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Two Rivers Platinum
Proposed New Tailing Storage Facility

Final Environmental Impact Assessment and Environmental Management Programme (EIA/EMP)

In terms of the

National Environmental Management Act (Act No. 107 of 1998)

Version – Final for Public Review
31 October 2013

Two Rivers Platinum

GCS Project Number: 11-536
LDEDET Reference Number: 12/1/9/2-GS22





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EXECUTIVE SUMMARY

Project Background

Two Rivers Platinum Mine (hereafter referred to as "TRP") is situated on the farm Dwarsrivier 372 KT, 60km north-east of Lydenburg within the Sekhukhune District Municipality of the Limpopo Province. TRP, which commenced operations in 2005, is a Joint Venture (JV) between African Rainbow Minerals (ARM) and Impala Platinum Holdings Limited (Implats).

TRP has an existing tailings storage facility (TSF) within the mining right area (MRA). TRP intends to expand their underground mining operations (this is addressed in a separate environmental authorisation process being undertaken parallel to this application) in order to sustain their production. The existing TSF will not be able to accommodate the tailings over the increased life of mine (LoM).

Project Description

The proposed new TSF will cover a footprint of 90ha on the farm De Grooteboom 373 KT. The TSF will be designed to accommodate 81 million ton of tailings, at a final height of 80m, and airspace of approximately 51 million m^3.

Merensky Reef tailings will be deposited at a rate of 200 000 tonne per month (tpm) for the first 13 years of the life of the proposed TSF, increasing to 500 000 tpm for the next 7 years.

The proposed TSF will include typical infrastructure such as toe paddocks, toe walls, toe drains, a pool wall, a penstock, a starter wall, seepage cut-off trenches, solution trenches, a return water dam (RWD) and a slurry delivery pipeline to be constructed between the concentrator plant and the TSF. The pipeline will cross over the Dwars River.

Site Selection

Of the four (4) potential sites assessed (Sites A to D); Site C (to the east of the TRP MRA) was the most suitable. Site A and D were fatally flawed due to undermining and Site B was located on in a previously mined and rehabilitated area overlapping the recently constructed Assmang Chrome Dwarsrivier mine TSF;

The original slurry delivery pipeline route posed a high risk to the Dwars River due to the length of the river along which the pipeline would run. Although the preferred pipeline route will be longer and will cost more to construct, it will reduce the environmental risks.

Environmental authorization applications

The applications of environmental authorisation for the proposed new TSF are being undertaken in four (4) parallel processes in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) (to obtain a Record of Decision/environmental authorisation), the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA) (to obtain an approved Environmental Management Programme (EMP)); and the National Water Act (Act No. 36 of 1998) (NWA) (to obtain a water use licence (WUL)).

The Limpopo Department of Economic Development, Environment and Tourism (LDEDET) submitted comments on the final Scoping Report in a letter dated 7 June 2013:

COMMENT FROM LDEDET	HOW COMMENT WAS ADDRESSED
A layout plan for the proposed development should be overlaid on the sensitivity map, and this must be included in the draft EIA Report. This is to ascertain that no development is proposed in highly sensitive areas	This map is included in this report.
The Department also requests the provision of the estimated project value for reporting purposes.	The estimated project value is R150 million (One hundred and fifty million Rand)
With regards to Activity 20 in GN R.545, the identification of Competent Authority's section in this said Regulations should be consulted to check if this activity is indeed triggered.	Activity 20 in GN R545 is not triggered; this activity has been removed from this draft EIA report.

Comments submitted by SAHRA (South African Heritage Resource Agency) have also been addressed as part of this report.

There are currently environmental processes being undertaken for the proposed underground mine expansion, the proposed sewage treatment plants and rectification application in terms of the NEMA for undertaking listed activities without environmental authorization (extension of the existing TSF). A summary of the parallel applications/processes currently being conducted by TRP is included in Table 1.1 below:

Table 0.1 Current Environmental Applications being undertaken by TRP

APPLICABLE LEGISLATION	APPLICATION TITLE	LEAD AUTHORITY	REF. NUMBER	DATE OF ACCEPTANCE OF APPLICATION	CURRENT PROGRESS
[1]NEMA	Proposed new TSF	[2]LDEDET	12/1/9/2-GC22	30 August 2012	Final Scoping Report accepted by LDEDET on 10 June 2013.

APPLICABLE LEGISLATION	APPLICATION TITLE	LEAD AUTHORITY	REF. NUMBER	DATE OF ACCEPTANCE OF APPLICATION	CURRENT PROGRESS
NEMA	Proposed UG2 and Merensky Mine	LDEDET	12/1/9/2-GS26	30 August 2012	Final Scoping Report accepted by LDEDET on 10 June 2013.
NEMA	Application to rectify unlawful commencement of listed activities.	LDEDET	12/1/9-S24G-GS2	28 November 2012	To be introduced at the EIA Phase authorities and public consultation.
[3]NEM:WA	Proposed Sewage Treatment Plants	[4]DEA, Pretoria	12/9/11/L946/5	18 June 2012	Final Scoping Report accepted by DEA on 17 May 2013.
[5]MPRDA	Two Rivers EMP Amendment in terms of Section 102 of the MPRDA to include all required infrastructure in one holistic application.	[6]DMR Polokwane	N/A	Meeting held on 30 July 2012 to discuss requirements	Authorities and public consultation. A consolidated EMP will be presented to the DMR at the end of the EIA phase.
[7]NWA	Two Rivers WUL amendments to include new proposed water uses.	[8]DWA, Nelspruit	N/A	Meeting held on 6 Feb 2013 to discuss requirements.	A Water Use Licence Amendment Application will be submitted after the EIA phase.

[1] National Environmental Management Act, 1998 (Act No. 107 of 1998).
[2] Limpopo Department of Economic Development, Environment and Tourism.
[3] National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
[4] Department of Environmental Affairs.
[5] Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
[6] Department of Mineral Resources.
[7] National Water Act, 1998 (Act No. 36 of 1998).
[8] Department of Water Affairs.

Public Participation

A comprehensive public participation process (PPP) was initiated during the Scoping Phase in and is an on-going process undertaken throughout the EIA/EMP. The process followed complies with the NEMA regulations and the NEMA PPP guideline:

- *Identification of Interested and Affected Parties (I&APs):* The existing TRP stakeholder database was updated with the latest contact details of the relevant local, regional and national authorities;
- *Notification of I&APs:* Background Information Documents (BIDs) were sent to I&APs listed on the TRP stakeholder database. Site notices were placed at six (6) locations at and around the proposed TSF and two newspaper advertisements was placed in the Steelburger newspaper on Friday, 11 January 2013. Further site notices were placed on 4 July as a reminder of the New TSF process (as part of the notification for other TRP environmental applications), as well as an additional newspaper advertisement placed in the Steelburger on Friday 5 July 2013 at the start of the EIA phase.

- *Public meetings:* Four public/stakeholder focus group meetings have been conducted. A Scoping phase meeting was held at the Kalkfontein Community Hall on 7 February 2013 in order to present the proposed applications and Scoping report. A second public open day was held on 21 August 2013, at the Malekane Community Hall. A focus group meeting was held at Didingwe lodge for surrounding landowners and mines on 22 August 2013. A final meeting with Bokomoso and Mr La Grange was held at the offices of GCS on 22 October 2013, in order to discuss and address objections raised to the proposed New TSF.
- *Authorities meetings*: The local, regional and national authorities identified were invited to attend an introductory authorities meeting held on 6 February 2013. The meeting was held at Two Rivers Platinum where the applications and Scoping Reports were presented. The meeting was followed by a site visit to familiarize the authorities with the proposed project sites. A second authorities meeting was scheduled on 21 August 2013, at Didingwe Lodge, in order to present the Draft EIA reports. The meeting was not attended by any authorities, as most were satisfied with the information presented and site visit conducted during the Scoping phase.

The issues raised by I&APs far are summarized in the following table:

ISSUE/CONCERN	RESPONSE BY GCS AND TRP
The public meeting was not planned well enough. The community was not notified properly and most of the information presented did not address the current issues at Kalkfontein.	GCS: GCS as the Environmental Assessment Practitioner (EAP) is required to advertise the public meeting two (2) weeks prior to the date of the public meeting. In this case, an advert was placed in the Steelburger newspaper on Friday, 11 January 2013; site notices were placed on site and at the entrance to the TRP mine, Background Information Documents (BIDs) and Scoping Reports, were placed at the Tribal Offices, including Kalkfontein. The last minute change of venue was not planned and GCS apologised in that regard. The topic of the public meeting was to specifically introduce TRP's current environmental authorisation applications. This is possibly not relevant to the current issues at Kalkfontein which should be addressed via a different forum.
Negative impact on living conditions and business also on possible sale to township developers.	The issue is addressed in section 8.2, 8.3 and 8.4 of this report as well as the SIA Report attached under Appendix B-8.
Holder of the prospecting rights on the targeted area. Requests the geological information with regards to the position of the dam.	The requested coordinates, date of issue and mineral prospected for was sent to the I&AP and he was referred directly to TRP for further discussions as his queries were of a legal nature.

ISSUE/CONCERN	RESPONSE BY GCS AND TRP
Team work, punctuality, safe work, care, respect, integrity, commitment. Would like more information on the mining sector.	The required worker behavior with regards to environmental best practice and emergency response is discussed in the Environmental Awareness and Emergency Response Plan attached under Appendix The information regarding the mining sector within the Limpopo Province is discussed briefly in section 5.14 of this document.
In favour of the proposed project. The project will assist employees in obtaining clarified water and it will also address the situation of un-purified water, as has been raised before.	This application relates to the proposed new TSF only and will not involve any water treatment.
Lebalelo Water User Association (LWUA) does not supply water to TRP. However, the Association has a pipeline crossing the farms Tweefontein 360 and Dwars Rivier 372 with a pump station and appurtenant works on the farm Dwars Rivier 372. The servitude is not registered yet but is in the process. From the map shown, it cannot be seen that the new mining activities would have any influence on the infrastructure mentioned. Keep I&AP informed and updated of the EIA progress.	Comment noted. This application does not address any mining activities. The issues related to mining will be addressed in the report for the UG2/Merensky expansion being undertaken parallel to this application process.
The objector raised the following issues • "fatally flawed" PPP; • More information regarding the NEMA section 24G application in respect of the existing TSF extension; • The extension of the existing TSF had not been considered as an alternative; • The EAP did not apply for all necessary listed activities in terms of the relevant acts; • The limited information provided in the Scoping Report is not sufficient to identify potential issues and impacts. • The objector raised the issue of the impact on the non-perennial drainage lines and requested a copy of the WUL. • The alternative TSF site should be considered in the EIA; • The social impacts (from an environmental, historical and health perspective), but this has been ignored by the EAP in the site selection process. • A noise impact assessment should be undertaken.	A response was sent to the LDEDET and Bokamoso by Mr. Le Grange, dated 15 May 2013. Not all the objector's issues are listed here, as they are too lengthly. Due to the length of GCS's response, this has not been discussed here, but is attached under Appendix C-8 as a stand-alone response report, specifically addressing all Mr La Grange and Bokomoso's concerns.

Baseline Environmental Description, Potential Impacts and Mitigation Measures

Climate

The project area is situated on the eastern escarpment on the border of the Highveld and Northern Transvaal climatic zones (Schulze, 1974). The climate can generally be defined as sub-humid, and can be locally described as normally hot and dry. The area falls within the summer rainfall zone and receives most of its annual rainfall during the period October to March. The prevailing wind direction is south-east. Refer to potential impacts in air quality below.

Geology

The project area is situated in the eastern limb of the Bushveld Igneous Complex, comprising the emplacement of at least 7 105km^3 of magma into the sediments of the Transvaal Supergroup.

The farm De Grooteboom 367 KT is underlain by rocks of the Winnaarshoek and Winterveld Norite-Anorthosite Formations of the Rustenburg layered suite. These formations comprise alternating layers of chromatite, pyroxenite, norite and anorthosite (SACS, 1980). The regional dip of the igneous layering is generally 10 - 15° to the west. The TSF pipeline route is underlain by norite and anthorisite, as pyroxenite and a portion of the Merensky Reef.

No faults or dykes were identified underlying, or in the immediate proximity of the new TSF site area.

No impacts on the geology are envisaged.

Topography

The TSF site is located between two ridges east of the Dwars River and Klein Dwars River confluence. The area is characterized by gentle slopes running in southerly direction towards the Springkaanspruit. The elevation ranges from 1068 mamsl (metres above mean sea level) in the northern extent of the TSF area to 991 mamsl in the southern extent of the TSF area with an average gradient of 1:22 sloping from a northerly to southerly direction.

The proposed tailings pipeline route is relatively flat from the starting point at the Merensky plant up to the proposed new TSF.

The tailings dam will have an impact on topography, and the associated visual impact. This is deemed to be moderate (medium) and mitigation measures include revegetation, dust suppression, and screening where possible.

Soils, Land Use and Land Capability

The three (3) major soil forms present within the proposed TSF footprint (Oudtshoorn, Rensburg and Mispah/Rock forms) and pipeline route are characterised by shallow soil depth and restrictive rock or duripan layers and are slightly acid to mildly alkaline, with high calcium and magnesium levels.

The proposed TSF area is currently in a good condition, comprising natural indigenous vegetation and disturbed areas where some construction activities such as trenching are taking place.

The agricultural potential is restricted due to the nature of the soils and the grazing capability of the proposed TSF footprint is limited five (5) head of cattle (not a viable agricultural unit).

Main impacts

- Dilution and/or loss of fertile topsoil component;
- Loss of topsoil stabilization;
- Loss of grazing land capability;
- Soil compaction;
- Erosion and siltation;
- Soil contamination/chemical soil pollution; and
- Change in natural landscape;

The impacts can be mitigated through appropriate use of machinery, construction during the dry season where possible, and suitable stockpiling of topsoil for rehabilitation.

Flora and fauna

According to the Biodiversity Geographical Information System (BGIS) (2007) 85.2% of the Greater Tubatse Local Municipality (GTLM), where the proposed TSF will be located, is currently considered untransformed. Furthermore the site forms part of the Sekhukhune land Centre of Endemism (SKCE).

Conservation important taxa were recorded within the proposed TSF footprint; which is considered a reflection of the pristine nature of most of the vegetation on a larger scale (Sekhukhune Mountain Bushveld).

The relatively low plant species diversity was recorded in the project area is attributed to the relatively brief survey period rather than poor species richness. The flora within the study area is regarded as sensitive owing to the presence and abundance of conservation important taxa. Furthermore, a high sensitivity is ascribed to the habitat types such as outcrops, sheetrock and drainage lines, which occur within the project area.

On a regional scale, the vegetation is classified as 'Least Threatened' implying that the recorded habitat types are likely well represented in the general region. However, recent increase in sustained mining and urban development were not necessarily take into consideration in the assessment and it is therefore important to establish a conservation principle before a significant portion of this habitat is being lost.

The proposed TSF footprint, and pipeline route, is regarded as possessing a medium-high or high faunal sensitivity.

The diversity of animals recorded in the study area during the survey attest to the untransformed nature and diversity of the habitats of the study area. The confirmed presence of two large Red Data carnivores, (Brown Hyena and Leopard), attests to the high ecological connectivity that exists between faunal habitats of the study area and surrounding areas, as well as the importance of the study area as a movement corridor and potential as sink and/or source habitats for many other species. Untransformed, natural habitat situated to the east, southeast and northeast of the study site are not yet severely affected by mining activities and therefore represent significant and sensitive areas in terms of faunal conservation efforts.

Main impacts

- Impacts on flora species of conservation importance (including habitat suitable for these species);
- Impacts on fauna species of conservation importance (including habitat suitable for these species);
- Impacts on sensitive or protected habitat types (including loss and degradation);
- Loss of sensitive/ natural habitat types (including plant diversity & abundance);
- Displacement of fauna species, human-animal conflicts & interactions (including diversity & abundance);

- Impacts on ecological connectivity and ecosystem functioning; and
- Indirect impacts on surrounding habitats.
- Cumulative impacts on conservation obligations and targets (including national and regional);
- Cumulative increase in local and regional fragmentation/ isolation of habitat; and
- Cumulative increase in environmental degradation, pollution.

Since the above impacts are difficult to mitigate, it has been recommended that a biodiversity offset area be implemented, should the New TSF be authorized. TRP has identified possible offset areas.

Surface Water

The project area is located within the B41G quaternary catchment of the Olifants Water Management Area (WMA). The proposed TSF area is traversed by non-perennial drainage channels which contribute to the Sprinkaanspruit, which is a non-perennial tributary of the Dwars River. The proposed tailings delivery pipeline will cross over the Dwars River as well as non-perennial tributaries of the Dwars River and the Springkaanspruit.

The calculated mean annual runoff for the TSF (93 046.154m^3/annum) is very low therefore the proposed TSF development will not have a significant impact on the runoff in the immediate or greater areas.

A surface water quality sample taken downstream of the proposed TSF site (TR SW1) indicated no impact from mining.

Surface water use in the B41G and B41H quaternary catchments is dominated by mining. Other water uses comprise agriculture, watering livestock, urban and non-urban industrial uses, as well as urban.

Main impacts

- Reduction of runoff to surface water resources;
- Increased sediment transport into downstream water resources;
- Obstruct natural drainage (vegetation and topsoil clearance);
- Diversion of clean water into dirty water areas (vegetation and topsoil clearance);
- Waterlogging of areas or pollution of water resources (vegetation and topsoil clearance);

- Risk of pollution of surface water resources; and
- Cumulative impacts on surface water quality due to TSF construction in the vicinity of existing mines.

Mitigation measures include implementing stormwater management infrastructure, and ensuring separation of clean and dirty water streams. Correct management of waste and hydrocarbons will mitigate potential surface water pollution.

Groundwater

The aquifers of the Bushveld Igneous Complex are characterised by a shallow weathered aquifer, and a low yielding fractured aquifer underlying it.

Some weathered zones can provide yields of between 2.0 - 5.0 l/s, which was confirmed by the drilling of boreholes near the proposed new TSF site.

Groundwater flows in a south westerly direction, towards the Groot Dwarsrivier and the Springkaanspruit. The Groot Dwarsrivier is the main receptor of groundwater flow within the area. The presence of water within the Springkaanspruit channel during the field investigation in the dry season (July 2012), suggested some groundwater baseflow contribution.

The groundwater usage identified during the hydrocensus included domestic use, stock watering and irrigation.

Groundwater sampling within the project area revealed high nitrates in two boreholes, which may be attributed to a nearby house septic tank system, livestock kraals and a chicken brooder. The high magnesium (Mg) and calcium (Ca) found in most of the borehole samples are often encountered in Bushveld Igneous Complex aquifers Bushveld Igneous Complex aquifers.

Without mitigation, the groundwater impacts are of medium significance and can be reduced to low with efficient implementation of the recommended mitigation measures:

- Infiltration of contaminated water into the groundwater system from the RWD if the liner gets damaged. The synthetic liner and would require regular surveys to detect possible damage. Clean water needs to be kept away from the RWD to minimise water volumes and risk of spilling from the site.

- Contaminated seepage from the TSF into groundwater system. Elevated concentrations SO_4, NO_3, Na, Cl are expected. Results from the groundwater model indicate local impact of these contaminant plumes, migrating about 800m from the site. The contaminant plume is expected to affect one user borehole and is not expected to reach the Springkaanspruit or the Groot Dwarsriver. Toe drains, under drains and cut of trenches should be installed to reduce the risk of vertical and horizontal contaminant seepage to the aquifer. The TSF should be operated with a minimum pool size to limit the infiltration volumes. This is especially important during the first two years where the footprint of the TSF is small and the tailings underlying the pool are not very thick yet. The infiltration rate of pool water is expected to reduce with time as the tailings thickness increases. The low risk of the contaminant migration after the above mitigation measures negates any requirement for a HDPE liner.

Air Quality

Local source contributors to ambient PM10 (airborne particulates) concentrations in the vicinity of the study site are domestic fuel burning and vehicle activity in residential areas/sensitive receptors close to the mine; the surrounding chrome and platinum mining activities; cattle ranching in the Steelpoort Valley; and agricultural activities and limited cultivation in fertile areas adjacent to the Steelpoort River.

Main impacts

- Creation of dust (due to vegetation clearing, construction activities, and potentially inefficient rehabilitation of TSF slopes).

Air quality monitoring and a dust suppression programme will be implemented to mitigate air quality impacts.

Noise

The existing noise levels in the vicinity of the TRP site include traffic on the R555 road and mining activities. Environments which are recognized as being noise sensitive include residential areas, offices, educational facilities and health and church buildings. None of these sensitive environments are in close proximity to the TRP mining area. The impact of noise is therefore deemed to be low. Mitigation measures will involve correct maintenance of machinery and vehicles to minimise noise on site.

Visual

The project area has a rural, bushveld atmosphere with mining activity forming a major part of the regional economy. The area presents a moderately disturbed sense of place primarily due to the existing mining activities. The pleasant scenery and rural atmosphere, however, adds attraction to the region.

The viewshed analysis indicates that the proposed TSF is visible for at least 2km in all directions, and partially visible in all directions for 10km. Areas with the most exposure include the eastern facing slopes of the Klein-Dwars River valley and the surrounding environment to the immediate south of the project area. Partial visibility occurs through large parts of the zone of influence.

Viewer groups identified around the study area include residents, tourists and motorist. The viewshed analysis indicates that there are sensitive receptors (residents and motorists) located within 0 – 2km, whilst residents and motorists also fall within 2 - 5km and 5 - 10km viewing distance of the proposed TSF.

Main impacts

- Change to/negative impact on aesthetics of the landscape;
- Poor visibility due to dust creation;
- Light pollution due to lighting of construction area;
- Visual Impact of extended TSF;
- Visual impact of Return Water Dam; and
- Cumulative impact on the visual character of the environment.

Mitigation measures will involve screening, concurrent re-vegetation and re-shaping at rehabilitation where possible.

Archaeology and Heritage

The proposed TSF area and pipeline route shows some signs of disturbance by past human interventions. Over-grazing also appears to have contributed to the disturbance of the area. A number of farm and other buildings are found along a road in the south-east, none of which have any heritage significance.

No sites of cultural heritage significance were located in the surveyed area (proposed TSF footprint and pipeline route). Three (3) Middle Stone Age tools and one (1) Iron Age potsherd were however found, in different locations in the erosion dongas.

No impacts on the heritage or archaeological environmental are envisaged.

Wetlands and Riparian zones

No wetlands were found to occur within the proposed TSF, or pipeline route, during the surveys undertaken in 2012 and 2013. The Sprinkaanspruit, with associated with a well-developed riparian zone, flows past to the south of the proposed TSF site, and two (2) small tributaries of the Sprinkaanspruit extend onto the TSF.

The tributaries are characterised by large eroded areas covering roughly 14.6 % of the TSF site. In places these eroded areas, are more than 5m below the surrounding landscape. The establishment of *Catha transvaalensis* trees through the eroded area indicates and the presence of the eroded areas on the 1:50 000 topographical maps dated from the mid-1980's show that this is not a recent occurrence. The exact cause of the erosion is not known, but is assumed to be due to bad/incorrect land management practices. The mountains of the area represent a naturally eroding landscape, and erosion scars are characteristic of the area. However, it is assumed that the erosion has been exacerbated and sped-up by bad land use management.

Main impacts

- Loss and disturbance of water resources and associated habitat;
- Increased sediment transport into downslope water resources;
- Altered runoff characteristics of the landscape;
- Increased sediment transport into downslope water resources;
- Altered runoff characteristics of the landscape;
- Erosion within watercourses;
- Water quality deterioration;
- Altered flow within watercourses; and
- Loss of wetlands and riparian habitat; and

Mitigation measures are largely the same as for surface water impacts. Most importance is the implementation and management of stormwater infrastructure and the separation of clean and dirty water on site.

Socio-economic environment

The GTLM is predominately rural in nature and, with the development of mines in the LM, the area has started to benefit economically in many ways (GTLM Integrated Development Plan (IDP) (2012/3)). The IDP highlights that although there are several mines in the area,

some existing resources remain unexploited. The LM views investment in this sector as very important as it brings with it investment in infrastructure, results in creation of job opportunities, etc.

The age dependency ratio for the Limpopo Province, Sekhukhune DM and GTLM has decreased from 1995 to 2010. During the same period, the unemployment rate of the GTLM increased by 31.17% from 1995 to 2010, which is much higher than the increase of 2.49% for Limpopo Province for the same period. The province has, however, seen a decrease of 21.41% in the number of employed persons, with this number increasing for both the Sekhukhune DM (15.86%) and GTLM (44.67%).

