the aquatic ecosystems and habitats.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Reduced impacts to surrounding wetlands	Wetlands	Decommissioning Phase	Enhance through: ▪ Rehabilitation Plan.	To improve the PES and EIS of the surrounding wetlands.
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Remedy through: ▪ Rehabilitation Plan.	To maintain the PES and EIS of the surrounding wetlands.
	Generation of noise	Noise	Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	To maintain the PES of the aquatic ecosystems and habitats.
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To maintain the PES and EIS of the surrounding wetlands.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Decommissioning Phase	Manage through: ▪ Closure Plan. ▪ Future Forum.	Ensure retrenchment is undertaken in accordance with the Social and Labour Plan and the requirements of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
Post-Closure					
Reclamation of Driefontein 3 and 5 TSFs	Improvement of groundwater quality	Groundwater	Post Closure	Enhance through: ▪ Rehabilitation Plan.	To improve groundwater quality in proximity to the TSF footprints.
	Increase in catchment yields and improved surface water runoff	Surface water	Post Closure	Enhance through: ▪ Rehabilitation Plan.	To improve catchment yields of the runoff water quality reporting to surface water resources.
	Improvement of visual landscape and change of land use from mining	Visual Environment	Post Closure	Enhance through: ▪ Rehabilitation Plan.	To alter the land use from mining to a suitable end land use, improving on the visual environment.
	Removal of radiation impacts to environment and public	Radiological	Post Closure	Manage through: ▪ Radiation Management Programme for CoR-69; and ▪ NNR approval.	To remove pollutions sources from the environment and reduce the potential for radiation exposure.

7 Item 1(f): Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes referenced in Sections 5 and 6 will be achieved, is provided in Table 7-1.

Table 7-1: Impact Management Actions

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
Construction Phase					
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ 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).
	Loss of topsoil as a resource	Soils	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ During the construction phase	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Sedimentation and deterioration of surface water quality	Surface water	Manage through: ▪ Storm Water Management Plan.	▪ During the construction phase	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Manage through: ▪ Erosion control and storm water management.	▪ During construction phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Destruction of habitats and loss of ecosystem services	Wetlands	Manage through: ▪ Wetland offset strategy. Remedy through: ▪ Rehabilitation Plan.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During construction phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Damage or alteration to structures older than 60 years of negligible cultural significance	Heritage resources	Manage through: ▪ Section 34 destruction permit	▪ Prior to the site clearing activities associated with the construction phase.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	▪ 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).
	Loss of topsoil as a resource	Soils	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Manage through: ▪ Erosion control and storm water management.	▪ During construction phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Siltation of wetlands impacting on ecosystem services	Wetlands	Manage through: ▪ Erosion control and storm water management.	▪ Throughout the project life.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During construction phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	▪ Throughout the construction phase.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Damage or alteration to structures older than 60 years of negligible cultural significance	Heritage resources	Manage through: ▪ Section 34 destruction permit	▪ Prior to the site clearing activities associated with the construction phase.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Direct investment and multiplier effect.	Socio-economic	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Population influx and associated impacts	Socio-economic	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ SPLUMA, 2013 (Act No. 16 of 2013).
	Physical and economic displacement	Socio-economic	Manage and remedy through: ▪ Sales agreement. ▪ Exclusion zones.	▪ Prior to construction.	▪ Constitution of South Africa; and ▪ King Report on Corporate Governance for South Africa, 2009.
Operational Phase					
Reclamation of Driefontein 3 and 5 TSFs	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Throughout the project life.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Contamination and deterioration of soils	Soils	Monitor and manage through: ▪ Erosion control and storm water management.	▪ Throughout the project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	AMD generation and seepage into groundwater	Groundwater	Monitor and manage through: ▪ Exposed tailings material minimisation. ▪ Groundwater quality monitoring.	▪ During the operational phase.	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Modification of instream habitat	Aquatic ecology	Manage through: ▪ Erosion control and storm water management.	▪ During the operational phase.	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
WBT and BWSF Complex	Contamination and sedimentation of wetlands	Wetlands	Monitor and manage through: ▪ Alien Invasive Management Plan; ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Throughout project life.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Pipelines and Roads	Soil compaction and erosion	Soils	Manage through: ▪ Erosion control. ▪ Site access restriction.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Contribution to country's economy	Socio-economic	N/A	▪ Throughout project life	▪ N/A
Decommissioning Phase					