Main impacts

- Resettlement (the proposed TSF site is on privately owned land);
- Waged labour;
- Employment creation and decrease in unemployment;
- Conversion and diversification of land use;
- Impact equity (fairness of the distribution of impacts (positive and negative)) across the community;
- Feelings in relation to the project;
- Impact on aspirations for the future;
- Physical quality of the living environment (actual and perceived);
- Aesthetic quality of the living environment;
- Personal safety and hazard exposure;
- Cumulative impacts on surrounding landowners and residents due to the creation of noise, dust, potential surface water contamination, etc.; and
- Cumulative impact on employment due to the creation of jobs during the construction phase of the TSF and the UG2 and Merensky expansion.

The New TSF has an overall positive impact, since it will form part of an existing mining operation, and will extend the life of mine, thereby extending production and employment in the area. Short-term negative impacts will be managed through effective communication with landowners and communities in the area.

A neighboring landowner, has raised objections to the New TSF application, since his property will be in very close proximity to the New TSF and Pipeline, should it be authorized. Two Rivers has engaged with the landowner, and offered to purchase the property, but an agreement has not yet been reached. GCS has addressed all queries raised by the objector in an objection response report, contained in Appendix C-8 of this report.

Monitoring and management

A groundwater and surface water quality monitoring programme beginning before the TSF construction is proposed to monitor any changes to water quality by the proposed development. Bi-annual biomonitoring of the Springkaanspruit close to the TSF is proposed. Furthermore monitoring of the soils and vegetation within the vicinity of the TSF is proposed during and after construction as well as post decommissioning to determine if rehabilitation and/or remediation efforts have been effective.

EAP Recommendation

The proposed new TSF will allow for the expansion of the existing mining operation at TRP, thereby allowing the mine to sustain production and retain employment and economic benefit to the region.

The neighbouring landowner's objections and queries have been addressed in detail, refer to Appendix C-8. The proposed New TSF footprint and pipeline route fall within an established mining area where the topography is a major limiting factor when sourcing a site suitable for a platinum tailings storage facility.

Based on the site selection process, stakeholder consultation process, and the fact that no fatal flaws were identified during the various specialist environmental studies undertaken, it is recommended that the project is authorised in terms of the NEMA.

It is recommended that a biodiversity offset area be implemented to mitigate the unavoidable loss of biodiversity within, and immediately surrounding, the proposed TSF site and pipeline route.

CONTENTS PAGE

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

1.1 Background

Two Rivers Platinum (TRP) is situated on the farm Dwarsrivier 372 KT, located 60km north-east of Lydenburg in the Sekhukhune District Municipal area of the Limpopo Province. TRP is a Joint Venture (JV) between African Rainbow Minerals (ARM) and Impala Platinum Holdings Limited (Implats).

TRP has a New Order Mining Right (LP 178 MC), which allows for the exploration and mining of the Platinum Group Metals (PGM's), other precious metals (gold and silver), and associated base metals and ores thereof on portions of the farm Dwarsrivier 373 KT. The development of the Two Rivers Project commenced in 2005.

Currently, the Upper Group 2 (UG2) is being mined from the underground via two portals, namely the Main decline and the North decline. The processing plant on site produces PGM concentrate. The product from the process plant is transported by road to the Impala Rustenburg Smelter for toll treatment and is then refined at the town of Springs in the Mpumalanga Province.

Platinum tailings from TRP are currently disposed of on an approved Tailings Storage Facility (TSF) to the south of the existing plant. It is the intention of TRP to extend their mining operations in order to sustain their production, as such the existing TSF will not be able to accommodate the subsequent increase in tailings emanating from the processing plant. TRP is therefore applying for authorisation to develop a New TSF outside of the approved Mining Rights area.

1.2 Brief Project Description

Specialist studies conducted by the mine indicated the necessity to commission a new TSF to accommodate future tailings for the remaining Life of Mine (LoM) which is approximately 20 years. The existing TSF will not be able to accommodate the subsequent increase in tailings emanating from the processing plant. The specifications for the New TSF are as follows:

- It must be able to accommodate 81 million ton of tailings;
- It will require an airspace of approximately 51 million m^3;
- The footprint will be approximately 90ha;
- The final height will be approximately 80m.

During the first 13 years of the life of the new TSF, Merensky Reef tailings will be deposited at a rate of 200 000 tonne per month (tpm), and, for the next 7 years, Merensky and UG2 Reef tailings at a rate of 500 000 tpm.

1.3 Contact Details

Kindly refer to Table 1.2 for the contact information in respect of TRP (the applicant).

Table 1.1 Contact Details of Applicant

Mining Right Holder	Two Rivers Platinum (Pty) Ltd
Physical Address	Dwarsriver Farm KT372, Lydenburg, 1120
Telephone	013 230 2650
Facsimile	013 230 2660
Email	Johannes.senyane@trp.co.za
Contact Person	Johannes Senyane

1.4 Property Description

The new TSF is proposed to be constructed on Portion 1 of the farm De Grooteboom 373KT (this area is not located within the approved Mining Rights area). TRP has a three (3) year option to purchase the land from the owner, should the new TSF be authorised in terms of the relevant environmental legislation (refer to Chapter 2). The land is owned by the Steenkamp Trust. Kindly refer to Table 1.1 for the details pertaining to the land owner. Refer to Figure 1.1 indicating the current TRP mine location, and the location of the proposed New TSF site on De Grooteboom 373KT.

Table 1.2 Land Owner Details

Owner	The Steenkamp Trust
Portions	Portion 1 of the farm De Grooteboom, 373KT.
Contact Person (Trustees)	Mrs Annatjie Roodt/ Ms Elsa van den Heever
Postal Address	P O Box 206, Lydenburg, 1120
Telephone	079 292 0532/ 082 579 2975
Mining Right Holder	Unknown

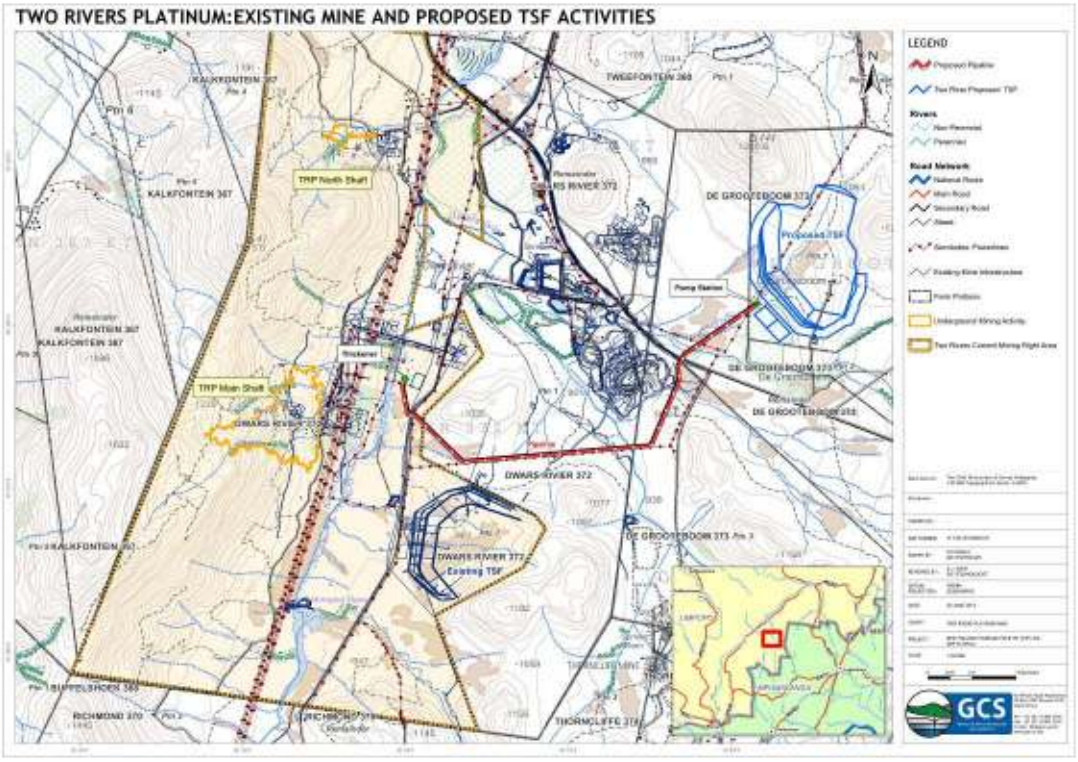


Figure not to scale, refer to the A3 Map over the page.

Figure 1.1 Location of the new TSF

1.5 Title Deed Description

Table 1.2 provides the title deed descriptions for the farm portions that will be affected by the proposed new TSF and slurry delivery pipeline.

Table 1.3 Title Deed of Farm Portions for the proposed TSF

FARM NAME & NUMBER	PORTION	REGISTRATION DIVISION	EXTENT (HA)	SURFACE OWNER AND TITLE DEED
De Grooteboom 373	1	KT	635.0187	Willem Johannes Steenkamp Testamentere Trust (T60820/2012)
De Grooteboom 373	3	KT	682.8195	Xstrata South Africa (Pty) Ltd (T152199/1999)
De Grooteboom 373	Remainder	KT	2979.7935	Jacob Ryno Le Grange (T146437/2002)
Dwars Rivier 372	1	KT	842.6880	ASSMANG Ltd (T129310/1998)
Dwars Rivier 372	7	KT	260.775	Two River Platinum (Pty) Ltd (T9520/2008)

Please note that the routing for the TSF pipeline was only confirmed in September 2013. Therefore certain farm portions affected by the pipeline were not included in the initial EIA Application Form. The Application form has been amended to include the correct farm portions and is included as Appendix F.

1.6 Document Layout

This EIA/EMP document is compiled in accordance to National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulation 543 of 2010, Section 31 and 32. For ease of reference the following table indicates where the subsections can be found in the report.

Table 1.4 Report content summary

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) ENVIRONMENTAL IMPACT ASSESSMENT REGULATION 543 OF 2010		SECTION IN EIA/EMP REPORT
SECTION	DESCRIPTION	
	Environmental Impact Assessment	
31	(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 35, and must include-	
	a) details of-	
	(i) the EAP who compiled the report; and	1
	(ii) the expertise of the EAP to carry out an environmental impact assessment;	1
	b) a detailed description of the proposed activity;	3
	c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is-	1
	(i) a linear activity, a description of the route of the activity; or	
	(ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	
	d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	5
	e) details of the public participation process conducted in terms of sub-regulation (1), including-	6
	(i) steps undertaken in accordance with the plan of study;	
	(ii) a list of persons, organisations and organs of state that were registered as interested and affected parties;	
	(iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and	
	(iv) copies of any representations and comments received from registered interested and affected parties;	
	f) a description of the need and desirability of the proposed activity;	4
	g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the	4

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) ENVIRONMENTAL IMPACT ASSESSMENT REGULATION 543 OF 2010		SECTION IN EIA/EMP REPORT
SECTION	DESCRIPTION	
	activity; h) an indication of the methodology used in determining the significance of potential environmental impacts; i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process; j) a summary of the findings and recommendations of any specialist report or report on a specialised process; k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures; l) an assessment of each identified potentially significant impact, including- (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated; m) a description of any assumptions, uncertainties and gaps in knowledge; n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation; o) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives; p) a draft environmental management programme containing the aspects contemplated in regulation 33; q) copies of any specialist reports and reports on specialized processes complying with regulation 32; r) any specific information that may be required by the competent authority; and s) any other matters required in terms of sections 24(4)(a) and (b) of the Act.	8 4 8 8 8 11 13 13 8 Appendix B
	Environmental Management Plan	
33	33. A draft environmental management programme must comply with section 24N of the Act and include - a) details of- i. the person who prepared the environmental management programme; and ii. the expertise of that person to prepare an	1

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) ENVIRONMENTAL IMPACT ASSESSMENT REGULATION 543 OF 2010		SECTION IN EIA/EMP REPORT
SECTION	DESCRIPTION	
	environmental management programme;	8
	b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of-	8
	i. planning and design;	
	ii. pre-construction and construction activities;	
	iii. operation or undertaking of the activity;	
	iv. rehabilitation of the environment; and	
	v. closure, where relevant.	
	c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;	3 & 8
	d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);	8
	e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;	9
	f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development, including, where appropriate, concurrent or progressive rehabilitation measures;	8
	g) a description of the manner in which it intends to-	8
	i. modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	
	ii. remedy the cause of pollution or degradation and migration of pollutants;	
	iii. comply with any prescribed environmental management standards or practices;	
	iv. comply with any applicable provisions of the Act regarding closure, where applicable;	
	v. comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	
	h) time periods within which the measures contemplated in the environmental management programme must be implemented;	8
	i) 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;	8
	j) an environmental awareness plan describing the manner in which-	10 & Appendix E
	i. the applicant intends to inform his or her employees of any environmental risk which may result from their work; and	
	ii. risks must be dealt with in order to avoid pollution or the degradation of the environment;	8
	k) where appropriate, closure plans, including closure objectives.	

2 LEGISLATIVE BACKGROUND

For most of its history, the mining industry in South Africa has not been subjected to comprehensive environmental regulation. However, in recent years, this has changed significantly and the industry is now required to comply with a multifaceted network of mining and environmental legislation.

There are no shortages of policy and legal frameworks to ensure "responsible" mining in South Africa. The *Minerals and Mining Policy for South Africa*, 1998 affirmed that the State, as custodian of the nation's natural resources will support mining development while maintaining and enhancing environmental awareness of the mining industry in accordance with national environmental policy, norms and standards. To this end, 10 principles on sustainable mining were adopted. These include the adoption of the precautionary approach, as well as the polluter pays principle; assertion that a consistent standard of environmental impact management would be adopted, irrespective of the scale of mining concerned; encouraging the mining industry to reduce problems of pollution by promoting a culture of waste minimisation through re-cycling, and re-use of waste products; and ensuring the effective implementation of environmental management measures and monitoring of occurrences of pollution, amongst others.

the purposes of this authorisation, application in terms of the *National Environmental Management Act*, 1998 (Act No. 107 of 1998) (hereinafter referred to as "*NEMA*"), the *Mineral and Petroleum Resources Development Act*, 2002 (Act No. 28 of 2002) (hereinafter referred to as the "*MPRDA*") and the *National Water Act*, 1998 (Act No. 36 of 1998) (hereinafter referred to as the "*NWA*") will be undertaken.

2.1 Environmental Legislation

2.1.1 The Constitution

The Constitution reigns supreme and the advancement of human rights is one of the foundations of South Africa's democracy. Furthermore, the Bill of Rights plays a central role in the democratic regime because it embodies a set of fundamental values which should be promoted at all times.

One of the fundamental values is contained in Section 24 and is, arguably, the cornerstone for environmental governance in South Africa which includes the mining industry. Section 24(a) proclaims the right of everyone ***"to an environment that is not harmful to their health or well-being"***. Mining companies are thus duty-bound to constitutional, legislative,

and other measures to prevent pollution and ecological degradation, promote conservation and to develop in a sustainable manner.

Two particular judgments deserve consideration in that they contain a comprehensive analysis of the nature and content of the environmental right within the sustainability context. Firstly, the court in *BP Southern Africa (Pty) Ltd v MEC for Agriculture, Conservation and Land Affairs* 2004 5 SA 124 (WLD) confirmed that environmental interests should be balanced with justifiable economic and social development well beyond the interests of the present living generation. The court justified the latter with Section 24(b), since this Section requires the environment to be protected for the benefit of present and future generations. The court confirmed the importance of sustainable development and predicted that it will ***"…play a major role in determining important environmental disputes in the future"***. Furthermore, the court emphasised the importance of progressively realising the protected environmental right by stating that:
"Pure economic principles will no longer determine, in an unbridled fashion, whether a development is acceptable. Development, which may be regarded as economically and financially sound, will, in future, be balanced by its environmental impact, taking coherent cognisance of the principle of intergenerational equity and sustainable use of resources in order to arrive at an integrated management of the environment, sustainable development and socio-economic concerns. By elevating the environment to a fundamental justiciable human right, South Africa has irreversibly embarked on a road, which will lead to the goal of attaining a protected environment by an integrated approach, which takes into consideration, inter alia, socio-economic concerns and principles."

Within this context, the mining industry (and the accompanied social and economic development it should bring with it) is constitutionally bound to uphold the environmental right. The court in *Fuel Retailers Association of Southern Africa v Director General: Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province* 2007 6 SA 4 (CC) attempted to balance these social, environmental and economic concerns by recognising the importance of economic and social development for the well-being of human beings. However, the court emphasised that development and the environment are inexorably linked and development cannot exist upon a weakening environmental base. Consequently, the promotion of development requires the protection of the environment.

The constitutional environmental right elevates the importance of environmental protection and conservation, and emphasises the significance that South Africans attach to a sound and healthy environment. In addition, the environmental right applies horizontally and this implies that the mining industry has to exercise a duty of care if liability, on the basis of the constitutional environmental right, is to be avoided. The constitutional environmental right is given effect to by means of detailed statutory provisions ranging from framework to sectoral legislation which relate to mining.

2.1.2 Environmental principles

Section 2(1) (c) of the NEMA provides that:
"***The principles set out in this section apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and… serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of this Act or any statutory provision concerning the protection of the environment…***"

Any decision taken in respect of the proposed application for environmental authorization should take into account the principles as set out in Section 2 of NEMA. GCS acknowledge that these principles serve as guiding principles because they are binding, enforceable and justiciable. By adhering to these principles, GCS promotes a cautious approach when advising on the activities, processes and daily operations of Two River's mining operation and advocates compliance with environmental regulatory measures.

The principles contained in Section 2 of NEMA are the corner stone of environmental governance and liability in South Africa and is based on the foundation of sustainable development. These principles all apply directly to mines by virtue of Section 37(1) of the *MPRDA* which provides that regard must be had to the NEMA principles by stipulating that the principles set out in Section 2 of NEMA:
"a) apply to all prospecting and mining operations, as the case may be, and any matter or activity relating to such operation; and
b) Serve as a guideline for the interpretation, administration and implementation of the environmental requirements of this Act."
Section 37(2) of the MPRDA further provides that:

"***Any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations.***"

(Own emphasis)

By virtue of Section 37(1) of the MPRDA, these principles apply to the mining sector and therefore the mining industry must adopt a risk-averse and cautious approach; prevent negative impacts or effects of their activities on the health and well-being of people and the environment; and pay for all their pollution since they remain liable for the effects of their policies, projects, programmes, products, processes, services or activities throughout their life cycles. When a competent authority takes a decision in terms of NEMA or any other law concerned with environmental protection, the principles must serve as guidelines. More specifically, the principles should guide the interpretation and implementation of the liability regime of NEMA and any other law concerned with environmental protection including mining related legislation. The following principles are particularly important and are discussed below.

2.1.2.1 Polluter pays principle

The polluter pays principle is reflected in the provision that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.

In essence, the polluter pays principle means that "***polluters and users of natural resources (should) bear the full environmental and social costs of their activities***". The PPP can also be described as an economic principle that requires the polluter (the mining industry in this instance) to be held liable to compensate or pay for pollution prevention, minimisation and remediation. Therefore, the crux of the principle is to impose economic obligations when environmental damage is caused by a polluter and this is achieved by setting minimum rules on liability for environmental damage.

2.1.2.2 Precautionary principle

The precautionary principle provides guidance during development or when anything occurs which might harm the environment and where there is scientific uncertainty. NEMA stipulates and requires "a risk averse and cautious approach" to be applied and that decision-makers should take "***into account the limits of current knowledge about the consequences of decisions and actions***".

This approach is also acknowledged in the *White Paper on a Minerals and Mining Policy for South Africa* in that:
"***…during decision-making a risk averse and cautious approach that recognises the limits of current environmental management expertise will be adopted and where there is uncertainty, action is required to limit the risk.***"

The precautionary principle requires the mining industry to take adequate precautionary measures to safeguard against contamination, pollution or degradation of the environment and where there is uncertainty, the action taken should be to limit the risk to the environment.

2.1.2.3 Preventive principle

The preventive principle is reflected in the concept that the disturbance of ecosystems and loss of biological diversity are to be "***…avoided, or…minimised and remedied***." Furthermore, the principle prescribes that the disturbance of the landscape and the nation's cultural heritage is to be avoided, and where it cannot be altogether avoided, must be minimised and remedied. Any negative impacts on the environment and on people's environmental rights should also be anticipated and prevented, and where they cannot be altogether prevented they should minimised and remedied.

The principle aims to minimise environmental damage by requiring that action be taken at an early stage of the process, and if possible, before such damage actually occurs. Broadly stated, it prohibits any activity which causes or may cause damage to the environment in violation of the duty of care established under environmental law. The preventive principle bestows on the mining industry an obligation to take steps to avoid causing certain types of damage to the environment, including the environment beyond their own territory or property.

2.1.2.4 Cradle-to-grave

A cradle-to-grave stewardship perspective indicates the adoption of a comprehensive ecological view of the impacts of a process on the environment, commencing with research, development and design through the extraction and use of raw materials, production and processing, storage, distribution and use, to the final disposal of the product and the waste generated as a by-product. The integrated consideration of all the environmental impacts forms part of this cycle. The "cradle-to-grave" principle advocates liability as a result of, or caused by, policies, programmes, projects, products, processes, services and activities.

Given the general purpose of NEMA, together with the other sustainability principles, this legal liability may include to rectify, remedy or compensate for environmental damage or degradation. The principle also recognises that environmental impacts, pollution or degradation may be associated with the entire life cycle of a mine, that is, from the identification, exploration phase through project planning, implementation, operations and post-operational closure, decommissioning and rehabilitation. Thus, the mining industry will remain liable for the damage or degradation caused by its activities throughout the life cycle of the mining operations until decommissioning and rehabilitation.

2.1.3 The National Environmental Management Act

As stated above, NEMA provides for a comprehensive array of principles which cumulatively aim to create among others, corporate socially responsible behaviour by establishing legal liability for environmental damage, as well as damage to human health and well-being. Apart from these principles, NEMA also contains mechanisms, procedures and structures to facilitate pollution prevention, minimisation and remediation.

Chapter 7 of NEMA contains essential provisions dealing with liability for environmental damage in South Africa and two key elements form part thereof; namely: pollution prevention and remediation. A duty of care is contained in Section 28, which encompasses the main liability provision which applies retrospectively and therefore also to historical pollution. Section 28(1) applies to all forms of pollution, including mining pollution, and is formulated generally by providing a duty of care to avoid, minimise and/or remedy pollution or environmental degradation. In terms of this subsection, the duty imposes liability on an almost non-exhaustive category of persons, because it refers to "every person". Section 28(2) goes even further and imposes the duty on a range of people including owners or people in control of land or premises and people who have the right to use the land or premises on which, or in which, an activity or process is, or was, performed or undertaken, or any other situation exists which causes, or is likely to cause, significant pollution or degradation to the environment.

The duty of care imposes strict liability since Section 28(1) requires reasonable persons to take reasonable measures. Subsection (3) provides an indicative range of measures that can be considered as “reasonable measures” and these may include measures to investigate, assess and evaluate the impact on the environment; inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation, contain or prevent the movement of pollutants or the causing of degradation, eliminate any source of the pollution or degradation and remedy the effects of the pollution or degradation. One can

identify from the wording an obligation to prevent and minimise pollution or degradation and the list indicates that remediation is clearly part of South African law. Where a mine fails to take reasonable measures to prevent or minimise pollution, it can be directed to do so by the relevant authority and if it does not comply with the directive, measures will be taken by government on its behalf, but at the mine's expense.

Under Section 34(7), liability is specifically extended to the director of the mining company concerned in his or her personal capacity, in other words, the director is personally liable. Furthermore, Section 43 provides that if directors failed to take all reasonable steps to prevent the offence being committed, and monetary advantage was gained, they may be personally liable for damages or compensation, have to pay a fine, or have to comply with remedial measures determined by the Court, and may even have to pay the State's investigative costs. The latter was confirmed in *Minister of Water Affairs and Forestry v Stilfontein Gold Mining Co Ltd and Others* 2006 5 SA 333 (W) where the court held, in a telling statement that:

"To permit mining companies and their directors to flout environmental obligations is contrary to the Constitution, the Mineral Petroleum Development Act and to the National Environmental Management Act. Unless courts are prepared to assist the State by providing suitable mechanisms for the enforcement of statutory obligations an impression will be created that mining companies [and their directors] are free to exploit the mineral resources of the country for profit over the lifetime of the mine, thereafter they may simply walk away from their environmental obligations. This simply cannot be permitted in a constitutional democracy which recognises the right of all of its citizens to be protected from the effects of pollution and degradation."

2.1.4 The Mineral and Petroleum Resources Development Act

Section 38 provides a key insight into the MPRDA's environmental liability approach. In terms of this Section, mining companies are required to familiarize themselves of potential environmental impacts; manage any environmental impacts; and rehabilitate the environment in so far as is reasonably possible. Furthermore, Section 38(1)(e) states that such holders, whose mining causes or results in ecological degradation, pollution, or environmental damage that may be harmful to the health or well-being of anyone:

"***…is responsible for any environmental damage, pollution or ecological degradation as a result of his or her operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates.***"

These holders will "*…remain responsible for any environmental liability, pollution or ecological degradation and the management thereof until a closure certificate has been issued*". Similar to NEMA, the MPRDA specifically extends the widely-framed liability of mines to the director of the mining company concerned in his or her personal capacity, by stating in Section 38(2) the following:

"*...the directors of a company or members of a close corporation are jointly and severally liable; for any unacceptable negative impact on the environment, including damage, degradation or pollution; advertently or inadvertently caused by the company or close corporation which they represent or represented*."

In general, this provides for a comprehensive liability net which must also be considered in light of NEMA's provisions. According to Section 39, a mine must indicate how it will contain or remedy the cause of pollution or degradation and migration of pollutants and comply with any prescribed waste standards or management practice. Granting of permission to mine or prospect, among others, is conditional on an environmental management programme and plan being submitted and accepted by the relevant government authority. Section 43 is one of the most important provisions as it deals with the responsibility for any environmental liability, pollution or ecological degradation until the issue of the closure certificate. It is important to note that environmental liability will not necessarily cease or fall away by the issuing of a closure certificate. In addition to the broader liability provisions above, Section 45 provides that the relevant authority may direct a mine to undertake remedial measures where:

"*...any prospecting, mining, reconnaissance or production operations cause or results in ecological degradation, pollution or environmental damage which may be harmful to the health or well-being of anyone and requires urgent remedial measures*."

Where the mine fails to take these measures, the relevant authority will act on its behalf and then recover costs incurred from the mine. If the mine fails to compensate the authority, the latter is empowered to seize and sell the mine's property to recover the costs. The mine will thus remain financially liable for the rehabilitation, even if it chooses to ignore the government directive.

NEMA is accompanied by the following regulations, published in terms of Section 24:

- The Environmental Impact Assessment Regulations published in GN R543 in GG 33306 of 18 June 2010 (hereinafter referred to as the ""NEMA Regulations);
- The Environmental Impact Assessment Regulations: Listing Notice 1 published in GN R544 in GG 33306 of 18 June 201;
- The Environmental Impact Assessment Regulations: Listing Notice 2 published in GN R545 in GG 33306 of 18 June 201; and

- The Environmental Impact Assessment Regulations: Listing Notice 3 published in GN R546 in GG 33306 of 18 June 201.

The purpose of the abovementioned regulations is to regulate the procedure and criteria as contemplated in Chapter 5 of NEMA, relating to the submission, processing and consideration of, and decision on applications for environmental authorisation.

2.1.5 The National Water Act

One of the main and ever-continuing concerns in South Africa is the sustainability of water management, and the costs associated with the prevention and remediation of pollution in a country with an average rainfall far below international standards. The NWA is one of the government's answers to some of these challenges and functions as sectoral legislation within the framework of NEMA.

Section 19 of the NWA mirrors the provision of Section 28 of NEMA and addresses the prevention and remediation of the effects of pollution. The NWA provides a wide duty of care in that:
"(1) an owner of land, a person in control of land or a person who occupies or uses the land on which-
(a) Any activity or process is or was performed or undertaken; or
(b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring."
The words "likely to cause pollution" broadens the scope of the duty, which enables an activity, or situation that is land-based, to trigger the application of the duty. The "reasonable measures" are not prescribed, but may include measures intended to:
"***cease, modify or control any act or process causing the pollution; comply with any prescribed waste standard or management practice; contain or prevent the movement of pollutants; eliminate any source of pollution; remedy the effects of pollution; and remedy the effects of any disturbance to the bed and banks of a watercourse."***

The NWA, furthermore, provides for water use authorisations which a mine will have to apply for, before commencing with its primary activity of mining. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use authorisations will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues.

The detrimental impact of mining on water resources is further regulated by the NWA in a comprehensive set of regulations titled: "Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources". In terms of these regulations:

"No person in control of a mine or [mining] activity may place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation."

Regulation 7 provides for a whole array of provisions which specifically aim to protect water resources from mining. These provisions state that every person in control of a mine or mining activity must take all reasonable measures to, inter alia: prevent water containing waste or any substance which causes or is likely to cause pollution from entering any water resource; design, modify, locate, construct and maintain all water systems including residue deposits, to prevent the pollution of any water resource through the operation or use thereof; cause effective measures to be taken to minimise the flow of any surface water or floodwater into mine workings, opencast workings, other workings or subterranean caverns; prevent the erosion or leaching of materials from any residue deposit or stockpile from any area; and ensure that water used in any process at a mine or activity is recycled as far as practicable. These provisions specifically relate to the protection of water resources and they clearly set out further additional liabilities for mines as far as their water resource protection activities are concerned.

2.2 Roles and responsibilities in terms of the *National Environmental Management Act*, 1998

This section sets out the roles and responsibilities of the Applicant, Environmental Assessment Practitioner (EAP) and affected parties.

2.2.1 The Applicant

An applicant is a person (including a juristic person) who has submitted an application for, inter alia, environmental authorisation. For the purpose of this application, Two Rivers Platinum (Pty) Ltd submitted an application for authorisation on 8 November 2012.

The NEMA Regulations require the applicant to appoint an EAP who will comply with the requisite statutory provisions and regulations on behalf of the Applicant (kindly refer to Section 2.2.2 1.8 below for a detailed discussion on GCS, the appointed environmental practitioners on the project). Further, the Applicant must:

- Provide the EAP with a detailed and precise statement of the purpose and need for the proposed activities;
- Take all necessary steps to verify whether the EAP complies with Sections 17(a) and (b) of NEMA; and
- Provide the EAP with access to all information regarding the application, whether or not such information is favourable to the Applicant.

2.2.2 The Environmental Assessment Practitioner

An EAP is responsible for the planning, management and coordination of environmental impact assessments (EIAs), strategic environmental assessments, environmental management programmes or any other appropriate environmental management instruments introduced through regulations. The EAP must be independent, objective and have expertise in conducting EIAs. Such expertise should include knowledge of all relevant legislation and of any guidelines that have relevance to the proposed activity.

An EAP must perform the work relating to the application in an objective manner, even if it results in views and findings that are not favourable to the Applicant, and disclose to the Applicant and competent authority all material information in the possession of the EAP.

2.2.3 Interested and affected parties

An interested and affected party (I&AP) is defined as any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

The NEMA Regulations distinguish between I&APs and registered I&APs. Registered I&APs refer to interested an I&AP whose name is recorded in the register opened for the environmental authorisation application.

Accordingly, only registered I&APs will be notified of:

- The availability of reports and other written submissions made (or to be made) to the competent authority (I&APs are entitled to comment on these reports and submissions); and
- The outcome of the application, the reasons for the decision and that an appeal may be lodged against a decision.

For the purpose of an application, the EAP must open and maintain a register which contains the names, contact details and addresses of:

- All persons who have submitted written comments or attended meetings with the Applicant or EAP;
- All persons who have requested the Applicant or EAP, in writing, to be entered on the register; and
- All organs of state which have jurisdiction in respect of the activity to which the application relates.

2.3 Environmental Process

2.3.1 Summary of all Environmental Authorisation Processes

TRP is in a process of expanding its mining operations. The expansion of the mining activities has resulted in the need for various environmental authorisations. The authorisation processes are being run in parallel as far as practically possible to streamline activities and reduce stakeholder fatigue in terms of the required consultation.

This report covers the subject of the proposed new TSF only.

2.3.2 Environmental Authorisation Required for the New TSF

The environmental process for the proposed new TSF will be undertaken in three (3) parallel processes namely the National Environmental Management Act (Act No. 107 of 1998) (NEMA) process for all the associated listed activities, the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) MPRDA process to develop an EIA/EMP for the Department of Mineral Resources (DMR); and the National Water Act (Act No. 36 of 1998) NWA process regarding the water uses that will be associated with the proposed development.

Two Rivers is not to undertake or commence with any activities on site prior to receiving the required Environmental Authorisations stated above. Should any activities commence on site without approval from relevant authorities. Should any activities commence on site without approval, Two Rivers will have to apply for rectification of such activities and will have to pay for penalties as set by the authorities. Table 2.1 summarises all the current applications.

Table 2.1 Current environmental authorisations being undertaken by TRP

APPLICABLE LEGISLATION	APPLICATION TITLE	LEAD AUTHORITY	REF. NUMBER	DATE OF ACCEPTANCE OF APPLICATION	CURRENT PROGRESS
[1]NEMA	Proposed new TSF	[2]LDEDET	12/1/9/2-GC22	30 August 2012	Final Scoping Report accepted by LDEDET on 10 June 2013.
NEMA	Proposed UG2 and Merensky Mine	LDEDET	12/1/9/2-GS26	30 August 2012	Final Scoping Report accepted by LDEDET on 10 June 2013.
NEMA	Application to rectify unlawful commencement of listed activities.	LDEDET	12/1/9-S24G-GS2	28 November 2012	To be introduced at the EIA Phase authorities and public consultation.
[3]NEM:WA	Proposed Sewage Treatment Plants	[4]DEA, Pretoria	12/9/11/L946/5	18 June 2012	Final Scoping Report accepted by DEA on 17 May 2013.
[5]MPRDA	Two Rivers EMP Amendment in terms of Section 102 of the MPRDA to include all required infrastructure in one holistic application.	[6]DMR Polokwane	N/A	Meeting held on 30 July 2012 to discuss requirements	Authorities and public consultation. A consolidated EMP will be presented to the DMR at the end of the EIA phase.
[7]NWA	Two Rivers WUL amendments to include new proposed water uses.	[8]DWA, Nelspruit	N/A	Meeting held on 6 Feb 2013 to discuss requirements.	A Water Use Licence Amendment Application will be submitted after the EIA phase.

[1] National Environmental Management Act, 1998 (Act No. 107 of 1998).
[2] Limpopo Department of Economic Development, Environment and Tourism.
[3] National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
[4] Department of Environmental Affairs.
[5] Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
[6] Department of Mineral Resources.
[7] National Water Act, 1998 (Act No. 36 of 1998).
[8] Department of Water Affairs.

2.3.3 The Process in terms of the National Environmental Management Act, Act 107 of 1998 (NEMA)

Table 1.3 provides a description of the S&EIR process followed in respect of the proposed New TSF and Table 1.4 indicates the identified listed activities applied for authorisation in terms of the NEMA Regulation 544 and 545.

Table 2.2 Description of the S&EIR process for the proposed New TSF in terms of GN R543 in GG 33306 of 18 June 2010

REGULATION	PROVISION	PROGRESS	DATE
Regulation 26	The Applicant or the EAP must complete the application form for environmental authorisation and submit to the competent authority.	The EIA application form was submitted to LDEDET.	8 November 2012
Regulation 13(2)	The competent authority must acknowledge receipt of the application within 14 days of receipt of the application.	LDEDET acknowledged receipt of the application and granted permission to proceed with the Scoping Phase.	28 November 2012
Regulation 27	After having submitted an application, the EAP managing the application must: • conduct a public participation process; • give notice of the proposed application to any organ of state which has jurisdiction in respect of any aspect of the activity; • open and maintain a register of all interested and affected parties; • consider all comments and representations received from interested and affected parties following the public participation process; • subject the application to scoping • prepare a scoping report; • give all registered interested and affected parties an opportunity to comment on the scoping report; and • Submit at least five copies of the scoping report to the competent authority.	<u>List of authorities consulted</u> The authorities as listed below have been invited to become involved in the process by written and telephonic invitation. • Department of Mineral Resources (DMR) - Regional Office-Polokwane; • Limpopo Department of Economic Development, Environment and Tourism (LDEDET); • Department of Water Affairs (DWA) - Regional Office Nelspruit; • South African Heritage Resources Agency (SAHRA); • Limpopo Department of Agriculture; • Greater Tubatse Local Municipality; and • Ward Councillor. All I&APs on the existing TRP database were contacted at the start of the project. During the consultation with I&APs, as well as with the mine, additional parties was identified and included within the existing database to provide an updated database. Numerous I&APs were notified by word of mouth. Parties who respond to the advertisements and notifications were also included in the database.	Written notification was submitted on 22 January 2013.
		A site notice was placed at the entrance to the mine, and at the	18 January 2013

REGULATION	PROVISION	PROGRESS	DATE
		proposed site of the New TSF.	
		One advertisement was placed as per the NEMA requirements. This n advertisement stipulated the project background, the process being followed, and the details and purpose of the PPP was placed in the Steelburger.	Published on Friday 11 January 2013
		Background Information Documents (BID) were sent to all I&APs/Stakeholders as per the existing database for TRP and all subsequent I&AP registering for the project. All I&APs were notified by way of fax, email or letter, depending on their preferred method of contact.	22 to 25 January 2013
		Public meeting	7 February 2013
		The Scoping Report was made available for review by I&APs for a minimum 30 day period and all registered I&APs were informed of the report's availability, CD's were provided to I&APs who required copies, the Scoping Report was also submitted to authorities for comment. A number of issues were received; please refer to Section 6 for a detailed list of these comments as presented in the issues trail. The comments and responses thereof were incorporated into the final Scoping Report.	21 January 2013 until 1 March 2013
Draft Scoping Report	The EAP managing an application must submit 5 copies of the Draft Scoping Report to the competent authority	LDEDET requested 3 hard copies of the draft Scoping Report, as well as 2 CDs of the said report.	Submitted – 18 January 2013 Acknowledgement of receipt – 11 February 2013
Regulation 29	The EAP managing an application must submit 5 copies of the Final Scoping Report to the competent authority.	LDEDET requested 4 hard copies of the draft Scoping Report as well as 1 CD of the said report.	18 April 2013
Regulation 30	The competent authority must, within 30 days of acknowledging	The Final ER was accepted by LDEDET, with comments for	10 June 2012

REGULATION	PROVISION	PROGRESS	DATE
	receipt of a Scoping Report, or receipt of the required information, reports, or comments or the amended scoping report, consider it, and in writing: • accept the report and advise the EAP to proceed with the tasks contemplated in the plan of study for EIA; • request the EAP to make such amendments to the report as the competent authority may require; or • Reject the scoping report.	amendment during the EIA phase. Please refer to Section 6 for a detailed list of these comments as presented in the issues trail as well as the relevant sections in which these queries, concerns, etc. are addressed within this report.	
Regulation 31	If a competent authority accepts a Scoping Report and advises the EAP to proceed with the tasks contemplated in the plan of study for environmental impact assessment, the EAP must proceed with those tasks, including the public participation process for EIA and prepare an EIA report in respect of the proposed activities.	EIA Reporting in progress.	July to September 2013
Regulation 34(1)	The EAP managing an application must submit the draft EIA report to the competent authority.	The Draft EIA Report was submitted to the LDEDET. The report was acknowledged, and comments were provided on 30 September 2013.	30 July 2013 – 30 September 2013
Regulation 34(2)	The competent authority must, within 60 days of receipt of a Final EIA report: • accept the report; or • Reject the report.	This will form part of the authority comment period.	The final EIA report will be submitted for public review and to LDEDET in November 2013.
Regulation 34(4)	An EIA report that is rejected in terms of Regulation 34(2) may be amended and resubmitted by the EAP.	This will be addressed if the EIA report is rejected by the LDEDET	N/A

Table 2.3 Listed Activities in terms of NEMA

NUMBER AND DATE OF THE RELEVANT NOTICE	ACTIVITY NUMBER	LISTED ACTIVITY	ACTIVITY DESCRIPTION
GN R 544 in GG 33306 of 18 June 2010	9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) With a peak throughput of 120 litres per second or more.	A pipeline is required to transport the slurry to the New TSF. There will be a running and a standby line for the slurry, as well as a return water pipeline. The pipeline length will be 6.8km. The slurry pipelines will be steel HDPE lined, internal diameter 0.24m, the peak throughput capacity will be 8 500 litres per second. The return water pipeline will be a steel gravity line, internal diameter 0.35m, the peak throughput capacity will also be 8 500 litres per second. This activity is triggered since the pipelines will exceed 1000m in length and the peak throughput will exceed 120 litres per second.
GN R 545 in GG 33306 of 18 June 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	Construction of the New TSF has the potential to detrimentally impact on a water resource. This is listed under Section 21(c),(g) & (i) of the *NWA*. TRP has an existing approved Water Use Licence which will require amendment to include construction of the New TSF. Since construction of a New TSF is not identified in terms of GN R544, or included in the list of waste management activities published in terms of section 19 of the *National Environmental Management: Waste Act*, 2009 (Act No. 59 of 2008) (NEM:WA) - Activity 5 is triggered.

NUMBER AND DATE OF THE RELEVANT NOTICE	ACTIVITY NUMBER	LISTED ACTIVITY	ACTIVITY DESCRIPTION
GN R 545 in GG 33306 of 18 June 2010	6(ii)	The construction of facilities or infrastructure for the bulk transportation of dangerous goods – (ii) In liquid form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity more than 50 cubic metres per day.	This activity is triggered since the tailings pipelines will exceed 1000m in length with a throughput capacity more than 50 cubic meters per day. Tailings slurry is a potentially dangerous substance, in liquid form.
GN R 545 in GG 33306 of 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	The total area to be transformed by the New TSF is 158.3Ha, which is larger than the listed maximum of 20Ha. The land is currently undeveloped and will be transformed for industrial use as part of the TRP mining operations.

2.3.4 LDEDET and SAHRA comments on the Final Scoping Report

The Limpopo Department of Economic Development, Environment and Tourism (LDEDET) submitted comments on the final Scoping Report in a letter dated 7 June 2013. The comments and manner in which theses were addressed in presented in Table 2.4. The letter from LDEDET is included in Appendix C-6.

Table 2.4: Comments from LDEDET

COMMENT FROM LDEDET	HOW COMMENT WAS ADDRESSED
A layout plan for the proposed development should be overlaid on the sensitivity map, and this must be included in the draft EIA Report. This is to ascertain that no development is proposed in highly sensitive areas	This map is included in this report as Figure 8.1, under Section 8.2.
The Department also requests the provision of the estimated project value for reporting purposes.	The estimated project value is R150 million (One hundred and fifty million Rand)
With regards to activity 20 in GN R.545, the identification of Competent Authority's section in this said Regulations should be consulted to check if this activity is indeed triggered.	Activity 20 in GN R545 is not triggered; this activity has been removed from this draft EIA report.

The South African Heritage Resources Agency (SAHRA) submitted comments on the Final Scoping Report in a letter dated May 13, 2013. The letter can be viewed in Appendix C-7. The comments and manner in which theses were addressed in presented in Table 2.5.

Table 2.5: Comments from SAHRA

COMMENT FROM SAHRA	HOW COMMENT WAS ADDRESSED
Clarity is required on the presence or absence of graves on the New TSF site.	The site selection report was based on desktop information and was not verified. During the Heritage Impact Assessment of the New TSF site, it was determined that no graves exist in this area.
Further information is required regarding the farm house and buildings on the property.	Refer to Section 2.3.4.1 of this report
It is recommended that a desktop paleontological assessment be undertaken for the site.	The desktop assessment was undertaken by Bruce Rubidge of Wits University. No artifacts of paleontological importance are likely. Refer to the assessment report in Appendix B-9
The New TSF pipeline route will need to be assessed	Relevant specialist studies undertaken by Dwarsrivier mine will be requested prior to the Final EIA report being completed. Should these studies not be relevant, a specialist HIA will be undertaken on the pipeline route.

2.3.4.1 Details regarding buildings on the New TSF site

Refer to photographs 2.1 to 2.5 below, providing more detail on the buildings currently present on the New TSF site.

Photo 2.1 Buildings present on the New TSF site

Photo 2.2 Buildings present on the New TSF site

Photo 2.3 Buildings present on the New TSF site

Photo 2.4 Buildings present on the New TSF site

Photo 2.5 Buildings present on the New TSF site

2.3.5 The Process in terms of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA)

Mines and mining related activities are regulated by the MPRDA, therefore in terms of Section 102 of the MPRDA, TRP requires authorisation for the proposed activities in the form of an amendment to the existing Environmental Management Programme (EMP), which must be approved by the DMR in Polokwane, before construction may begin.

The EMP to be submitted to DMR will comply with the requirements stipulated in Section 51 of GN R527, dated 23 April 2004, in terms of Section 107(1) of the MPRDA. As such, the EMP will contain the following:

- An assessment of the environment likely to be affected by the proposed operations;
- An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed operation, including cumulative impacts;
- A comparative assessment of the potential operation, as well as a comparison of other potential land uses for those sites;
- Identification of appropriate mitigatory measures for each significant potential impact of the proposed operation;
- Description of the stakeholder engagement process undertaken during the course of the assessment, issues that were raised and questions asked by I&APs and authorities, and how these issues and questions were addressed;

- Identification of gaps in knowledge, report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;
- Description of the arrangements for monitoring and management of environmental impacts;
- A description of the environmental objectives and specific goals for the management of the identified environmental and socio-economic impacts during all phases of the development (construction, operation, decommissioning and post-closure);
- A description of the appropriate technical and management options chosen for each environmental, socio-economic, cultural and historical impact for all project phases;
- Action plans to achieve the specific goals set out, as well as timeframes for the implementation of mitigatory measures;
- Procedures for environmental related emergencies and remediation;
- Planned monitoring and environmental management programme performance assessment;
- An environmental awareness plan; and
- An undertaking by the applicant to comply with the provisions of the MPRDA and regulations thereto.

2.3.6 The Process in terms of the National Water Act, Act 36 1998 (NWA)

In addition to the NEMA and MPRDA authorisations, activities which have the potential to impact on a water resource require that a water use licence (WUL) issued by the DWA, under the NWA. Section 21 of the NWA identifies certain water uses which have to be authorised. The existing WUL will be amended to include the New TSF and submitted to the DWA in Nelspruit for the following Section 21 water uses:

- 21 (c): Impeding or diverting the flow of water in a water course.
- 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource.
- 21 (i): Altering the bed, banks, course or characteristics of a water course.

In addition, an Integrated Waste and Water Management Plan (IWWMP) will also be amended and submitted as a supporting technical document to the WULA. The IWWMP will be used as a management tool by TRP to manage water emanating from the New TSF as a result of runoff or seepage, using best practices in the interest of protecting the water resources which may be affected.

A WUL may be issued for a maximum period of 40 years with a specified review period. The WUL also prescribes a set of conditions to protect water resources, and gauge the impact of the water use. These have to be strictly adhered to for as long as the water use continues. This may extend beyond the life of the New TSF and other uses, as TRP will be responsible for impacts caused by the TSF after decommissioning and closure.
Furthermore, Section 27 of the NWA specifies that the following factors, regarding water use authorization, must be taken into consideration:

- The efficient and beneficial use of water in the public interest;
- The socio-economic impact of the decision whether or not to issue a license;
- Alignment with the catchment management strategy;
- The impact of the water use and possible resource directed measures; and
- Investments made by the applicant in respect of the water use in question.

Section 27 considerations will be included in the WULA and IWWMP. This will assist TRP in ensuring that the water uses applied for, are undertaken in a manner that does not negatively impact on the public, water resources, or downstream water users or compromise any of the country's international obligations with regards to shared water resources.

2.4 Environmental Process Objectives

In order to mitigate potentially negative impacts and to identify any potential fatal flaws which may render the project environmentally unacceptable, GCS has adopted an integrated, step-by-step process to identify issues of concern and to thoroughly investigate these issues.