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
Reclamation of Driefontein 3 and 5 TSFs	Removal of a pollution source will improve the ambient air quality.	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Vegetation establishment.	▪ During the decommissioning phase.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Improvement of land capability due to the removal of the TSFs.	Soil and land capability	Enhance through: ▪ Rehabilitation Plan.	▪ During the decommissioning phase.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Increased biodiversity of the area due to the removal of unfavourable habitats.	Fauna and Flora	Enhance through: ▪ Rehabilitation Plan.	▪ During the decommissioning phase.	▪ South African National Biodiversity Index.
	Increased aquatic biodiversity and habitat	Aquatic ecology	▪ Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Reduced impacts to surrounding wetlands	Wetlands	Enhance through: ▪ Rehabilitation Plan.	▪ During the decommissioning phase.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
WBT and BWSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ During the decommissioning phase.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Degradation of habitats and loss of ecosystem services	Wetlands	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout the project life.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	▪ During decommissioning phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ During decommissioning phase	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ During the decommissioning phase.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Loss of topsoil as a resource due to compaction and erosion	Soils	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Degradation of habitats and loss of ecosystem services	Wetlands	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout the project life.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	▪ During decommissioning phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ During decommissioning phase	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Manage through: ▪ Closure Plan. ▪ Future Forum.	▪ 15 years prior to decommissioning.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002).
Post Closure					
Reclamation of Driefontein 3 and 5 TSFs	Improvement of groundwater quality	Groundwater	Enhance through: ▪ Rehabilitation Plan.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Increase in catchment yields and improved surface water runoff	Surface water	Enhance through: ▪ Rehabilitation Plan.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Improvement of visual landscape and change of land use from mining	Visual Environment	Enhance through: ▪ Rehabilitation Plan.	▪ During decommissioning phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Removal of radiation impacts to environment and public	Radiological	Manage through: ▪ Radiation Management Programme for CoR-69; and ▪ NNR approval.	▪ During decommissioning phase	▪ National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).

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. In addition, consultation with landowners and I&APs was undertaken as part of the Social Impact Assessment and input was requested regarding the environmental objectives in relation to closure.

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 WRTRP, including the Driefontein Mining Right area, 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 are 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 financial provision for the Driefontein Mining Right area for planned closure is **R 23 423 521.70**, with the 1 year financial provision calculated as **R 9 686 963.27**, as summarised in Table 8-1.

Table 8-1: Summary of the Closure Cost Liability for the Driefontein Mining Right Area

Description	Closure Cost After 1 year of Mining	Planned Closure Cost	Closure Cost After 10 years of Mining
West block Thickener	R 2,186,501.57	R 2,186,501.57	All infrastructure and dump footprints would have been rehabilitated during year 10 of mining
Dams and pump stations	R 2,464,143.68	R 2,464,143.68	
Linear Infrastructure	R 1,210,027.93	R 1,210,027.93	
Driefontein TSFs	R 952,722.82	R 10,429,807.72	
Total	**R 6,813,396.00**	**R 16,290,480.90**	
Monitoring Costs (groundwater)	R 798,950.00	R 798,950.00	
Monitoring Costs (vegetation)	R 7,109.90	R 43,964.90	
Maintenance Costs (vegetation)	R 198,560.24	R 1,966,220.09	
Radiation Clearance	R 370,000.00	R 740,000.00	
Project Management (12%)	R 817,607.52	R 1,954,857.71	
Contingency (10%)	R 681,339.60	R 1,629,048.09	
GRAND TOTAL	**R 9,686,963.27**	**R 23,423,521.70**	

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 are 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. The current monitoring network for the Driefontein Mining Right area is considered to be adequate. In terms of the Ultimate 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

A PM_{10} monitoring network has been established as part of the Kloof Mine. It is recommended that the PM_{10} monitoring network is expanded, with a minimum of one PM_{10} monitoring site commissioned for each Mining Right area. The monitoring network should be established prior to the commencement of the project to establish ambient PM_{10} levels. The monitoring sites should be located downwind of the activities and at the closest receptors. The monitors must be calibrated on an annual basis to ensure the integrity of the measured data.

9.1.2 Fauna and Flora

The fauna and flora monitoring programme should be initiated prior to construction and continue throughout the construction phase and must be conducted annually during the growing season (December to March). Annual monitoring must be undertaken during the same months each year. 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 and birthing seasons 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 rehabilitation. 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 vegetation establishment. 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 has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces). In addition, monitoring must ensure 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). SGL is currently undertaking biodiversity assessments and has a Biodiversity Management Action Plan in place; these must be extended to include the WRTRP.