To ensure that the negative impacts are identified and mitigated in the early stages of the project, and that the positive impacts are maximised, it will be necessary for the environmental study to meet the following aims:

- Follow the guideline process as outlined by the NEMA and the MPRDA;
- Provide input in the feasibility phases to ensure that the most technically feasible, and environmentally sound options are selected;
- Ensure that impacts are identified early through investigations to minimize environmental damage and maximise benefits;
- Conduct thorough special investigations that will allow the project team to develop an adequate understanding of the issues to be dealt with;
- Compile an EIA that will identify, evaluate and address the potential impacts;
- Provide ongoing environmental input into the project planning and development;

- Compile an EMP that will limit the significance of the negative impacts and maximise the positive aspects;
- Ensure that all relevant I&APs / Stakeholders are consulted and involved throughout the project;
- Ensure that an open and transparent communication structure is in place during the life of the mine.
- Strong emphasis will be placed on the NEMA, MPRDA, NWA and NEMWA process to ensure that the three (4) processes will be able to run concurrently, and will easily be comparable with no confusion between the different processes.

2.5 Environmental Assessment Practitioner

This section of the Report relates to the content of an EIA Report as regulated by Regulation 31 of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*
	(a) details of - *(i) the EAP who compiled the report; and* *(ii) The expertise of the EAP to carry out an environmental impact assessment;…*

In terms of Section 17 of NEMA, TRP must appoint environmental assessment practitioners (EAPs) before applying for an environmental authorisation of any activity listed in terms of GN R544; R545 and R546. For this purpose TRP has appointed GCS (Pty) Ltd (GCS) to undertake the necessary environmental assessments and to ensure that all legislative requirements are adhered to as part of the environmental authorisation process.

GCS provides a professional, independent consulting service in the fields of water, environmental, engineering and earth sciences. The GCS team consists of highly trained staff that has extensive experience in the fields of hydrogeology, hydrology, pedology, engineering geology, engineering and environmental science. GCS undertakes hydrogeological investigations for water supply projects, groundwater pollution studies, mining hydrogeology, mathematical modelling and hydrogeological aspects of waste disposal throughout sub-Saharan Africa. GCS also provides expertise in environmental management services.

GCS was founded in 1987 and the broad GCS client base ranges from individuals, engineers, municipalities and mines, to Independent States and Governments. GCS is an independent practice, which is wholly owned by the partners of the company. GCS is an independent environmental consulting firm and will undertake the EIA and co-ordinate the specialist investigations which form part of the EIA. GCS will also be responsible for the relevant public participation process related to the proposed project. Table 2.6 lists the GCS project team.

Table 2.6 EAPs from GCS (Pty) Ltd

NAME	POSITION	GENERAL QUALIFICATIONS	YEARS OF EXPERIENCE IN EIAS AND EMPS
Tanja Bekker	Environmental Unit Manager	• MSc. Environmental Management • Pr.Sci.Nat (Reg No: 400198/09) • Member of the Environmental Law Association • Member of the International Association for Impact Assessment • Technical and Quality Control	10
Megan Wuite	Senior Environmental Consultant	• BSc Agriculture (Soil Science) • M Environment and Development • Pr.Sci.Nat (Reg No: 400400/13) • Member of the International Association for Impact Assessment	5

2.6 Reporting

Based on the outcome of the Environmental Scoping Phase, an EIA and an EMP Report must be submitted to the Ministers of LDEDET and the DMR for consideration and approval.

2.6.1 Environmental Impact Assessment

The EIA Report must determine the nature, extent, duration, probability and significance of the environmental, social and cultural impacts of the project, the reasonable alternatives and the required mitigation measures for each impact during the life of the mine. It is the

role of the relevant environmental authorities to make a decision on whether the project should proceed or not, based on the information provided in the EIA and this report therefore does not make a recommendation on whether the project should proceed or not.
Regulation 31(2) of the NEMA Regulations (GN R543) stipulates that an EIA Report must contain all necessary information to enable the competent authority to consider the application and to reach a decision. The EIA Report must contain, inter alia, the following:

- A description and comparative assessment of all alternatives identified;
- A description of all environmental issues identified as well as the significance of each issue and an indication if the extent to which the issue could be addressed by the adoption of mitigating measures;
- An Environmental Impact Statement; and
- An Environmental Management Programme.

Furthermore, the criteria which the competent authority will apply, when considering applications in terms of the provisions of NEMA, is enunciated in Regulation 8 of the NEMA Regulations (GN R543). The latter regulation states that consideration must be had for Section 24O, Section 24(4) as well as the need and desirability of the activity. The activities identified in the provisions of NEMA and the Regulations thereto pertain to activities which may have a detrimental impact on the environment.

The criteria to be taken into account by the competent authority when considering applications as set out in Section 24O and 24(4) of NEMA includes, inter alia, the following relevant factors:

- Any pollution, environmental impacts or environmental degradation likely to be caused if the application is approved or refused;
- Measures taken to protect the environment from harm as a result of the activity which is the subject of the application;
- Measures taken to prevent, control, abate or mitigate any pollution, substantially detrimental environmental impacts or environmental degradation;
- The ability of the applicant to implement mitigation measures and to comply with any conditions subject to which the application may be granted;
- Where appropriate, any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment; and
- Any comments received from organs of state that have jurisdiction over any aspect of the activity which is the subject of the application.

2.6.2 Environmental Management Programme (EMP)

Each specialist was required to identify means of avoiding, mitigating and/or managing the negative impacts in his/her particular aspect of the investigation. The recommended management strategies are synthesised in this report by GCS to formulate the EMP for the proposed listed activities and the operation as a whole. Management strategies are based on the recommendations by specialists in their specific field of study. The management measures will be incorporated into the mine systems to avoid, or appropriately manage impacts from the outset.

A draft EMP must include details of the person who prepared the EMP and the expertise of that person to prepare an EMP. The draft EMP must, furthermore, include:

- Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified, including environmental impacts or objectives in respect of –
- Planning and design;
- Pre-construction and construction activities;
- Operation or undertaking of the activity;
- Rehabilitation of the environment; and
- Closure, where relevant.
- A detailed description of the aspects of the activity that are covered by the draft EMP;
- An identification of the persons who will be responsible for the implementation of the mitigating measures;
- Where appropriate, time periods within which the measures contemplated in the draft EMP must be implemented; and
- Proposed mechanisms for monitoring compliance with the environmental management plan and reporting thereon.

The EIA ensures that the needs of the environment (biophysical and socio-economic) are identified. The EMP in turn provides a tool for meeting the objective to reduce or avoid negative environmental impacts associated with a project within a certain environment by providing detailed mitigation measures and management commitments. All of these sections will become legally binding on the approval of this report.

3 DETAILED PROJECT DESCRIPTION

This section of the report relates to the content of an EIA Report as regulated by Regulation 31 of the NEMA Regulations:

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*
	(b) a detailed description of the proposed activity.

Refer to Appendix G which contains the full design report for the proposed new TSF. Information regarding the pipeline was extracted from the feasibility study conducted for the associated Merensky Concentrator Plant, which is being applied for as part of the EIA Application for the UG2 and Merensky Expansion.

Refer to Appendix H which contains the geotechnical study conducted on the proposed New TSF site.

3.1 Need for the New TSF

Platinum tailings from TRP are currently disposed of on an approved TSF to the south of the existing plant. Further studies by the mine indicated the need to commission a new TSF to accommodate future tailings for the remaining Life of mine (LoM) which is approximately 20 years. The need for the New TSF arose as a result of the expansion and increase production in the underground mining operations. The original TSF was not constructed to provide for the entire LoM and with the increased production the life of the TSF was further reduced.

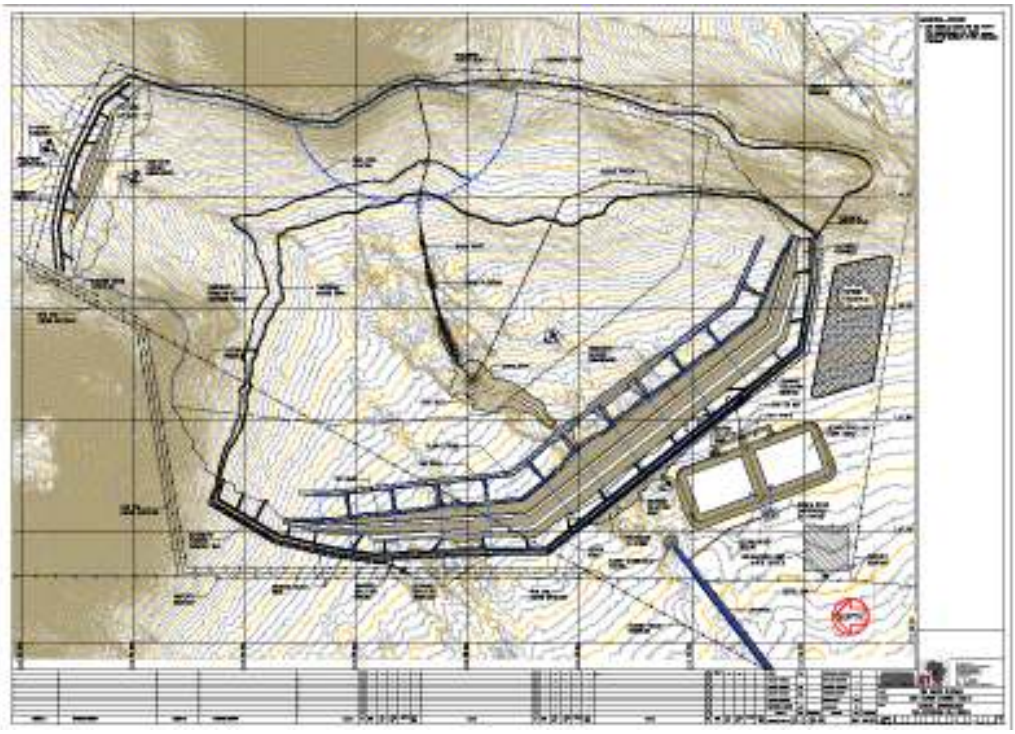
Due to the increase in production, the existing TSF will not be able to accommodate the subsequent increase in tailings emanating from the processing plant. The specifications for the New TSF are as follows:

- It must be able to accommodate 81 million ton of tailings;
- It will require an airspace of approximately 51 million m^3;
- The footprint will be approximately 90ha; and
- The final height will be approximately 80m.

During the first 13 years of the life of the New TSF, Merensky Reef tailings will be deposited at a rate of 200 000 tonne per month (tpm) and thereafter, for the next 7 years, Merensky and UG2 Reef tailings at a rate of 500 000 tpm. The New TSF will be located on Portion 1 of the farm De Grooteboom 372 KT.

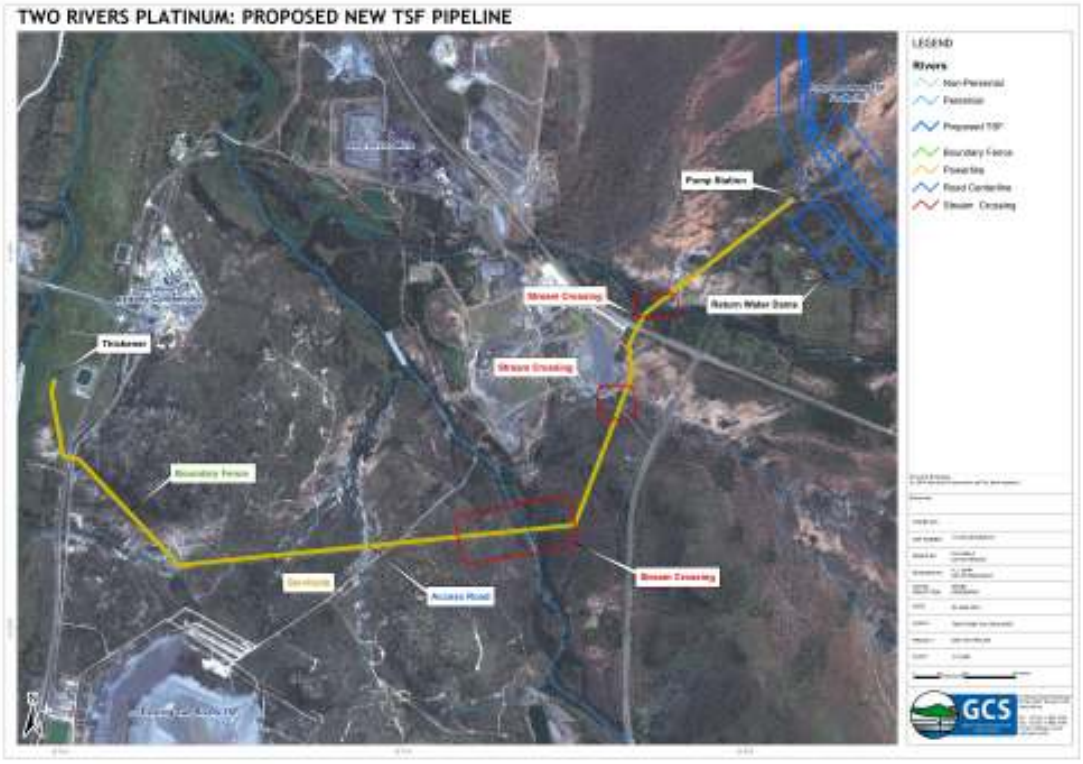
3.2 Location of the New TSF

The proposed TSF will be located on Portion 1 of the farm De Grooteboom 372KT. The pipeline will traverse Portions 1, 3 and the remainder of De Grooteboom 373KT, as well as Dwarsrivier Portions 1 and 7. A number of sites were investigated during the site selection process and site C was chosen as the most feasible.
Kindly refer to Appendix A for the Site Selection Report. Further, refer to Figure 3.1 and Figure 3.2 for the detailed layout of the proposed TSF and Pipeline.



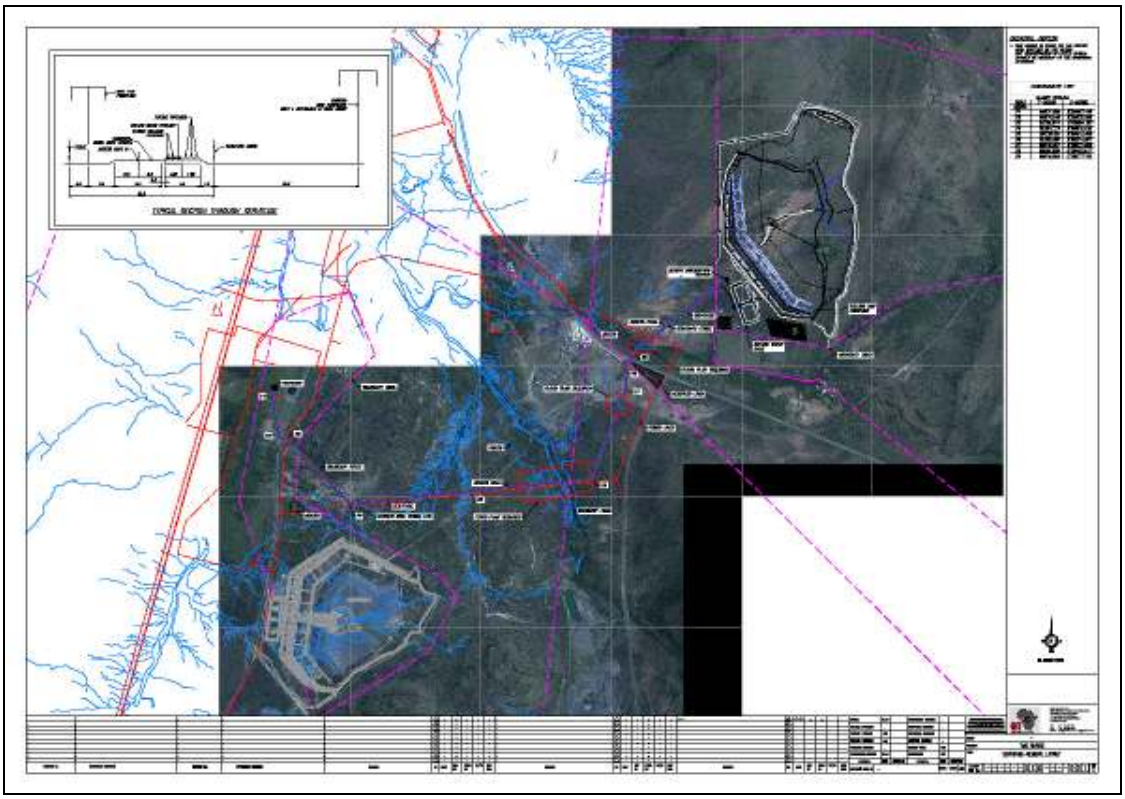
[Figure not to scale, please refer to the map adjacent to this page]

Figure 3.1 Detailed layout of the proposed New TSF and site



[Figure not to scale, please refer to the map adjacent to this page]

Figure 3.2 Detailed layout of the proposed New Tailings Pipeline



[Figure not to scale, please refer to the map adjacent to this page]

Figure 3.3 Layout of the pipeline & road with servitude cross-section

3.3 Description of the New TSF

INFRASTRUCTURE/ACTIVITY	DESCRIPTION	NEMA LISTED ACTIVITY
The construction of TSF triggers a water use terms of Section 21 (g) of the NWA, for which a water use licence (WUL). Section 21 (g) refers to the *"Disposal of waste or water containing waste in a manner which may detrimentally impact on a water resource."*	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	GN R545, Activity No. 5
Vegetation will be cleared and soil from the TSF footprint area will be stripped and stockpiled, and the TSF and associated infrastructure (e.g. Return Water Dam). The entire footprint will exceed 20 hectares.	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	GN R545, Activity No. 15
The proposed TSF will be constructed outside the approved TRP mining right area; therefore an amendment to the existing mining right will be required.	Any activity which requires a mining right or renewal thereof as contemplated in sections 22 and 24 respectively of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	GN R545, Activity No. 20

TRP requires a TSF which will be able to accommodate approximately 81 million ton of tailings, which will be deposited over a period of 20 years. It is expected that 250t of tailings per month will be produced during the first 13 years, and thereafter 500 000t of tailings per month for 7 years.

The following infrastructure is envisaged for the proposed TSF:

- Tailings toe paddocks and toe walls;
- Toe drain overlain by uncompacted sand filter material and filled with filter stones;
- Pool wall;

- Penstock with inlets and outlets. The penstock will be lined by a layer of stone pitching rocks;
- Starter wall;
- Stormwater bund wall made up of nominally compacted backfills;
- Deep box culvert;
- Seepage cut-off trenches excavated to competent rock and lined with compacted clay materials;
- Stone pitched solution trenches;
- Paddock wall made of norite nominally compacted;
- Proctor density; and
- Return water dam (RWD).

3.4 Associated Project Infrastructure

The following infrastructure is required for operation of the New TSF:

- Water And slurry pipelines;
- Power lines;
- A medium-security boundary fence will prevent people and livestock from entering the New TSF area;
- An unpaved gravel road will provide access to all areas of the site;
- A temporary storm water diversion trench will divert non-contaminated run-off from the upstream external catchment area;
- A topsoil stockpile;
- Catchment paddocks, along the downstream toe line of the started embankment, will collect surface runoff and silt load from the outer slopes;
- A Return Water Dam (RWD);
- Floating barges and walkways;
- Contractor's Camp; and
- Fuel And Diesel Storage tanks;

3.4.1 Water and Slurry Pipelines

INFRASTRUCTURE/ACTIVITY	DESCRIPTION OF LISTED ACTIVITY	NEMA LISTED ACTIVITY
The slurry delivery pipeline required will be 6.8km long and have a peak throughput of	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water-	GN R544, Activity No. 9

8 500l/s	(iii) with an internal diameter of 0,36 metres or more; or with a peak throughput of 120 litres per second or more.	
The slurry delivery pipeline required will be 6.8km long and have a peak throughput of 8 500l/s (8.5m^3/s).	The construction of facilities or infrastructure for the bulk transportation of dangerous goods – (ii) In liquid form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity more than 50 cubic metres per day.	GN R545, Activity No. 6

A pipeline is required to transport the slurry to the New TSF. There will be a running and a standby line for the slurry, as well as a return water pipeline. The pipeline length will be 6.8km. The slurry pipelines will be lined with steel HDPE with an internal diameter of 0.24m and a peak throughput capacity of 8 500 litres per second. The return water pipeline will be a steel gravity line with an internal diameter 0.35m and a peak throughput capacity of be 8 500 litres per second.

A RWD, located downstream of the TSF, will collect seepage and decant return. A return water pumping system will transfer the water from the RWD to the process plant. A floating barge pumping system will decant supernatant from the storage basin to the RWD. Floating walkways and platforms will provide access to the barge pumps.

3.4.1.1 Tailings Pipe Paddocks/Spill Dams

Six paddocks were provided along the tailings pipeline for spill and pollution control. Capacity of the paddocks was based on the volume of two pipes for a length of 1km and projected storm water runoff that maybe accumulate between the paddocks. Paddocks were designed to accommodate spill/pollution control vehicles such as dredges and "Bobcat" loaders.

3.4.1.2 Tailings pipe road underpasses

The pipeline has to pass through three roads along its route to the TSF, one within the plant complex and two main roads outside the plant complex. In-situ cast culverts were provided because 'culvert jacking' would be impractical due to its size and depth. The culvert within the plant complex will be dealt with during the plant construction. For the other two, a section of the existing roads will be removed, the culvert constructed and the road restored. This would require a 3m founding level, from the top of the existing roads, which

adequately caters for the culvert depth and the road layer works on top of the culvert roof. The road restoration layer works have to accommodate heavy industrial vehicle loading.

3.4.1.3 Tailings Pipe River Crossings

The pipeline would need to the Dwars River and to non-perennial tributaries to the Dwars River between the plant and the proposed new TSF. Concrete supports occur on the river bed and banks. 2m deep founding level from the river bed, of which there is a 1m deep geo-mattress to the underside of the foundation and 1m deep engineered backfill on top. The geo-mattress is G6/G7 material, compacted to 95% MOD AASHTO in layers not exceeding 150mm. The engineered backfill is dump rock material (maximum stone size of 200mm) compacted in 300mm layers with 8 passes by a 10T vibratory roller. Four such foundation strategies were allowed for.

3.4.2 Electricity Supply and Power lines

Power will be supplied from the existing TRP mine via an overhead line along the pipeline servitude.

3.4.3 Access roads

A 5m wide compacted gravel road is provided alongside the tailings pipeline for inspection, maintenance and access to the spill paddocks. The river crossing for this road will comprise typical cement low water bridges.

3.4.4 Workshops, administration and other buildings

3.4.4.1 Contractors Camp

The TSF operation will require the construction of a contractor's camp for contractors who will be in charge of operation. Associated with camp will be:

- An onsite office;
- Workshop area;
- Store room;
- Tea room; and
- Change room.
- Parking area for the construction vehicles Only during the construction Phase

The contractor's camp will accommodate approximately 60 people during construction and 20 people for the operational phase. The camp will disturb a total area of 0.6ha during construction. The contractor's camp will be reduced to an area of 0.24ha during the operational phase.

3.4.4.2 Fuel and Diesel storage

Diesel storage during the construction phase will not exceed 30 000 litres (30m^3). The permanent (operational phase) storage facility will not exceed 10 000 litres (10m^3). These diesel tanks will be located within the footprint area.

3.4.5 Solid Waste Management

The existing waste management plan for TRP will be implemented at the new TSF area. Uncontaminated rubble will be collected from the TSF area and transported to the mine from where it will handed in an appropriate manner as detailed below:

- **Industrial waste** will be limited to oil, diesel and grease. This waste will be sold in bulk back to the manufacturers. Unwanted waste (oils and greases are disposed of at Holfontein in Johannesburg. There is currently no suitable site in Steelpoort.
- **Domestic waste** will be contained in a skip and disposed of in a licensed municipal waste disposal site in Steelpoort/ Burgersfort area.
- **Commercial waste** handlers have been appointed by the mine management to responsibly dispose of all waste generated by the mining operation.

3.4.6 Waste Water Management Facilities

A septic tank will be used for sewage disposal as there will be a small staff component on site, housed in a pre-manufactured site office.

3.4.7 Water Management and Water Supply

3.4.7.1 Storm Water Management

Permanent storm water diversions are not required, as the natural catchments upstream of the final footprint are small and contribute less than 1% of all the water that reports to the TSF pool (Ilanda Water, 2012).

It is recommended that a single temporary storm water diversion be installed at an outlet elevation of 1 030 mamsl. The location of the diversion is indicated in Figure 3.2. As the TSF footprint increases, the pool capacity increases and so does the facility's ability to buffer storm water inflows. The need for temporary storm water diversions decreases as the footprint increases. No temporary storm water diversions are required at the final TSF footprint (Ilanda Water, 2012).

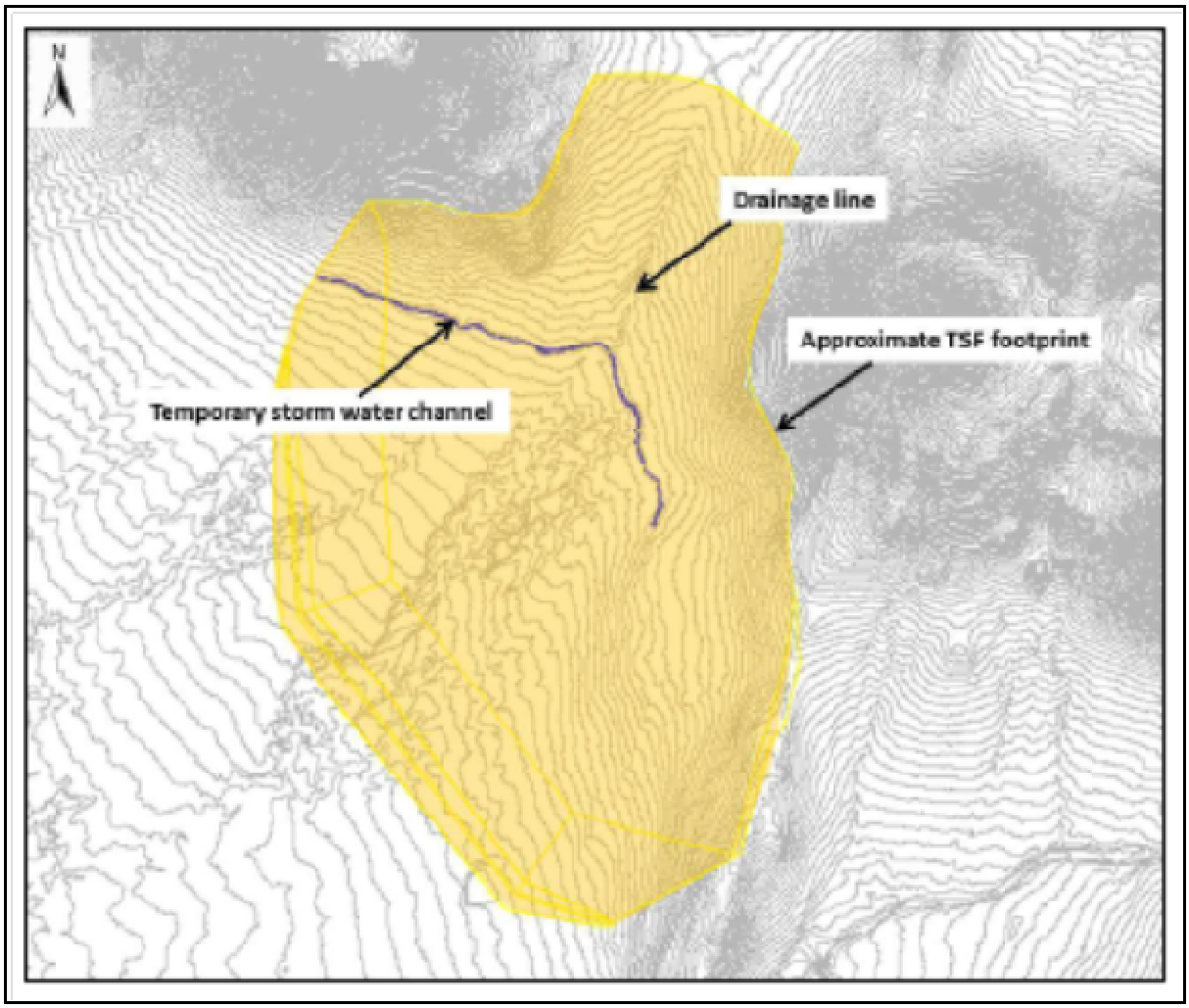
3.4.7.2 Potable and Process Water Supply

An existing borehole will be utilized for potable water supply and any process water required will be supplied by the return water pipeline.

3.4.8 Soil Stockpile

During stripping operations, topsoil will be stockpiled for future rehabilitation purposes. The topsoil stockpile will be contoured so as to blend with the natural environment and will be stabilised with vegetation.

The final closure requirements will determine the topsoil stripping and stockpile volumes. As far as possible, topsoil will be stockpiled within an economic radius of the proposed rehabilitation areas.



[FIGURE NOT TO SCALE]

Figure 3.4 Location of the temporary storm water channel (taken from Ilanda Water, 2012)

3.4.8.1 Civil Structures

The following civil structures will be associated with the New TSF and pipeline to the plant:

- Tailings Pipe Supports (2/Ø 300 pipes). Initially this will be the return water pipeline, then three (3) more pipes will be added when the UG2 is diverted to the new TSF;
- 1.15m deep unreinforced concrete plinths are provided at 5m intervals for 7km long pipeline route;
- Tailings Pipe - road underpasses (3 off);
- Tailings Return Water pump station;
- Tailings Pipe River crossings;
- Fours concrete supports, per river crossing, are provided to accommodate the three 20m long steel pipe gantry bridges. Each concrete support has three essential elements, together forming one support mechanism, viz. (i) the concrete base, (ii) the concrete column (varies in height according to river bed and embankment profile) and (iii) the concrete capping beam onto which the gantry bridge end frames will be supported.
- Tailings Pipe Storm water Berm - Release Culverts;
- Twelve concrete culverts are provided where the pipeline service road infringes on the release drains;
- Note - All concrete structures are reinforced, unless otherwise specified;
- Buildings;

There will only be one MMC at the new TSF for both the return water pumps and the booster station. This will be a brick clad building. The booster station is a concrete steel structure.

3.5 Design Criteria

TRP requires a TSF that will be able to accommodate 81 million tons of tailings, which will be deposited over the next 23 years. The TSF and associated infrastructure will cover a total footprint area of 90ha with a final TSF height of approximately 80m. The details of the proposed New TSF are summarized in Table 3.1.

Table 3.1 Design Criteria

ITEM	CRITERIA	UNIT	DESIGN VALUE/ ASSUMPTION	SOURCE
1 SOLID MANAGEMENT				
1.1	Tailings material	Type	UG2 and Merensky Platinum	TRP

ITEM	CRITERIA	UNIT	DESIGN VALUE/ ASSUMPTION	SOURCE
1.2	Design Life	Years	20	TRP
1.3	Deposition rate	Tpm	Year 0 to 13:250 000 Year14 to 20:500 000	TRP
1.4	Total Storage requirement	Tons	81 million	TRP
1.5	Placed dry Density (assumed)	t/m^3	1,6	Geo Tail
1.6	Airspace requirement	Ratio	51 million	Geo Tail
1.7	Topsoil	During stripping operations, topsoil will be separated from trees and brush and stockpiled separately in designated areas for future rehabilitation purposes. The vertical height of the stockpiles should not exceed 5m.		TRP – As per approved EMP
2 WATER MANAGEMENT				
2.1	Design storm	Mm	1 in 50 year, 24 hour storm = 119	Published
2.2	Design Freeboard	M	Design storm plus 0,8m dry freeboard on top of the normal operating level and excluding decant return.	Legal Requirement
2.3	Maximum return water pump rate	%	100 (% of slurry water pumped to TSF)	TRP
3 STRUCTURAL STABILITY				
3.1	Side slope factor of safety		Temporary slopes = 1,3 Permanent slopes = 1,5	Geo Tail
3.2	Seismicity		Low seismic activity – no special precautions required	TRP

3.5.1 Lining of the proposed New TSF

A hydrogeological study has been completed for the proposed New TSF site. Refer to Appendix B-1. Results from the groundwater model will indicate local impact of Sulphate (SO_4), Nitrate (NO_3), Sodium(Na), Chlorine(Cl) contaminant plumes, migrating about 800m from the site. The contaminant plume is expected to affect one user borehole and is not expected to reach the Springkaanspruit or the Groot Dwars River. Toe drains, under drains and cut-off trenches should be installed to reduce the risk of vertical and horizontal contaminant seepage to the aquifer.

The TSF will be operated with a minimum pool size to limit the infiltration volumes. The low risk of the contaminant migration after the above mitigation measures negates any requirement for a HDPE liner.

No HDPE liner is recommended for the TSF based on the model predictions and the low overall significance of the impact after the construction phase mitigation measures are implemented. The efficient operation of the under drains in combination with the low permeability bedrock eliminates the need for an HDPE liner system at the TSF.

3.6 Project Planning and Associated Activities

Geo Tail (Pty) Ltd was commissioned to carry out the necessary activities and tasks to present a definitive feasibility study for the new TSF required for the platinum processing operation at TRP.

The project planning considerations, as contained in the feasibility study, can be summarized as follows (GeoTail, 2012):

3.6.1 Construction phase

The TSF and storm water diversion system will be constructed in accordance with technical specifications and construction drawings, which is essential in ensuring that the facility functions according to the design intent. The following aspects will be monitored during the construction phase:

- Box cut depths and foundation preparation requirements for the embankments and roads.
- Excavation classification and stability.
- Material selection, moisture conditioning and compaction for earthworks.
- Filter material (quantity, specification and quality).
- Materials on site.
- Concrete works (strength, reinforcement etc.),
- Survey measurement and control.

3.6.2 Operational phase

To ensure that TSF is operated safely and efficiently, a system of management and monitoring of critical parameters must be implemented. The following are critical parameters to be monitored:

- Technical; i.e. settlements, phreatic levels, climatic data, side slope geometry, available storage capacity, etc.
- Process; i.e. Specific Gravity (SG), particle size distribution, deposition rate, slurry density, etc.
- Geotechnical properties of the tailings material; i.e. placed dry density, in-situ moisture content, shear strength, permeability, etc.

- Operational; i.e. pool size and location, freeboard, return water pumps rates, decant rates, etc.
- Environmental; i.e. water quality, ground water table, environmental properties of tailings, etc.

In addition, on-going maintenance and repairs will be required for all the design components to ensure that the design intent is met at all times.

3.6.3 Closure phase

The closure considerations can be summarized as follows:

- The required final side slope and top surface geometries will be achieved during the operation phase. The top surface will either be divided into smaller compartments and/or the water will be allowed to drain in a controlled fashion to the historical pool area from where the runoff will be allowed to evaporate or discharged in a controlled manner to the environment.
- The final side slopes and the top surface will be covered with a vegetated engineered layer. The purpose of the cover is to stabilize the tailings surface (erosion and dust generation) and to minimize the infiltration of water and oxygen.
- An emergency spillway will be included in the final closure design.
- Generally all surface structures (i.e. pump stations, pipelines, power lines, etc.) will be removed.

4 PROJECT ALTERNATIVES

This chapter fulfils the report requirements set out in Regulation 31(2) (f), (g) and (i) of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*	
	(g)	A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;
	(i)	Description and comparative assessment of all alternatives identified during then environmental impact assessment process.

4.1 Activity Alternatives

Two (2) alternatives were assessed to address the issue of tailing disposal at TRP, i.e. the expansion of the existing TSF and the construction of a new TSF.

4.1.1 Option 1: Existing TSF Expansion

Platinum tailings from TRP are currently disposed of on an existing TSF to the south of the existing plant. Although increasing the footprint of the existing TSF would have a smaller impact on the environment compared to the construction of a new TSF, even maximum expansion of the existing TSF (within safe engineering limits) will not be able to accommodate the projected increase in tailings produced at processing plant due to the proposed extension of TRP's mining operations.

4.1.2 Option 2: New TSF (preferred option)

The second option that was assessed was the construction of a new TSF. Potential sites for a new TSF were limited due to the terrain and the presence of alluvial aquifers in the area (Refer to section 3.2, 4.3 and 4.10).

Four potential sites were identified and subjected to a site selection process, discussed in the following section, to determine the most suitable site for the new TSF.

4.2 Site Alternatives

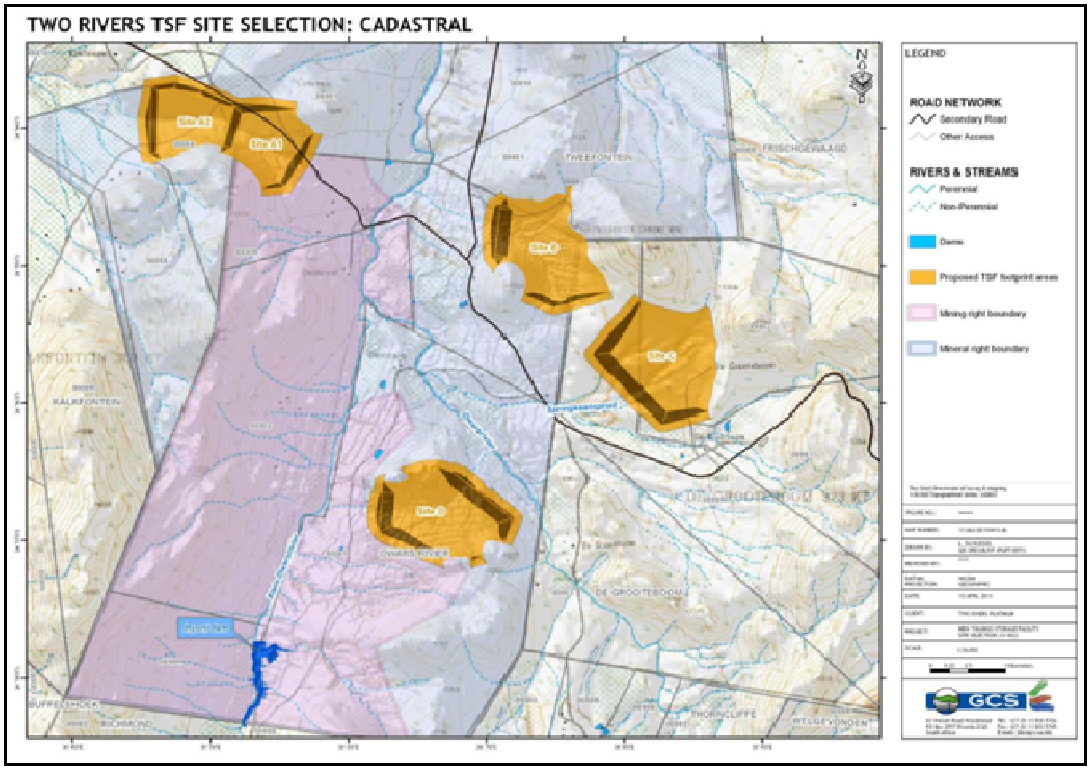
4.2.1 Candidate Sites

Four (4) potential candidate sites for the development of a new TSF were identified by TRP, Geotail cc and GCS (Pty) Ltd. These alternative sites were subjected to a desktop site selection process (Refer to Appendix A). Geotail assessed the engineering criteria and GCS

assessed the environmental and social criteria. Both these assessments were combined as one site selection process to identify the most suitable and practical location for the proposed TSF.

The locations of the sites investigated are indicated in Figure 4.1 below:

- Site A is located on the north-western border of portion 3 of the farm Dwarsrivier 372KT, extending into portion 1 of the farm Tweefontein 360KT and portions 3, 4 and 6 of the farm Kalkfontein 367KT;
- Site B is situated on the north-eastern border on the portion 0 (Remaining Extent) of the farm Dwarsrivier 372KT and, crossing into portion 1 of the farm Tweefontein 360KT portion 0 (Remaining Extent) of the farm Grooteboom 373KT;
- Site C is on the north-western portion 1 of De Grooteboom 372KT; and
- Site D is located on the eastern part of portion 7 of the farm Dwarsrivier 372KT, between the Groot and Klein Dwars Rivers.



[Figure not to scale, please refer to the map adjacent to this page]

Figure 4.1 Locations of alternative new TSF sites

4.3 Site Selection Process

The purpose of the site selection process was to identify a number of suitable sites for the proposed TSF and subject the candidate sites to preliminary environmental, engineering, social and design modelling investigations in order to provide enough information on which to base an informed decision in terms of the preferred alternative.

The steps involved in the site Selection process are summarised in Figure 4.2.

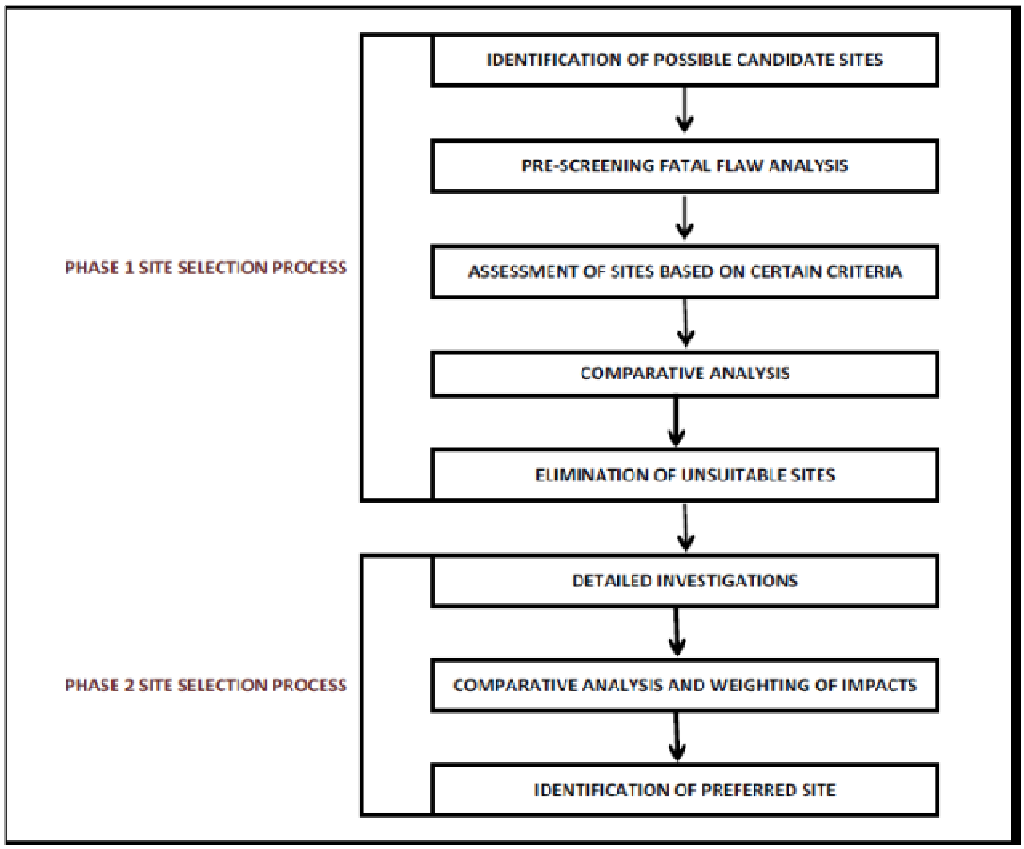


Figure 4.2 Site Selection Process

All the candidate sites were investigated in terms of the environmental, engineering and public acceptance criteria listed in Table 4.1.

Table 4.1 Site Selection Criteria

ENVIRONMENTAL	ENGINEERING & ECONOMIC	PUBLIC ACCEPTANCE
• Hydro-geological characteristics (including faults and dykes); • Geological baseline; • Topography; • Hydrology (specifically	• Safety classification (taking into consideration the zone of influence); • Technical viability and structural stability; • Airspace utilization;	• Surrounding and existing land owners; • Existing land use; • Current resource use; • Property ownership;

ENVIRONMENTAL	ENGINEERING & ECONOMIC	PUBLIC ACCEPTANCE
100m buffer zones from drainage lines); • Environmental sensitivity of the sites in terms of Mpumalanga C-plan; • Soil, land use and land capability; • Vegetation types; • Heritage aspects; • Servitudes; and • Wetlands.	• Conflict with mining activities, including ore sterilization; • Economic radius; • Visual Impact; • Practicality (ease of construction); • Servitudes (access roads, pipelines, power lines etc.); • Expansion potential; • Stormwater diversion (external catchment); • Run-off control (surface water); • Seepage control (under drainage); • Deposition method; • Water return and storage; • Dust control (air quality); and • Closure considerations.	• Mineral Rights; • Buffer zone, i.e. maintaining a sufficient radius between the TSF and potential sensitive receptors; • Air quality; • Displacement of local inhabitants; • Graves and sites of cultural-historic value; • Distance to the nearest residential area; and • Aesthetic considerations.

These criteria were tested through a weighting system which was then modelled in ArcGIS.

The numerical rating system and model are discussed in more detail under section 3.3 of the Site Selection Report (Appendix A).

4.3.1 Summary of Results

4.3.1.1 Benefits and Constraints

Based on the environmental baseline conditions for each candidate site, the benefits and constraints for each site were assessed and are summarized in Table 3.2 to Table 3.5.

Table 4.2 Benefits and Constraints of Site A

ASPECT	BENEFITS	CONSTRAINTS
Biodiversity	• Partially disturbed agricultural land	• Large areas of undisturbed Sekhukhune Centre of Endemism vegetation is found within the boundary of this site.
Geology		• Located partially on alluvial aquifer; and • The site is traversed by dykes as well as faults.

ASPECT	BENEFITS	CONSTRAINTS
Hydrology		• Slurry pipeline will have to cross the Dwars River; and • Non-perennial drainage line on the western portion of the site.
Cadastral	• Partially owned by TRP	• TRP does not own the whole property.
Soil		• Soils are highly erodible once disturbed.
Land Use and Capability	• Fairly shallow soil, with poor land capability.	
Vegetation		• Site has a high importance in terms of vegetation protection.
Archaeology		• Imminent that heritage sites will be found on the site.
Servitudes	• Powerlines and access routes close-by	• Pipeline to cross the Dwars River.
Engineering		• Sterilisation of TRP ore.
Economic	• Extended life of mine advantage to communities; • Fairly close to plant.	• Compensation for acquiring the properties applicable.
Public Acceptance		• Potential impact on downstream residents and • Potential relocation of downstream residents.

Table 4.3 Benefits and Constraints of Site B

ASPECT	ADVANTAGES	CONSTRAINTS
Biodiversity	• Disturbed through agricultural and mining activities.	
Geology		• Located partially on alluvial aquifer; and • A fault and a dyke traverse the site.
Hydrology		• Slurry pipeline will have to cross the Dwars River; and • Two non-perennial drainage lines cross the sites.
Cadastral		• Property owned by Assmang Dwarsrivier Chrome Mine (Dwarsrivier Mine).
Soil	• Soils disturbed by mining and historic agricultural activities	• Hutton soils in this area are sensitive to erosion.

ASPECT	ADVANTAGES	CONSTRAINTS
Land Use and Capability	• Fairly shallow soil, with poor land capability. • Mining rights area.	• Liability in terms of closure.
Vegetation	• Very little natural vegetation still present.	
Archaeology	• No sites of archaeological importance.	
Servitudes	• Powerlines and access routes close-by	• Pipeline to cross the Dwars River
Engineering		• Safety risk to Dwarsrivier Mine northern portal area
Economic	• Extended life of mine advantage to communities; • Fairly close to plant.	• Closure risk.
Public Acceptance	• To be determined.	• Dwarsrivier Mine is unwilling to accommodate TRP.

Table 4.4 Benefits and Constraints of Site C

ASPECT	ADVANTAGES	CONSTRAINTS
Biodiversity	• Partially disturbed through agricultural	
Geology		• Located partially on alluvial aquifer; and • Two (2) faults potentially traverse the site.
Hydrology		• Slurry pipeline will have to cross the Dwars River; and • Sprinkaanspruit tributaries cross the site.
Cadastral		• Property owned by private land owners
Soil	• Soils disturbed by mining and historic agricultural activities	• Soils are highly erodible once disturbed.
Land Use and Capability		• Current tourism and agricultural use.
Vegetation	• Low conservation value.	
Archaeology	•	• High possibility of heritage sites
Servitudes	• Powerlines and access routes close-by	• Pipeline to cross the Dwars River • Existing powerlines will have to be moved.

ASPECT	ADVANTAGES	CONSTRAINTS
Engineering		• Safety risk in terms of downsteam users and residence.
Economic	• Extended life of mine advantage to communities; • Fairly close to plant.	• Cost in acquiring the property.
Public Acceptance		• Potential relocation of people.