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):

- Presence or absence of plant species;
- Presence or absence of weed species in rehabilitated areas;
- 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 alien invasive vegetation 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 Invasive Vegetation monitoring

During vegetation monitoring, the presence of alien invasive vegetation species should also be detected. An active programme of weed management must be implemented to control the presence and spread of invasive weeds. 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 alien invasive vegetation species over time, to the point where no alien invasive vegetation species are present and no further population recruitment occurs. The WRTRP must aim to reduce the alien invasive vegetation infestation to 0 ha for all areas considered as part of the operations.

9.1.2.2 Fauna

The fauna monitoring will be closely linked to the flora monitoring to enable solid scientific conclusions and comparisons; in addition, 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 and line transects 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. 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. SGL has an existing biomonitoring programme in place and this will be expanded to take into account the WRTRP.

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. 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).

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 assessment.	Determine if water quality deterioration is occurring.	Monthly	Standard water quality monitoring, as per the surface water specialist report.

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in this study will suffice.	Determine if water/habitat quality deterioration is occurring.	Bi-annual	Monitor for presence of fish.

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 Groundwater

Groundwater monitoring must be undertaken at all phases of the mine operation to identify potential impacts on the groundwater and to ensure effective measures can be undertaken at an early stage before serious damage to the environment takes place.

An extensive monitoring programme has been developed as part of the Kloof Mining Right area with specific reference to the RTSF site; a total of 45 boreholes have been identified for monitoring. SGL is currently undertaking monitoring as part of the Driefontein Mining Right area. It is recommended that this monitoring programme continues in frequency and for constituents. The monitoring boreholes are provided in Plan 26.

Plan 26: Monitoring Boreholes for the Driefontein Mining Right Area

9.1.6 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 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.).

The framework for monitoring the implementation and performance of social management actions will need to be compiled and developed once all social programmes and structures are in place for the project. A detailed example is provided in Appendix O which will require updating once the project has been approved to commence.

9.2 Item 1(h): Monitoring and Reporting Frequency

The monitoring and reporting frequency for the monitoring programmes per environmental aspect are supplied in Table 9-2.

9.3 Item 1(i): Responsible Persons

The responsible persons for the respective monitoring programmes are detailed in Table 9-2. The environmental manager for SGL will be responsible for ensuring that all monitoring programmes are undertaken.

9.4 Item 1(j): Time Period for Implementing Impact Management Actions

The time period for implementing impact management actions has been provided for in Table 9-2.

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 Driefontein 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; and ▪ PM_{10}.	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. An independent or suitably qualified internal specialist is sufficient.	The dust buckets must be analysed 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 or internal 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.	A groundwater specialist, either independent or an internal specialist, must undertake the monthly water level monitoring and quarterly groundwater quality monitoring.	Bi-annual monitoring and reporting must be undertaken by the independent aquatic ecologist.
	Deterioration of groundwater quality and reduction in water levels.	Groundwater quality monitoring must be undertaken as per the current monitoring programme implemented for the Driefontein Mining Right area. The monitoring borehole locations are provided in Plan 26.	A groundwater specialist must undertake the monthly water level monitoring and quarterly groundwater quality monitoring.	Groundwater quality must be monitored as per the current Driefontein Mining Right area monitoring programme. A database must be managed and must keep records of all monitoring results. A report must be compiled on a quarterly basis detailing the results of the water levels and groundwater quality.

10 Item 1(l): Indicate the Frequency of the Submission of the Performance Assessment Report

A performance assessment will be undertaken every two years by a suitably qualified person. 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

Driefontein Gold Mine has a management procedure and internal communication strategy for identifying environmental training needs and providing awareness and competence training that was developed and successfully implemented as part of the Environmental Management System (EMS) of the mine. The EMS has been based on ISO 14001:2004 principles.

The communication strategy is reviewed on an annual basis and revised as necessarily. This strategy will be revised to include the internal and external stakeholders of the new mining development prior to the commencement of mining.

11.1.1 Internal Communication and Awareness Campaign

Internal communication is conducted every second month through the EMS committee. Applicable employees, which include the management team, have been identified by Driefontein Gold Mine to form the EMS and the committee discusses all relevant environmental issues on a quarterly basis at least. Action plans are drafted and followed up during meetings. Weekly Health, Safety, Environment and Community (HSEC) meetings are held on a weekly basis and will include the following:

- Mine specific HSEC management where all heads of departments discuss with the relevant operations' manager and HSEC issues;
- Review meetings to provide feedback to the Operations Director on a monthly basis and includes all HSEC issues; and
- Group Environmental Meeting Committee which includes the environmental coordinators attending a meeting where all relevant environmental issues are discussed. Monthly environmental reports are compiled which are distributed to management for discussion and review.