Table 4.5 Benefits and Constraints of Site D

ASPECT	ADVANTAGES	CONSTRAINTS
Biodiversity	• Partially disturbed through mining.	• Highly significant to conserve.
Geology		• Located on important primary alluvial aquifer; and • Three (3) faults and 2 dykes traverse the site.
Hydrology	• Existing slurry pipeline can be extended.	• Two non-perennial tributaries located on the site.
Cadastral		• Mining right owned by Dwarsrivier Mine.
Soil		• Soils are highly erodible once disturbed.
Land Use and Capability	• Low potential agricultural land; and • Located in a mining right area.	
Vegetation	• Low conservation value.	
Archaeology		• Several grave sites on the property.
Servitudes	• Powerlines and access routes close-by.	• Existing powerlines will have to be relocated.
Engineering		• Sterilisation of ore.
Economic	• Extended life of mine advantage to communities; and • Fairly close to plant.	• Cost in ore compensation not viable.
Public Acceptance		• Will result in the closure of Dwarsrivier Mine.

4.3.1.2 Fatal Flaw Analysis

A fatal flaw assessment was undertaken thereafter (Refer to Table 4.6), which resulted in the identification of fatal flaws at Site A and Site D.

Table 4.6 Fatal Flaw Analysis

SITE ID	POTENTIAL FATAL FLAW	CRITICAL FACTOR	FATAL FLAW (Y/N)	DESCRIPTION
Site A	Pipeline to cross the Groot or Klein Dwars River from the plant.	Construction of pipeline will have to cross the Dwars River. Careful mitigation is imperative.	**NO**	Proper mitigating measures, management, inspections and an emergency preparedness plan should allow for effective protection of the water resources.
	Steep gradient against the rocky outcrop.	Potential contamination into unknown tributary of the Steelpoort River.	**NO**	Design considerations – velocity versus slope and stormwater management according to the best practice guidelines.
	Faults and dykes across the site.	Potential contamination of groundwater through underlying aquifer.	**N0**	Groundwater contamination can be prevented through lining of TSF and dirty water containment facility.
	Across non-perennial drainage line.	Will lead to loss of integrity and existence of part of the non-perennial drainage line.	**NO**	Water Use Licence in terms of section 21 (c) and (i) of the National Water Act, 1998 (Act 36 of 1998) and an exemption from the requirements of GN704 (dated 4 June 1999) will be required.
	Sensitive vegetation.	Compromise high sensitivity vegetation.	**YES**	No further potential for additional off-set areas.
	Sterilisation of Ore.	Undermining of the TSF will occur.	**YES**	Large ore body underneath site.
Site B	A North-south trending dolerite dykes and fault traverses the site.	• Groundwater rehabilitation may be required; • Site may need to be partially lined.	**NO**	The dolerite dykes are not directly beneath the site. The prevention or mitigation of impacts is possible through appropriate mitigation measures such as lining of the TSF and all dirty water containment dams, as well as careful management, e.g. flushing of groundwater.
	High aquifer permeability.	• Infiltration can lead to groundwater pollution and eventually surface water pollution and the aquifer feeds the Dwars River.	**NO**	The prevention or mitigation of impacts is possible through appropriate mitigation measures such as lining of the TSF and all dirty water containment dams, as well as careful management, e.g. flushing of groundwater.
	Slurry pipeline to cross the Groot Dwars River.	• Potential for surface water contamination on the event of leakages.	**NO**	Proper mitigating measures, management, inspections and an emergency preparedness plan should allow for effective protection of the water resources.

SITE ID	POTENTIAL FATAL FLAW	CRITICAL FACTOR	FATAL FLAW (Y/N)	DESCRIPTION
	Closure Liability.	• TRP does not own the surface or mineral rights on the property. This might pose a risk in terms of closure for both TRP and Dwarsrivier Mine.	**NO**	Dwarsrivier Mine already indicated the potential to reach an agreement on negotiations.
	Safety Risk to Dwarsrivier Mine northern portal operations.	• Failure of the TSF may result in the flooding of Dwarsrivier Mine underground workings.	**NO**	Design engineering criteria can ensure stability and safety to protect any downstream users.
	Soil erosion.	• The soils if the area is prone to erosion once disturbed.	**NO**	Stability measures and concurrent rehabilitation can ensure that erosion is managed effectively and avoided.
	Across non-perennial drainage line.	• Will lead to loss of integrity and existence of part of the non-perennial drainage line.	**NO**	Water Use Licence in terms of section 21 (c) and (i) of the National Water Act, 1998 (Act 36 of 1998) and an exemption from the requirements of GN704 (dated 4 June 1999) will be required.
Site C	Located on an alluvial aquifer with high aquifer parameters (porosity, storability and transmissivity) that will enhance the spread of a contamination plume.	Groundwater contamination must be prevented through lining of TSF and dirty water containment facility.	**NO**	Mitigation and management is not likely to sufficiently reduce the impact on groundwater.
	Within the floodplain of the tributary of the Sprinkaanspruit.	• Will lead to loss of integrity and existence of part of the non-perennial drainage line.	**NO**	• Site will have to be fully lined; and • Water Use Licence in terms of section 21 (c) and (i) of the National Water Act, 1998 (Act 36 of 1998) and an exemption from the requirements of GN704 (dated 4 June 1999) will be required.
	Slurry pipeline will have to cross the Dwars River.	• Potential for surface water contamination on the event of leakages.	**NO**	Proper mitigating measures, management, inspections and an emergency preparedness plan should allow for effective protection of the water resources.
	Current land use.	• Tourism and agriculture is in contrast with mining related activities.	**NO**	Mining development forms part of the IDP of the Greater Sekhukhune Municipality.

SITE ID	POTENTIAL FATAL FLAW	CRITICAL FACTOR	FATAL FLAW (Y/N)	DESCRIPTION
	Land privately owned.	• Relocation of people will be applicable; • Rights to the land will have to be acquired.	**UNCERTAIN**	TRP lawyers are still handling the process. This may turn out to be a fatal flaw at a later stage.
	Heritage sites and graves.	• Relocation of graves may be applicable.	**NO**	Consent from families will be required to relocate graves.
	11kVA powerlines.	• No powerlines are allowed over the TSF.	**NO**	Consent from ESKOM is required to move the powerlines.
Site D	Sterilisation of Dwarsrivier Mine ore.	• Ten (10) years of ore underneath site.	**YES**	Compensation applicable makes site not viable.
	Three faults and two dykes cross the site.	Groundwater pollution if site isn't lined.	**NO**	Site will have to be fully lined as the cumulative potential for groundwater contamination is just too high.
	Partially located on a primary alluvial aquifer that feeds into the Dwars River.	Ground and surface water contamination.	**NO**	Mitigation and management is not likely to sufficiently reduce the impact on groundwater. Site will have to be lined.
	Biodiversity.	Vegetation of high significance.	**NO**	If sufficient off-set areas can be found then it will not be feasible.
	Grave sites.	Grave sites at the western end of the site will have to be moved at the.	**NO**	Consent from families required to move the grace sites.
	Powerline.	High voltage powerline cross the site.	**NO**	Consent form ESKOM require to move the power line.

4.3.1.3 Numerical Ranking

The application of the numerical rating system (as described under section 3.3 of the Site Selection Report, refer to Appendix A) allowed for the ranking of the sites in order of their suitability (the site ranked at number 1 is the most suitable across all the criteria applied).

Table 4.7 Ranking of sites (%)

SITE	SITE SELECTION RATING	SITE RANKING
A	57%	4
B	67%	1
C	60%	2
D	59%	3

4.3.1.4 Preferred Site

The results from the site selection assessment indicate that Site B is the most feasible site for the development of a new TSF taking all assessment criteria into consideration. Site C scored slightly lower than Site B in the overall rating but is more favourable in terms of cost and engineering perspectives, therefore this was considered as a second option.

Site A & D are both fatally flawed due to undermining. This in combination with the overall environmental sensitivity of the two sites excludes these two sites from consideration.

Subsequent to completion of the site selection report, the following information came to light:

- **Assmang Dwarsrivier Chrome Mine had approval for, and has since constructed a TSF over portion of Site B;**
- **TRP was informed of other applications for mining expansions on Site B; and**
- **Site B is a previously rehabilitated area and costs involved to construct the TRP New TSF on this site would far exceed the costs on Site C.**

Site B was therefore eliminated and Site C was chosen as the preferred site for construction of the TRP New TSF.

4.4 Tailings Delivery Pipeline Alternative Routes

The tailings delivery pipelines (operational and standby pipelines) as well as the return water pipeline will run parallel to each other along the same route between the Merensky Concentrator Plant and the proposed new TSF.

The pipeline route originally proposed by the TSF design engineers (indicated as the black and yellow line in Figure 4.3) was rejected by TRP due to the route running alongside the Dwars River. This route would pose a higher risk to the water resource than merely crossing over the Dwars River.

Following this, a second pipeline route (indicated as the red and white line in Figure 4.3 below) was devised which, at approx 7km, will be longer than the original pipeline route and will cost more to construct, but will reduce the environmental risk associated with the operation.

During the Draft EIA phase, when specialist studies were conducted on the pipeline route, it was noted that the upper section of the pipeline would cross a meandering watercourse in a number of places. This water course is to be diverted, so would be dry after the New TSF construction, but neverless it was deemed preferable to divert the route away from this watercourse. This is a very slight alteration to the routing, and is indicated in Figure 4.4 below.

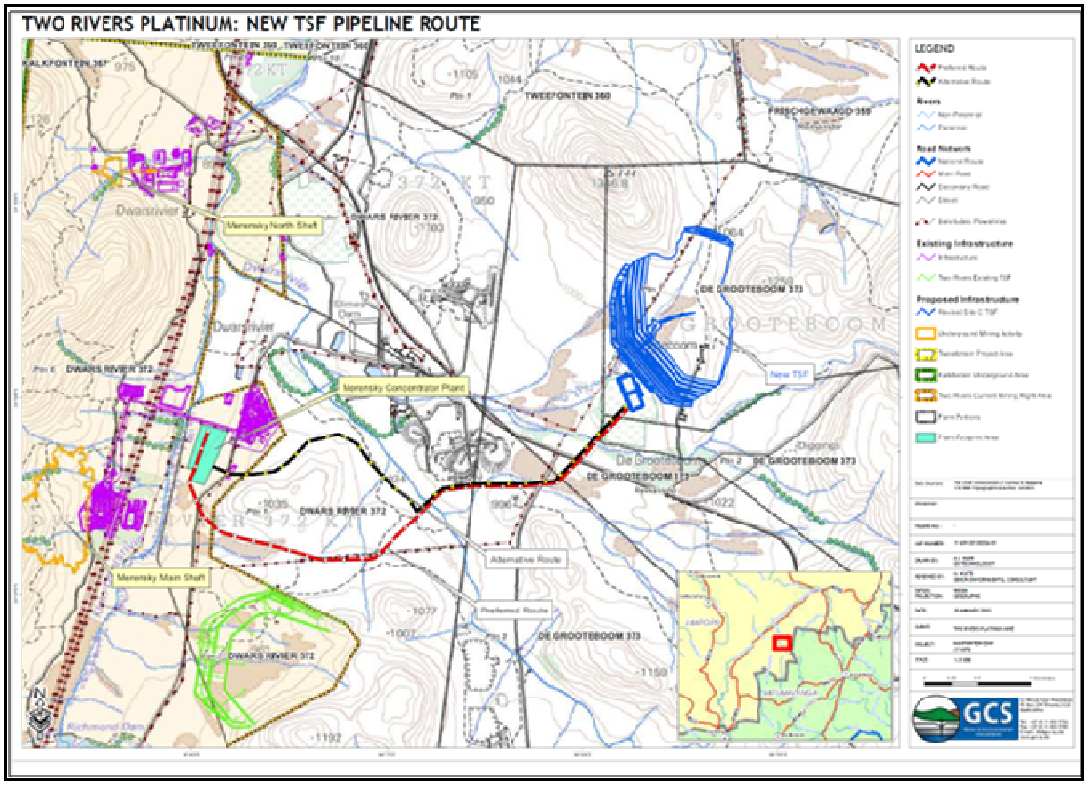


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Figure 4.3 TSF pipeline routes considered

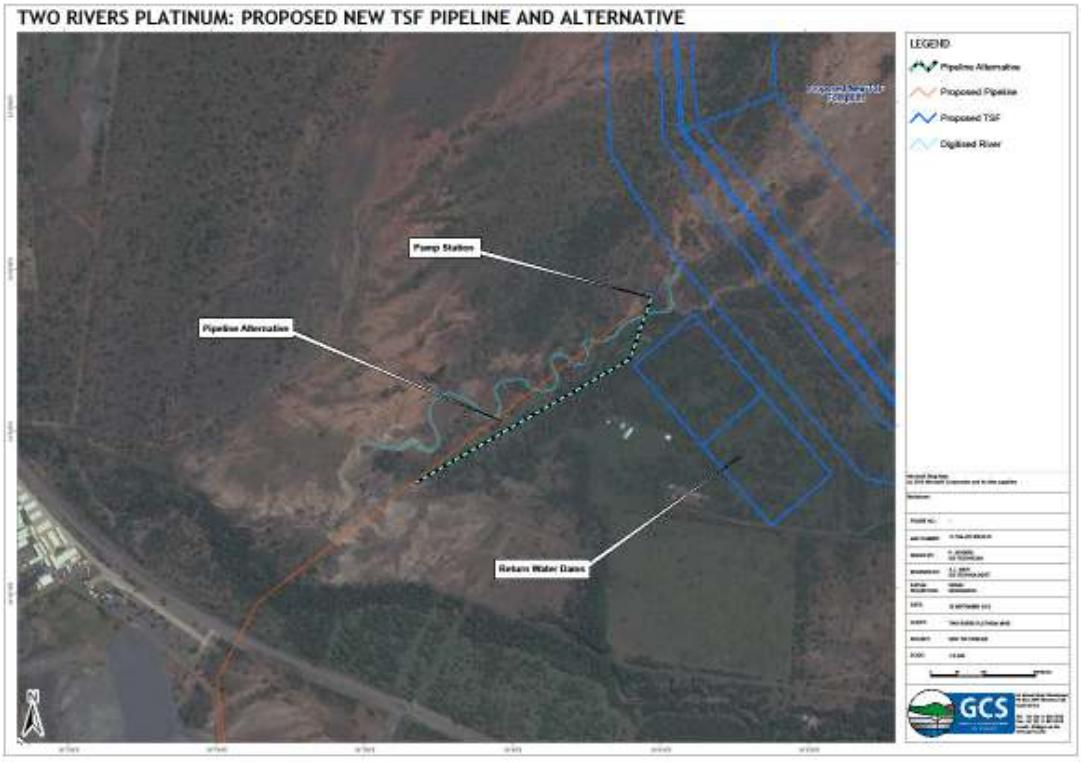


Figure 4.4 Alternate (Final) pipeline routing at the entrance to the New TSF

4.5 Land Use Alternatives

4.5.1 Tourism

The area in which the project site is located is not a major tourism area, with very few recreational facilities in close proximity to the proposed new TSF. The closest parks and recreational facilities are the Lydenburg Nature Reserve, the Gustav Klingbiel Nature Reserve, and the Sterkspruit Nature Reserve, all in the vicinity to the town of Lydenburg, approximately 40km south-west of the proposed site.

4.5.2 Residential

The proposed site is located on land which is privately owned. The applicant has a three (3) year option to purchase the property. This transaction will only be undertaken once all relevant environmental authorisations have been obtained for the proposed New TSF.

The proposed site is located in a remote area which is surrounded by mining operations, with no existing bulk services infrastructure. This area is within the area referred to as the "Mining Belt" (eastern limb of the Bushveld Complex) according to the GTM Integrated Development Plan (IDP) (2012/2013). The IDP identified this area an "important structuring element of the GTM spatial development". The town of Steelpoort, located approximately 20km, by road, from the TRP mine was identified as a district growth point for the GTM which implies that the GTM has identified the potential for future growth and the need for future housing development and service provision.

It is therefore expected that future residential developments close to the TRP mine will be concentrated within the Steelpoort area.

The potential for residential development within the project area is therefore extremely limited and is not considered a viable alternative land use.

4.5.3 Grazing/Agricultural Land

The results of the land capability assessment (Refer to Soils, Land Use and Land Capability Report attached under Appendix B-2 and section 4.6 of this report), show that the proposed TSF site is not suitable for agriculture. The is no potential for dryland agriculture or for crop production under irrigation due to the restrictiveness of the soil forms present as well as the presence of very high calcium levels.

Furthermore, there is currently no irrigation infrastructure or water supply (by means of a water use authorization) in place for the purpose of irrigated agriculture. This will add to the cost of irrigated crop production.

Although the area has the potential to support cattle farming/grazing at a rate of 6-8 ha per large stock unit (LSU), the total area of the proposed site would only be able to accommodate five (5) head of cattle, which is not considered a viable agricultural unit.

4.5.4 Mining

The potential presence of ore bodies underlying the proposed new TSF site was assessed as one of the criteria during the site selection process.

The result of this assessment was the construction of the new TSF at the preferred site would not sterilize any ore bodies, i.e. there were no economically viable ore deposits underlying this area. Therefore the project site is not considered suitable for mining purposes.

4.6 No-go Option

If the 'no-go' option were implemented, TRP would not be able to proceed with any expansion projects, as there would be insufficient capacity to store tailings from the mine.

Tailings are an unavoidable by-product of the platinum beneficiation process and no other alternatives exist for the disposal of tailings except for the development of a permanent storage facility (regardless of the whether the tailings are wet or in paste form).

Without sufficient capacity for tailings disposal/permanent storage, no beneficiation may take place, which will prevent the sale of product from the mine. This will results in a loss of revenue for TRP and a loss of employment.

4.7 Benefit/Motivation for the project

Platinum tailings from TRP are currently disposed of on an approved TSF to the south of the existing plant. Studies conducted by TRP indicated the need to commission a new TSF to accommodate future tailings for the remaining LoM which is approximately twenty (20) years. The need for a new TSF arose as a result of future expansion and increased production in the underground mining operations. Facilitating the continuation of mining at TRP will allow for the retention of employment at TRP in the long term and will allow TRP to contribute the local economy for a longer period.

5 DETAILED ENVIRONMENTAL BASELINE DESCRIPTION

This chapter fulfils the report requirements set out in Regulation 31(2) (d) of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*
	(d) A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

Specialist investigations were conducted for the proposed new TSF site C (only feasible site identified), but not for the tailings delivery pipeline route, as this route was only made available after the specialist field surveys were completed. The baseline environmental information with regards to the tailings delivery pipeline is therefore obtained from desktop information only.

Information pertaining to the tailings pipeline route is extracted from maps produced using data sourced from the Chief Directorate of Survey and Mapping; 1: 50 000 Topographical Series: 2430 CC; Land Types of South Africa Digital Map (1:250 000 scale); and Agricultural Resource Council Institute for Soil, Climate and Water (Pretoria, 2006).

5.1 Geology

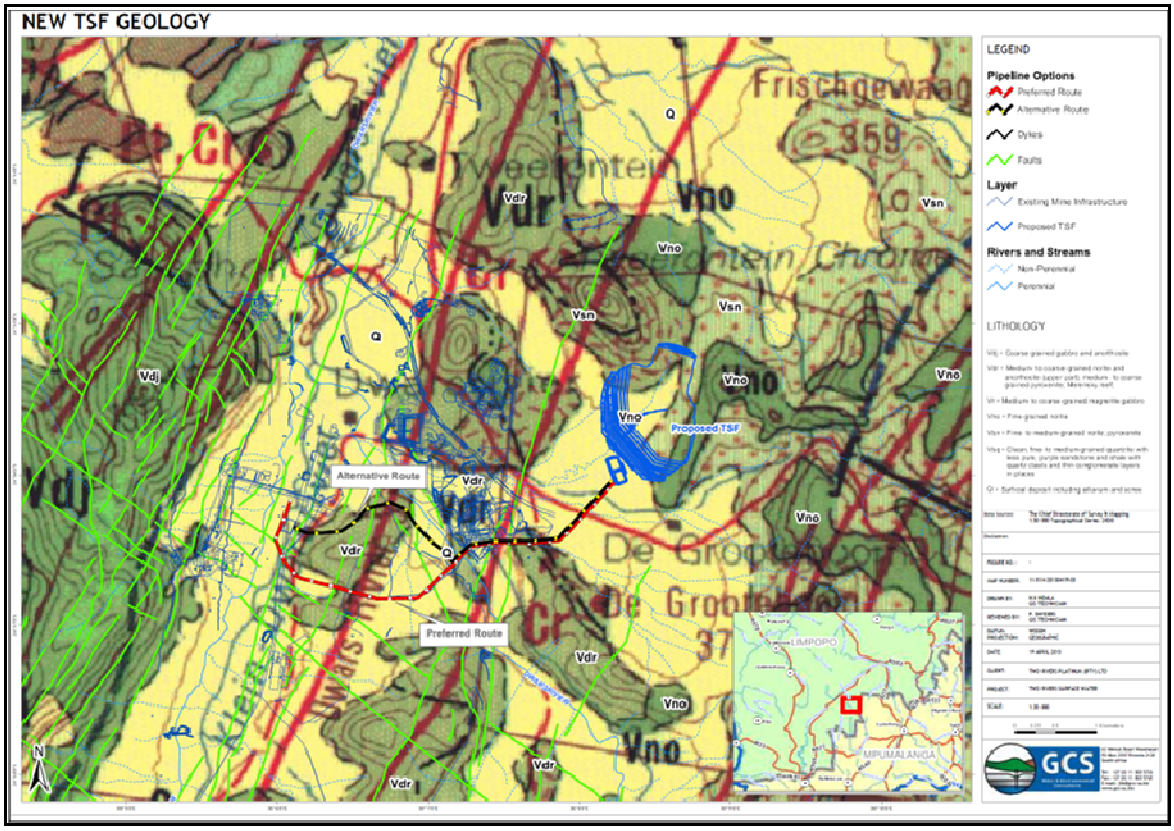
The information in this section of the report is extracted from the Hydrogeology Report compiled by GCS and attached under Appendix B-1.

5.1.1 Regional Geology

The new TSF and associated infrastructure are situated in the eastern limb of the Bushveld Igneous Complex, the world's largest layered intrusion, comprising the emplacement of at least 7 105km^3 of magma into the sediments of the Transvaal Supergroup.

The farm De Grooteboom 367 KT is underlain by rocks of the Winnaarshoek and Winterveld Norite-Anorthosite Formations of the Rustenburg layered suite. These formations comprise alternating layers of chromatite, pyroxenite, norite and anorthosite (SACS, 1980). The regional dip of the igneous layering is generally 10 - 15° to the west.

The geology of the project area is presented in Figure 5.1.



(Figure not to Scale- Please see map on adjacent page)

Figure 5.1 Geology of the area

5.1.2 Local Geology

The proposed new TSF site is underlain by norite and anorthosite as revealed by the drilling of the monitoring boreholes.

According to the 1:50 000 geological map (Council of Geoscience), the TSF pipeline route is underlain by norite and anthorisite, as pyroxenite and a portion of the Merensky Reef.

5.1.2.1 Structure

The regional dip of the igneous layering on De Grooteboom is approximately 10° to the west, striking north/south. Some faults are evident, forming a conjugate set striking north-north east/south-south west and north west/south east respectively. Two sets of later intrusive dykes comprise a distinct swarm of NNE-trending dykes, and a lesser set of dykes striking west-north west. The dykes consist of a fine to medium grained dolerite.

5.1.2.2 Faults and Dykes

During the assessment of the 1:50 000 geological map (Council of Geoscience), no faults or dykes were identified underlying, or in the immediate proximity of the new TSF site area. Geophysics confirmed the lack of lineaments. The proposed pipeline route traverses an area underlain by several faults. Refer to Figure 4.1.

5.2 Climate

The information in this section of the report is extracted from the various specialist reports attached under Appendix B.

5.2.1 Regional climate

The project area is situated on the eastern escarpment on the border of the Highveld and Northern Transvaal climatic zones (Schulze, 1974). The terrain is generally sub-montane with steep slopes.

The climate can generally be defined as sub-humid, and can be locally described as normally hot and dry. The area falls within the summer rainfall zone and receives most of its annual rainfall during the period October to March.

5.2.2 Rainfall

The closest weather stations, which are most representative of the project area, are Beetgeskraal, Maartenshoop and Lydenburg. A summary of the mean monthly and mean

annual rainfall at the stations as per the South African Weather Services (SAWS) records is given in Table 5.1 and Table 5.2. The mean annual rainfall is in the order of 703mm.

Table 5.1 Rainfall in TRP region (SAWS)

STATIONS			
Station Name	Beetgeskraal	Maartenshoop	Lydenburg
WB Station No.	05545168	05934195	0554816A7
Length of Record	1927-1970	1909-2001	1961- 2000
RAINFALL			
Average Monthly (mm)			
January	109	115	137.8
February	90	88.9	78.1
March	87.3	81.9	75
April	54.4	45	47.5
May	16.2	15	16
June	9.9	6	5.9
July	7.9	5.9	5.5
August	6.3	7.6	10.1
September	25.1	21.8	24.6
October	57.9	60.3	66.1
November	118.9	1126.3	126.3
December	129.1	122.9	118.4
Average annual (mm)			
Annual	712	686.4	711.3

Table 5.2 Rainfall in Region of TRP-Lydenburg Weather Station (1961 to 1990)

MONTH	MEAN DAYS OF RAIN	MAXIMUM 24 HR RAINFALL		MAXIMUM AND MINIMUM TOTAL PER MONTH / YEAR			
		MM	DATE	MAX	YEAR	MIN	YEAR
January	13.3	66	1982/01/11	261	1975	42	1979
February	10.0	110	1961/02/09	246	1985	20	1983
March	9.1	57	1969/03/10	187	1987	7	1966
April	7.0	47	1967/04/05	139	1973	2	1987
May	3.2	40	1962/05/02	50	1972	0	1966
June	1.3	29	1961/06/20	52	1989	0	1990
July	1.0	29	1974/07/01	50	1984	0	1987
August	1.6	36	1987/08/26	65	1979	0	1984
September	3.1	74	1988/09/01	135	1973	0	1989

October	8.9	50	1990/10/07	141	1984	28	1965
November	14.1	66	1970/11/27	295	1983	53	1985
December	13.4	78	1983/12/17	287	1987	49	1972
Annual	86	110	1961/02/09	1117	1987	530	1966

5.2.3 Temperature

The temperature data obtained from the Lydenburg Weather Station (Table 5.3) indicates that summers are warm, with temperatures rarely exceeding 30°C, and winters are mild.

Table 5.3 Temperatures Recorded in the TRP Region (Lydenburg Weather Station)

	TEMPERATURES (°C)				
	LYDENBURG WEATHER STATION (1961 TO 1990)				
Month	Mean daily			Extremes	
	Maximum	Minimum	Average	Highest	Lowest
Jan	25.9	14.7	20.3	33.5 (1983/11)	15.8 (1972/23)
Feb	25.5	14.2	19.8	34.5 (1983/27)	14.9 (1967/19)
Mar	24.8	12.9	18.8	34.0 (1984/02)	13.6 (1975/18)
Apr	22.6	10.0	16.3	31.3 (1987/04)	12.8 (1974/03)
May	20.8	6.0	13.4	28.0 (1979/08)	9.0 (1972/13)
Jun	18.3	2.8	10.6	25.3 (1962/28)	5.9 (1968/03)
Jul	18.8	2.7	10.7	26.4 (1983/15)	8.0 (1967/15)
Aug	20.9	4.8	12.8	28.5 (1979/08)	6.2 (1977/24)
Sep	23.6	8.1	15.9	33.5 91983/29)	6.4 (1974/04)
Oct	24.0	10.8	17.4	33.5 (1961/24)	9.3 (1965/19)
Nov	24.2	12.7	18.4	33.3 (1981/06)	9.0 (1968/11)
Dec	25.2	14.1	19.6	31.8 (1972/30)	15.2 (1966/17)
Annual	22.9	9.5	16.2	34.5 (1983/27)	5.9 (1968/03)

5.2.4 Mean Annual Evaporation

The mean annual evaporation (MAE) for the area, as recorded at the Lydenburg Weather Station, is 1731 mm. This is the closest full weather station to the project site. No evaporation data is available for the weather stations Beetgeskraal and Maartenshoop.

Table 5.4 Average Evaporation (Lydenburg Weather Station)

MONTH	RAINFALL (1961 – 2000)	EVAPORATION FIGURES
January	137.76	176
February	78.13	154.7

March	74.98	148.9
April	47.50	114.6
May	16.00	102.5
June	5.86	88.2
July	5.48	103.2
August	10.12	137.7
September	24.63	170.6
October	66.09	184.2
November	126.34	165.9
December	118.42	182
Year	711.30	1731

From the evaporation and rainfall figures it can be seen that the project area is located in a water deficit area, where evaporation is greater than rainfall.

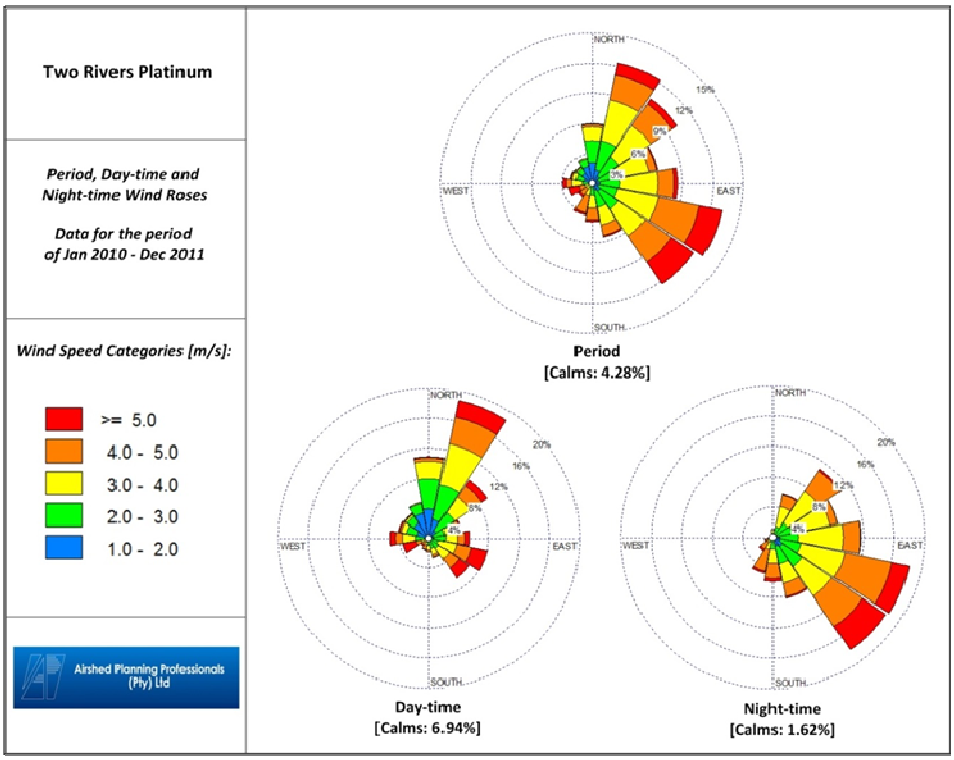
5.2.5 Prevailing Wind Direction

An air quality assessment was undertaken in December 2012 by Airshed Planning Professionals (Pty) Ltd for the TRP which is approximately 2km to the east of the proposed TSF site.

The information presented in this study presents the closest wind field information to the proposed project area.

The wind rose comprises 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses, reflect the different categories of wind speeds; the red area, represents winds in excess of 5 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated.

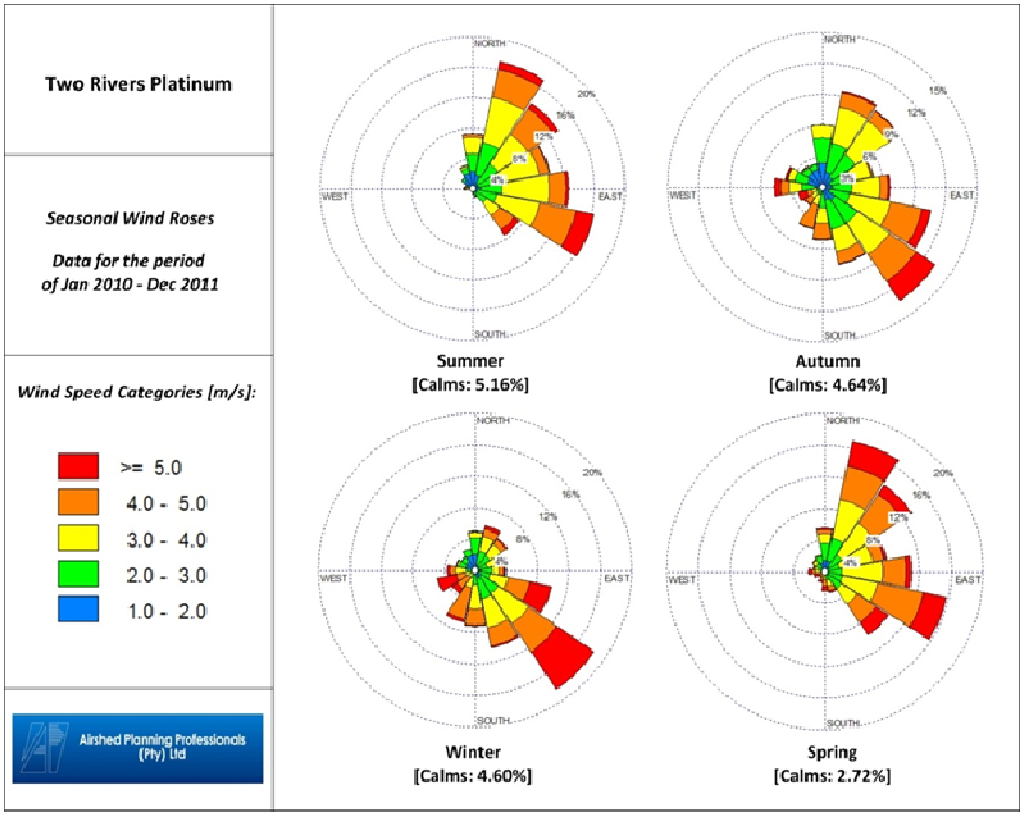
The period and diurnal wind flow field variability is shown in Figure 5.2, from which it is apparent that the dominant wind is from the southeast, with a strong component from the north-easterly sector. Calm conditions prevailed 4.3% during the 2010-2011 period with a period average wind speed of 3.3 m/s. Wind speeds exceeding 5 m/s occurred with a frequency of 10%. The north-easterly wind flow increases during day-time conditions with southeasterly wind flow increasing during the night.



(TAKEN FROM APPENDIX B-8)

Figure 5.2 Period and diurnal wind roses (MM5 data: 2010-2011)

The seasonal wind flow field variability is shown in Figure 5.3. There is not much variability between the seasons. During spring and summer months, the strongest winds were from the north-northeasterly and south-easterly directions. Autumn and winter months were characterised by a lower frequency of winds from the northeast and a higher incidence of strong winds from the southeast.



(TAKEN FROM APPENDIX B-8.)

Figure 5.3 Seasonal wind roses (MM5 data: 2010-2011)

Queries were raised regarding the Wind Direction modelled, as part of the stakeholder consultation process. Refer to Appendix 16 of Appendix C9 which contains more information.

5.2.6 Incidence of extreme weather conditions

The area is not exposed to extreme temperatures. Frost and hail are rare occurrences.

5.3 Topography

The information in this section is extracted from the Visual Impact Assessment Report compiled by GCS and attached under Appendix B-3.

The TSF site is located between two ridges approximately 5km to the east of the Dwars River and Klein Dwars River confluence. The area is characterized by gentle slopes running in southerly direction towards the Springkaanspruit. The elevation ranges from 1068 mamsl (metres above mean sea level) in the northern extent of the TSF area to 991 mamsl in the southern extent of the TSF area with an average gradient of 1:22 sloping from a northerly to southerly direction. The photographs were taken at the centre of the TSF location. The

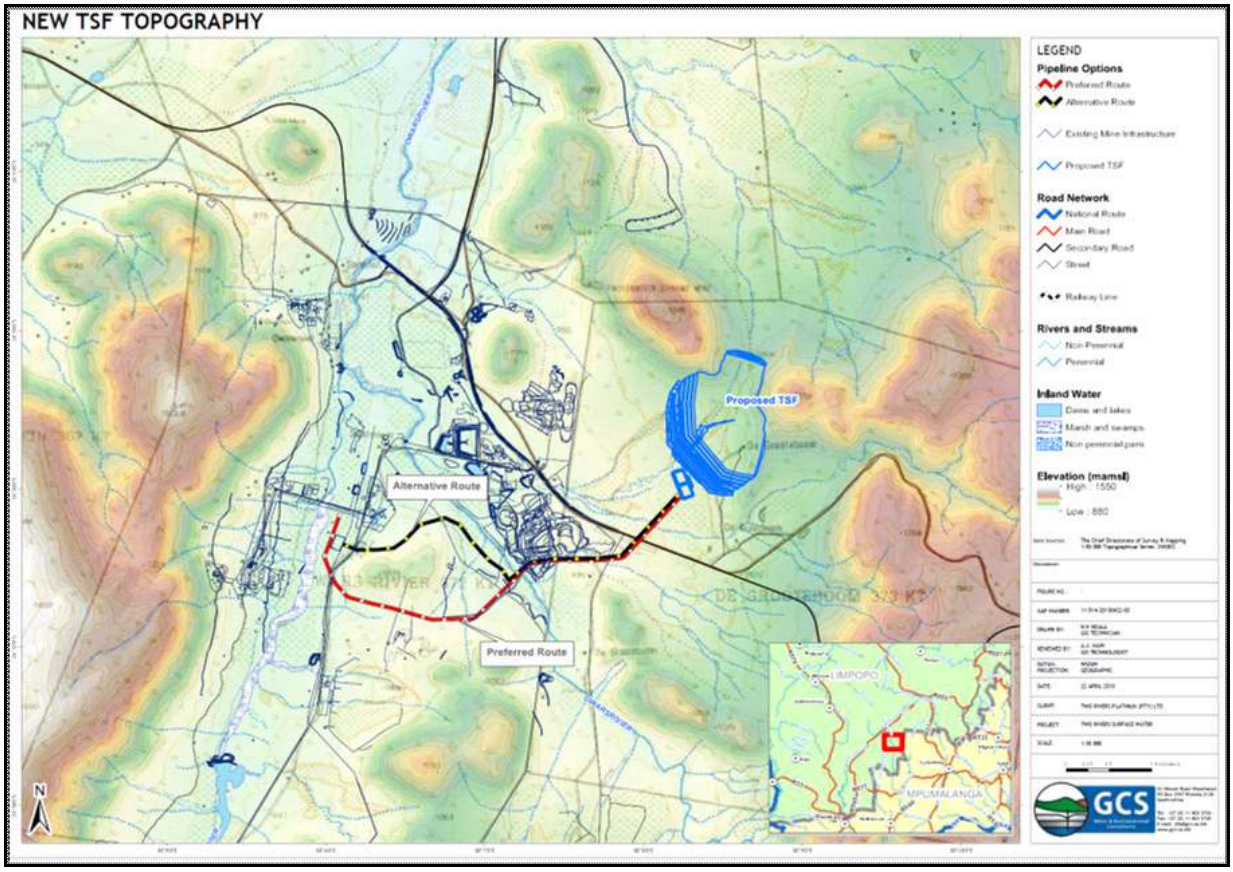
area to the north-west and south-west are presented in Photo 4.1. The topography of the TSF area is shown in Photo 5.1 and Photo 5.2, as well as Figure 5.4.

The surrounding area comprises of undulating, mountainous terrain, where elevations range from 1 900 mamsl in the Schurinksberg range in the east to 800-1 000 mamsl in the Steelpoort, Dwarsrivier and Klein-Dwarsrivier river valleys. The elevation rises steeply to 1 600m to the west and south west of the Dwarsrivier valley, on the western periphery of the Dwarsrivier farm. Major topographical features include the Dwarsriver and Klein-Dwarsrivier river systems and steep slopes forming part of the Merensky and UG2 outcrops.

The preferred tailings pipeline route is relatively flat from the starting point at the Merensky plant up to the proposed new TSF.

Photo 5.1 TSF location looking to the north-west

Photo 5.2 TSF location looking to the south-west



[FIGURE NOT TO SCALE – PLEASE REFER TO MAP ON ADJACENT PAGE]

Figure 5.4 Topography of the project area

5.4 Soils, Land Use and Land Capability

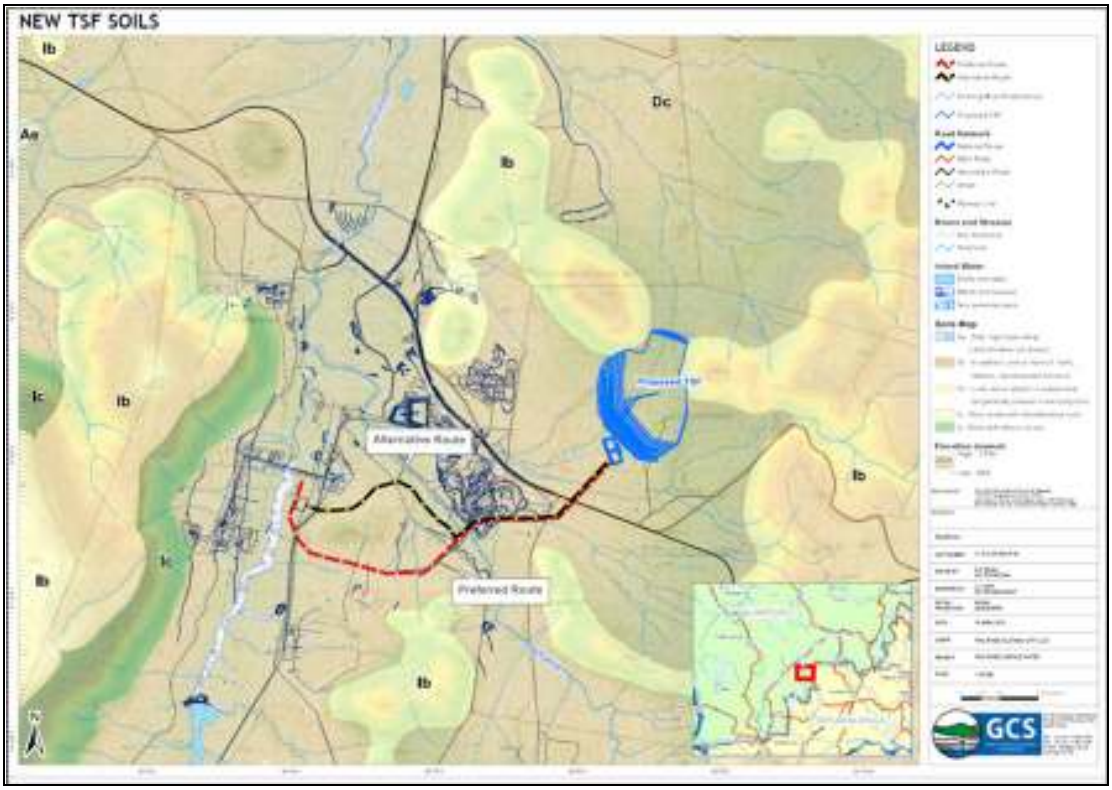
The information provided in this section is extracted from the Soil, Land Use and Land Capability Assessment report compiled by TerraAfrica Consult for the proposed new TSF footprint area, attached hereto as Appendix B-2. Appendix B-2a contains the Soil, Land Use and Land Capability Assessment undertaken specifically for the pipeline route.

5.4.1 Land Types

According to the GIS information available (Refer to Figure 5.5), the proposed TSF footprint and pipeline route will traverse an area which is dominated by the Dc land type (in addition, one or more of: vertic, melanic, red structured horizons).

The proposed new TSF project area comprises three land types: Dc13, Ib30 and Ib192 which are presented in Figure 5.5:

- ***Land type Dc31*** is found in landscapes where the slope is between 1 and 15% and slope length between 200 and 800m. The soil forms in this land type are dominated by pedocutanic or prismacutanic diagnostic horizons overlying carbonate containing horizons or rocky layers. The clay content of the top horizon is indicated to range between 20% and 50% clay. These soils in this area are derived from norite and gabbro of the Rustenburg Layered Suite.
- ***Land Type Ib30*** consists of a soil-rock complex which occurs in areas where the slope is between 5 and 15% and sometimes steeper, with slope lengths ranging between 30 and 800m. The soil forms of this land type consist of rock covered with shallow layers of miscellaneous soil forms. Clay content ranges between 20% and 50%. The geology and rocks are dominated by ferrogabbro, ferrodiorite, magnetitite, gabbro, norite and anorthosie of the Rustenburg Layered Suite of the Bushveld Complex.
- ***Land type Ib192*** consists of a soil-rock complex occurring on where the slope is between 5 and 15% and sometimes steeper, with slope length ranging between 30 and 800m. The soil forms consist of rock covered with shallow layers of miscellaneous soil forms and lithocutanic soil forms. This land type is dominated by soil of the Glenrosa soil form.



[FIGURE NOT TO SCALE- PLEASE REFER TO MAP ON ADJACENT PAGE]

Figure 5.5 Land-Type map for the project area

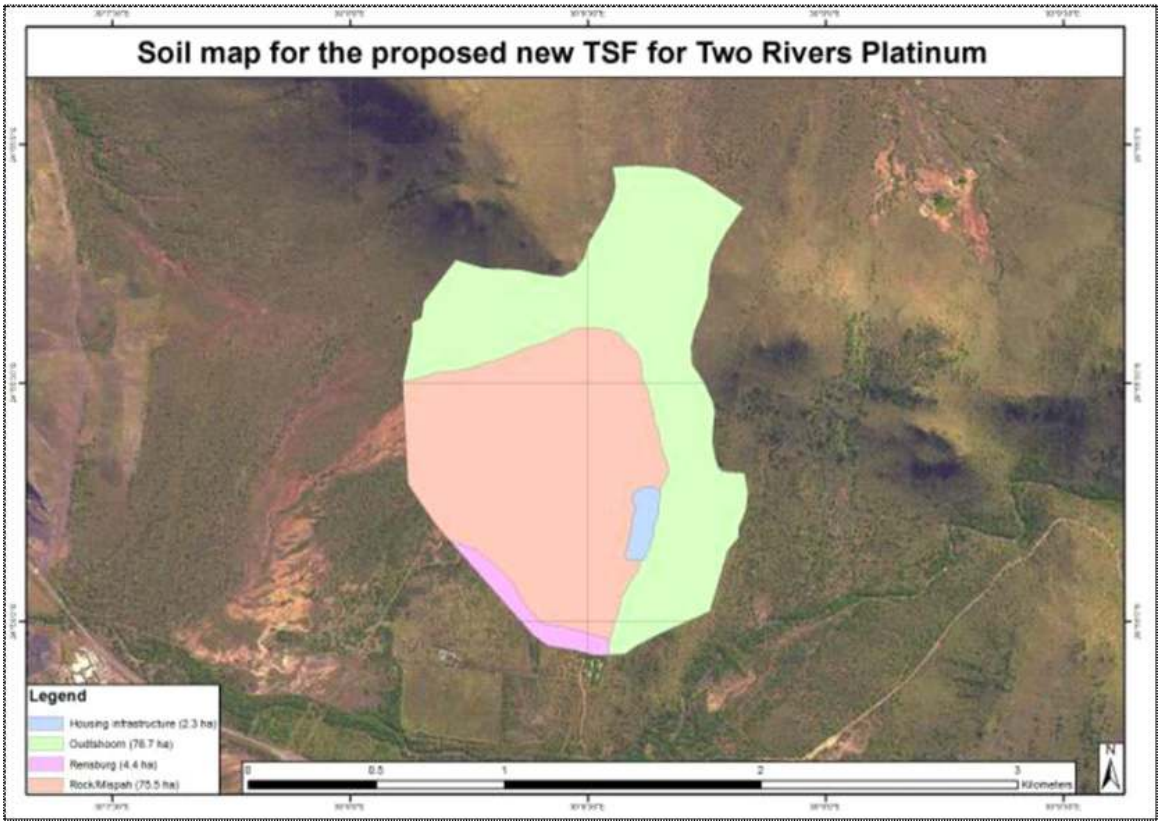
5.4.2 Soil Classification of the New TSF Footprint

Three (3) different soil forms are present in the proposed development area i.e. soils of the Oudtshoorn, Rensburg and Mispah/Rock forms (Refer to Figure 5.6[FIGURE NOT TO SCALE- PLEASE REFER TO MAP IN APPENDIX B-2]

Figure 5.6). These soil forms are characterised by shallow soil depth and restrictive rock or duripan layers. The area is dominated by the Oudtshoorn soil form (76.7 ha). Specific information regarding the soil types along the proposed tailing delivery pipeline route is not available.