11.1.2 External Communication and Awareness Campaign

11.1.2.1 Stakeholder Register

A stakeholder register will be developed that will include any person or group of people who are interested and or affected by the HSEC or operational performances of the operations, excluding employees. The register contains a list of all stakeholders and includes the name of the stakeholder organisation, contact name, address, e-mail address and telephone numbers. The register is maintained by the environmental department and will be updated on a continual basis.

11.1.2.2 Stakeholder Reports

The environmental performance and issues report is compiled on a quarterly basis; the reports are collated at the end of each year and published in the stakeholders' website for all stakeholders to access.

11.1.2.3 Community Forums and Interested and Affected Parties Meeting

Driefontein Gold Mine is a member of the Westrand Mining Interest Group which deals with all environmental issues in the region and addresses them collectively. In addition, Driefontein Gold Mine is a member of the Wonderfontein Spruit Forum which includes environmental groups, communities and land owners. The forum offers a platform for raising environmental issues that need to be addressed.

11.1.2.4 External Complaints Register

An HSEC external complaints register is stationed at Driefontein Gold Mine. Should a complaint or concern be raised, a formal Incident Investigation is opened as part of the EMS and managed and investigated in accordance with a fixed operating procedures. Records are kept of the external complaints, as well as the follow-up investigations and actions undertaken. Regular contact is kept with the complainant until the complaint has been satisfactorily addressed.

11.2 Item 1(m)(2): Manner in which Risks will be dealt with to Avoid Pollution or the Degradation of the Environment

An environmental emergency and remediation plan has been developed for the Driefontein Mining Right area as part of Driefontein Gold Mine. Emergency response will be conducted in accordance with the Driefontein ISO 14001 EMS procedure. The procedure describes how emergencies and incidents will be dealt with and recorded. The objective is to ensure that all employees are trained and capable of reacting effectively to emergencies to mitigate the impacts on the environment.

The emergency preparedness and response procedure describes:

- The identification of incidents;
- Emergency responses to emergencies;
- Incident and emergency training; and
- Emergency drills.

In addition, the mitigation and management measures associated with environmental risks that may arise during the operation of the project are provided in Table 11-1.

Table 11-1: Mitigation Measures for Environmental Risks

Unplanned Event	Environmental Aspects	Potential Impact	Mitigation and Management Measures
Hydrocarbon spillages	Aquatics, surface water 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.
Pipeline leaks, spills, bursts and failure	Wetlands	Deterioration of surrounding wetlands' health and functioning.	▪ Pipelines are to be supported on reclaimed railway sleepers placed at 9m intervals as it approaches the wetland; ▪ The pipeline will be unsupported across the 15 m wetland/ river span and this will also contain a continuous HDPE liner; ▪ The pipeline will not contain any flanges for the full length of the wetland crossing; ▪ 50 m before and after the wetland crossing, the pipeline will be supported on plinths (an in-situ cast concrete support) with foundations located at 9m intervals and also fitted with steel straps; ▪ The pipeline will be fitted with inspection points; ▪ All flanges within 100m of the wetland will be fitted with spray prevention plates; ▪ The spillage paddock will be located outside on the

Unplanned Event	Environmental Aspects	Potential Impact	Mitigation and Management Measures
			wetland; ▪ 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; ▪ No flanges to be utilised in the floodline demarcated areas; ▪ Implement the Emergency Response Plan; ▪ Known heritage resources in proximity to burst pipelines must be assessed for potential damage. Any change to the status quo of the heritage resource must be reported to the responsible HRA immediately
Pump failure and sump overflow	Surface water	Degradation of surface water quality, impacting downstream users, wetlands functioning and aquatic habitats.	▪ Construct, monitor and maintain overflow compartments downstream of the sumps; ▪ Sumps to be constructed to handle a 1:50 year extreme rainfall event; and ▪ Ensure emergency procedures are compiled and implemented in the event of a power failure, such as the operational modifications and the use of stand-by generators to operate the pump station should the sumps begin reaching capacity.
Accidental exposure of unidentified heritage resources	Heritage	Damage or destruction to heritage resources generally protected under Section 35 and 36 of the NHRA.	▪ Chance Find Procedures must be developed prior to the construction 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 Qualification

Appendix C: Economic Impact Assessment

Appendix D: Public Participation Process

DIGBY WELLS ENVIRONMENTAL

Appendix E: Air Quality Impact Assessment

Appendix F: Groundwater Impact Assessment

Appendix G: Soil Impact Assessment

Appendix H: Surface Water Impact Assessment

Appendix I: Fauna and Flora Impact Assessment

Appendix J: Aquatic Impact Assessment

Appendix K: Wetland Impact Assessment

Appendix L: 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