5.4.2.1 Mispah/Rock soil form (75.5 ha or 47.5% of the baseline study area)

This group of shallow, rocky soils consists of the Mispah soil form and rocky outcrops. Mispah soil form and rocky outcrops can be categorised in the international classification group of lithic soil forms. In lithic soil forms the solum is dominated by rock or saprolite (weathered rock). These soils have sandy to sandy-loam texture, while topsoil structure is apedal to moderately blocky and the profiles are very shallow (as shallow as 0.05m of soil on a rocky layer).



[FIGURE NOT TO SCALE- PLEASE REFER TO MAP IN APPENDIX B-2]

Figure 5.6 Soil map the TSF footprint area (Soil Study Report in Appendix B-2)

The orthic A-horizon of the lithic soil group is unsuitable for annual cropping or forage plants (poor rooting medium since the low total available moisture causes the soil to be drought prone). These topsoils are not ideal for rehabilitation purposes as they are too shallow and/or too rocky to strip. Topsoil stripping and stockpiling of the "shallow" soils should only be attempted where the surface is not too rocky.

5.4.2.2 Oudtshoorn soil form (76.7 ha or 48.3% of the study area)

The Oudtshoorn soil form identified is found on the lower slopes of the proposed site. This soil form consists of an orthic A horizon overlying a neocutanic B1-horizon that is underlain by a dorbank horizon. This dorbank horizon is cemented by silica and also contains accessory cements, mainly calcium carbonate and iron oxides.

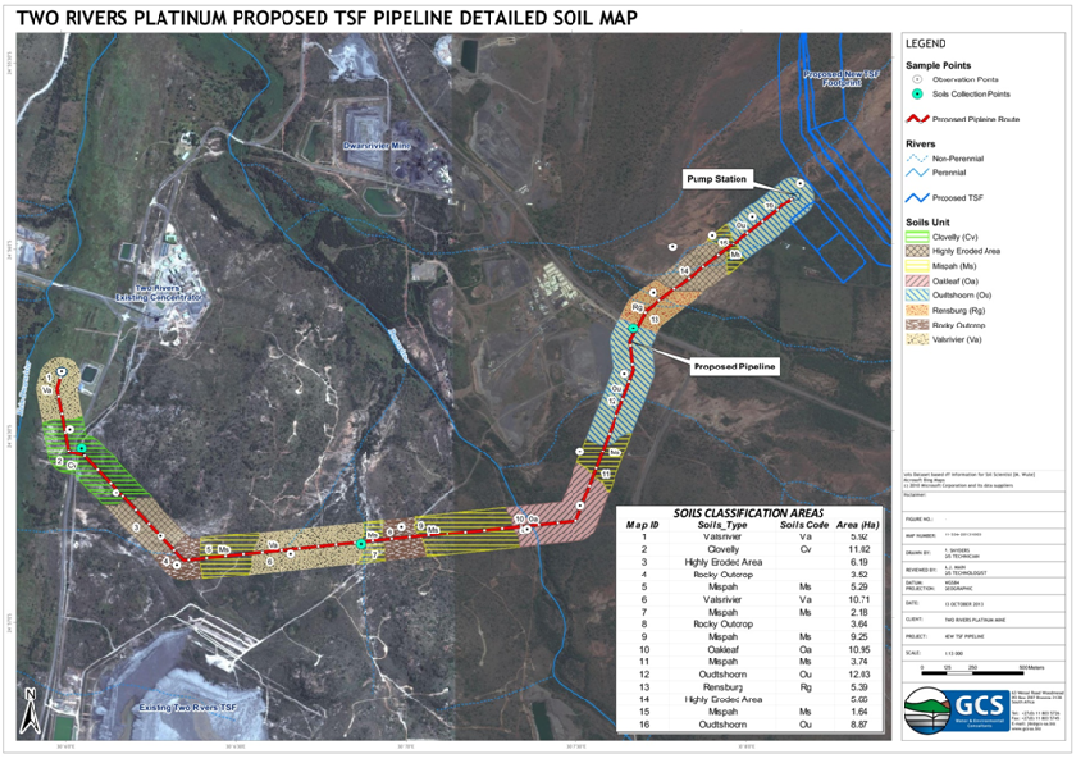
The orthic A horizon of these profiles are very shallow (0.05 – 0.15 m) as is the neocutanic B1-horizon (from 0.05m to 0.60m). The neocutanic horizon overlying the hardpan carbonate horizon have sandy-loam texture and contain infrequent lime nodules. The Oudtshoorn soil form is limited by chemical properties and physical depth to soils suitable for extensive grazing purposes or wilderness.

5.4.2.3 Rensburg soil form (4.4 ha or 2.8% of the study area)

The Rensburg soil form is found in the valley bottom of the proposed site. This soil form consists of a vertic A horizon overlying a G horizon.

5.4.3 Soil Classification of the New TSF Pipeline

Soils were classified and mapped according to their distribution along the pipeline route. Mispah and Oudthoorn were the dominant soil forms, with Valsrivier being more prevalent on the valley bottoms. Areas of erosion, Clovelly, Oakleaf, Rock and Rensburg were identified on the route. Refer to Figure 5.7 below indicating the pipeline soils map



[FIGURE NOT TO SCALE- PLEASE REFER TO MAP IN APPENDIX B-2A]

Figure 5.7 Detailed Soils Map for the Pipeline Route (Soil Study Report in Appendix B-2a)

5.4.4 Soil chemical properties and soil fertility

The results of the chemical analysis over the proposed TSF site, are presented in the Soil Specialist report in Appendix B-2 and B-2a. The pH of the analyzed soil samples in the study area ranges from 6.3 to 7.7 and the soils found on the sites can be described as slightly acid to mildly alkaline. Calcium and magnesium levels are very high with calcium ranging between 1485 mg/kg and 4502 mg/kg and magnesium 141 mg/kg and 1849 mg/kg. None of the metals analysed are above the threshold level.

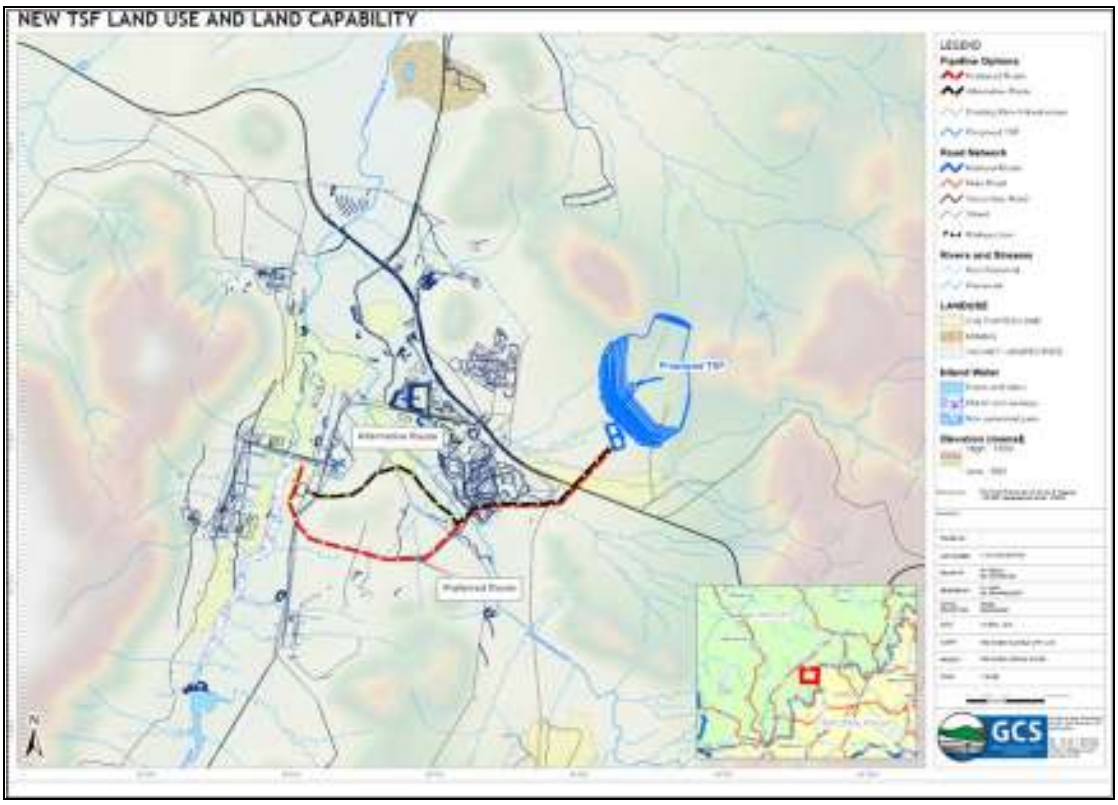
5.4.5 Land Use

According to the Chief Directorate of Survey and Mapping, 1:50 000 Topographical Series: 2430CC, the land over which the proposed TSF is located, as well as through which most of the tailings delivery pipeline traverses is zoned as vacant or unspecified land use. The

pipeline traverses through sections of previously cultivated land at the start (close to the Merensky plant) and the end (close to the proposed TSF) of the route. This information is presented in Figure 5.8.

The current land use of the proposed TSF footprint area and pipeline route consists of natural indigenous vegetation and disturbed areas where some construction activities such as trenching are taking place. There is no evidence of previous farming activity such as cattle and crop farming within the proposed TSF footprint area.

The land use of the surrounding areas includes the operations of the existing TRP Mine as well as the existing TSF of the mine. The larger area around the proposed site has also been developed into mining areas over the past ten (10) years. Areas not used for mining purposes, are either used for game farming that includes tourism facilities or for construction of infrastructure associated with the mining industry.



[Figure not to scale – please refer to map on adjacent page]

Figure 5.8 Land Use map for project area

5.4.6 Land Capability

Land capability classes for the proposed TSF footprint and pipeline were determined using the guidelines outlined in section 7 of The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981). The Chamber of Mines pre-mining land capability system was utilized, given that this is the dominant capability class classification system utilized in the mining and industrial fields.

Following the classification system, the soil and land types identified in the study area could all be classified into two land capability classes, i.e. land with wilderness land capability and land with grazing land capability (Refer to land capability maps in Appendix B2 and B2a). This indicates that due to limitations caused by slope, landscape positions as well as shallow soil depth, the area is best suited for conservation and game farming with animals naturally occurring in the area.

5.4.6.1 Dryland Production Potential

The TSF site and pipeline route has no soil with arable land capability and therefore has no dryland production potential.

5.4.6.2 Irrigation Production Potential

The site has no potential for crop production under irrigation due to the restrictiveness of the soil forms present as well as the presence of very high calcium levels that will impede the nutrient uptake of crops cultivated under irrigation. It should also be noted that currently no irrigation infrastructure and water rights are in place for the purpose of irrigated agriculture. This will add to the cost of irrigated crop production.

5.4.6.3 Cattle farming potential

Although the area has the potential to support cattle farming/grazing at a rate of 6-8 ha per large stock unit (LSU), the total area of the site is so small that only five head of cattle can be kept here. Five (5) head of cattle is not considered a viable agricultural unit.

5.5 Flora

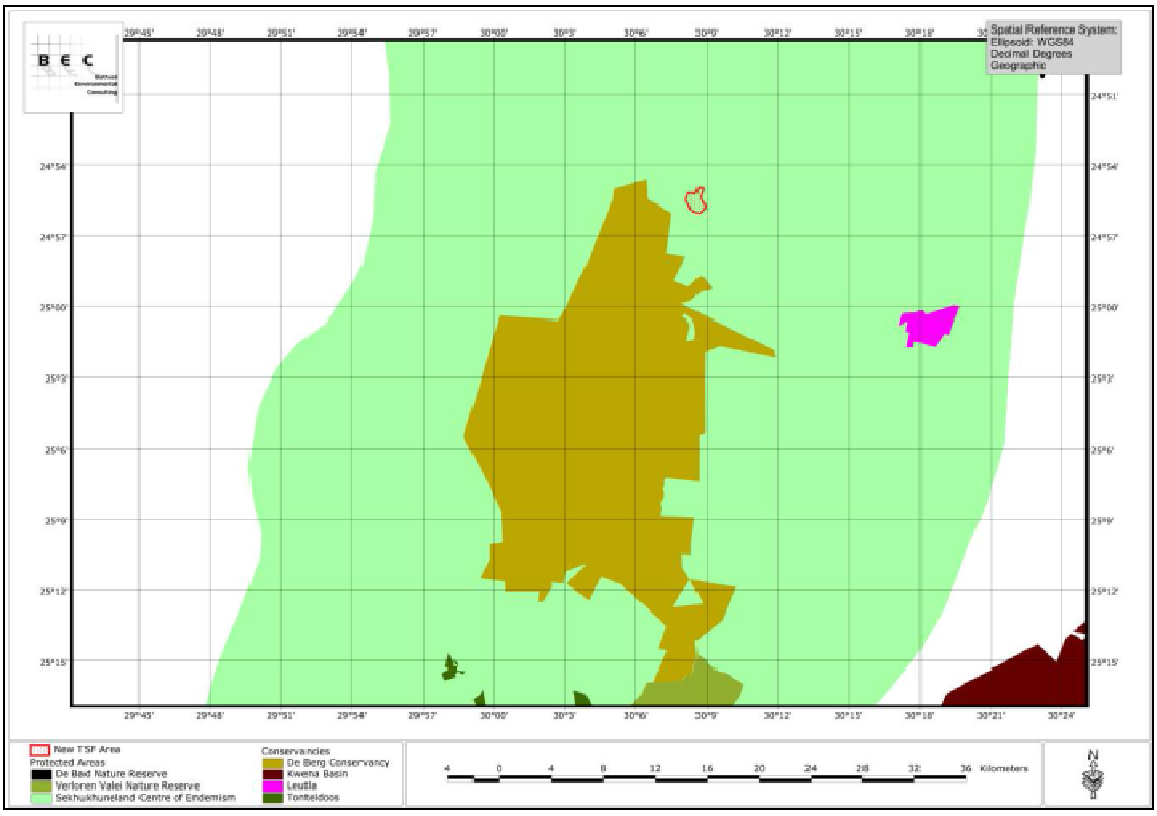
The information in this section of the report is extracted from the Biodiversity Impact Assessment Report compiled by Bathusi Environmental Consulting attached under Appendix B-4. Appendix B-4a contains a Biodiversity Impact Assessment Report conducted by GCS for the New TSF pipeline route. The information in the sections below refers to both the New TSF footprint and pipeline route.

5.5.1 Biophysical Attributes

The study area is situated within the Greater Tubatse District Municipality (GTM), which comprises approximately 459 900ha. The Biodiversity Geographical Information System (BGIS) (2007) assessment indicates that approximately 85.2% of the municipality is currently considered untransformed. This figure is however regarded an overestimation of the true extent of remaining natural (pristine) habitat. In spite of untransformed woodland habitat characterising the study area, the effects of commercial agriculture, urban settlements, infestation by alien invasive trees and recent increases in mining activities are evident in the surrounding region, manifesting as a mosaical land cover, particularly to the west of the proposed site. Road and railway infrastructure in the region caused a moderate level of habitat fragmentation and isolation in the immediate region.

The study area is situated within the Sekhukhune land Centre of Endemism. Other areas of conservation that are present in the near vicinity of the proposed site include (Refer to Figure 5.9):

- Protected areas:
  - De Bad Nature Reserve (25km northeast); and
  - Verloren Vallei Nature Reserve (35km south),
- Conservancies:
  - De Berg Conservancy (1.5km southwest): This area comprises approximately 40 778 ha and forms part of the TRP Environmental Management Plan. Animals as well as approximately 6 500 plants have been relocated. The long-term focus is to establish the De Berg Conservancy Programme, which is dedicated to environmental conservation. The programme will establish an area where landowners' rights are guaranteed if sustainable.
  - Kwen Basin (41km southeast);
  - Leutla (16km southeast); and
  - Tonteldoos (40km southwest).



[NOT TO SCALE – REFER TO THE BIODIVERSITY REPORT IN APPENDIX B-4]

Figure 5.9 Conservation areas in the vicinity of the proposed New TSF

The Environmental Potential Atlas (ENPAT) (2003) database indicates several topographical heterogeneous areas being present (slopes exceeding 8%) in the immediate region of the study area. During the reconnaissance site investigation, several topographically heterogeneous areas were observed on the site in the form of localised and small outcrops and ridges. The topography of the immediate region comprises mostly 'Low Mountains'. Altitude of the study area varies between 1 000m and 1 100m.

The BGIS information indicates that approximately 1 250ha of the GTM is comprised of wetlands. Areas of surface water are present in the study area and surrounds in the form of rivers, perennial and non-perennial steams. Larger rivers of the immediate region include the Dwars River and Groot Dwars River, situated to the east and southeast of the study area respectively.

The geology of the region is a recognised driving force in vegetation development and distinctive patterns are observed that are likely to be resultant from geological boundaries. The Dwarsrivier Norites and Croydon Clinopyroxenite geological formations are represented in the study area. The preferred site is situated largely within the Dc31 land type unit. This land type accommodates land where duplex soils are dominant.

5.5.2 Sekhukhune land Centre of Endemism

The Sekhukhune Land Centre (SKC) comprises a mountainous region with flat to undulating valleys. Sekhukhune land is known for its parallel belts or rocky ridges and mountains, including the Leolo and Dwars River ranges. The core of the Centre is formed by the surface outcrops of the Rustenburg Layered Suite of the eastern Bushveld Complex.

Little is known of the vegetation of the SKC, but the bushveld is unique and deserves recognition as a separate type. One of the characteristic trees of this bushveld type is Kirkia wilmsii, a species that is relatively rare in other parts of the Mixed Bushveld. Vegetation differences between the north- and south facing aspects of the mountains are often striking. Intriguing vegetation anomalies associated with heavily eroded soils are present throughout the region. These areas (not serpentinite) are very sparsely vegetated with a distinctive, though highly impoverished flora including, for example Searsia keetii, Euclea linearis and Amphiglossa triflora. The origin and chemical composition of these eroded areas, which are natural features, are not known.

Many apparent endemic species of the SKC are awaiting formal description (e.g. in Acacia, Boscia, Polygala and Stylochiton). The genus Lydenburgia (Celastraceae), represented by Lydenburgia cassinoides (= Cassia transvaalensis), is near-endemic to the region. Succulents abound in the hot, arid valleys of the SKC.

The genus Aloe is particularly prolific, with many of the species being shared with the adjacent Wolkberg Centre. The area around Burgersfort is reputed to have the highest concentration of Aloe species in the world.

Despite it scenic landscapes, there is only one official nature reserve in the SKC, namely Potlake Nature Reserve. Owing to the ruggedness of the terrain, however, the mountainous parts of the SKC are still fairly intact, with many private land owners keen to promote ecotourism in the region. Overgrazing by domestic livestock has seriously degraded the vegetation in the densely populated areas in around the Leolo Mountains. Population pressure is also adversely affecting the flora of the Steelpoort River Valley, particularly in the Steelpoort-Burgersfort-Maandagshoek area. Efforts to conserve high-priority areas in the SKC must acquire an increased urgency in light of the unusual natural features of these areas, such

as the rich phytodiversity of the ultramafic soils. Conservation of this botanically important area should receive the highest priority, not only from a biodiversity point of view, but also because of its importance as a water catchment area.

5.5.3 Floristic Sensitivity of the study site

5.5.3.1 New TSF Footprint

The following conservation important plant taxa were recorded during the survey period [Limpopo Nature Conservation Act, 2003 (Act No.7 of 2003)]:

- *Boophone disticha* (Declining status, poisonous, medicinal uses)
- *Boscia foetida* (Medicinal Uses, browsing value, Protected Schedule 12)
- *Elephantorrhiza praetermissa* (Protected Schedule 12)
- *Euphorbia* species (Protected Schedule 12)
- *Gladiolus* species (Protected Schedule 12)
- *Lydenburgia cassinoides* (Near threatened, protected tree, National Forest Act, 1998)
- *Sclerocarya birrea* (Protected tree, medicinal uses, edible parts)

The number of conservation important plant taxa that were recorded within the study area during the relatively brief survey period, is a reflection of the pristine nature of most of the vegetation encountered in the study area. It also reflects the pristine nature of the vegetation on a larger scale (Sekhukhune Mountain Bushveld). Considering the brief nature of the survey, the pristine nature of the vegetation and the number of conservation important species that are known to occur in the general region, it is highly likely that additional conservation important species will be recorded in the study area should subsequent surveys be conducted.

5.5.3.2 New TSF Pipeline

The following conservation important plant taxa were recorded during the survey period.

- *Boophone disticha;*
- *Boscia foetida;*
- *Chlorophytum cf. cyperaceum;*
- *Elephantorrhiza praetermissa;*
- *Euphorbia species;*
- *Gladiolus species;*
- *Lydenburgia cassinoides; and*
- *Sclerocarya birrea.*

5.5.4 Discussion

The relative low floristic diversity that was recorded during the brief site investigation period is a reflection of the brief nature of the survey period rather than a poor species richness of the vegetation. The study conducted by McCleland (2008), during which 400 species were recorded over an extended period, can be used as an indication of the profusion of conservation important taxa as well as the high phytodiversity of the region in general. Importantly, several plants of conservation importance have been recorded on the site during this brief period, the most abundant being Lydenburgia cassinoides (Bushman's Tea). Other conservation important taxa occur sporadically throughout the study site.

Floristic sensitivity of the respective habitat types and the site in total are strongly determined by the presence and abundance of conservation important taxa. Considering that these species are encountered throughout the study area, the flora is regarded sensitive.

In addition, some of the habitat types are restricted in size and are furthermore regarded as atypical to the natural vegetation, such as outcrops, sheetrock, drainage lines and erosion gullies. A high sensitivity is ascribed to these particular areas. The vegetation, on a regional scale, is however classified as 'Least Threatened' implying that the habitat types encountered in the study site, is highly likely well represented in the general region. However, recent increase in sustained mining and urban development were not necessarily take into consideration in the assessment and it is therefore important to establish a conservation principle before a significant portion of this habitat is being lost.

5.6 Fauna

The information in this section of the report is extracted from the Biodiversity Impact Assessment Report compiled by Bathusi Environmental Consulting attached under Appendix B-4, as well as the Pipeline Ecological study conducted by GCS in Appendix B-4a.

5.6.1 Background

It is important to view the study area on an ecologically relevant scale; consequently, all sensitive animal species (specific faunal groups) known from the Limpopo Province are included in this assessment. Detailed regional and scientific data on all faunal groups are lacking (notably for most of the invertebrate groups) and as a result only data sets on specific faunal groups allow for habitat sensitivity analyses based on the presence/ absence of sensitive faunal species (Red Data species) and their specific habitat requirements.

5.6.2 Faunal Diversity of the TSF footprint site

Table 9 in Appendix B-4 (the specialist Biodiversity Impact Report) presents a list of all taxa recorded during the field investigation as well as species confirmed to be present by the landowner. The presence of 61 animal taxa was confirmed by means of visual sightings, tracks, scats, burrows and species-specific calls as well as camera and small mammal trapping. The following results were recorded:

- 25 invertebrate species;
- 10 reptile species;
- 18 bird species; and
- 14 mammal species.

The diversity of animals recorded in the study area included two Red Data species, namely:

- Leopard (Panthera pardus) and
- Brown Hyena (Parahyaena brunnea).

Three (3) alien and invasive species were recorded:

- Common Pigeon (*Columba livia*);
- Common Myna (*Acridotheres tristis*); and
- Feral Domestic Cat (*Felis catus*).

This list of species was compiled over an inclusive period of 41 hours of sampling, but is not regarded a comprehensive account of the faunal diversity of the site and surrounds. Eighty percent (53 species) of the total species account was observed over the first half (4h30) of active sampling; 90% (60 species) were recorded after five and a half hours. However, for the purpose of this EIA assessment, the list compiled during the survey period is regarded sufficient to indicate the sensitivity and required attributes of faunal assemblages of the study area.

5.6.3 Faunal diversity of the New TSF Pipeline Route

Sensitive terrestrial faunal species likely to persist in natural terrestrial woodland of study site include:

- Lesser Kestrel (Falco naumanni –Vulnerable);
- Lanner Falcon (Falco biarmicus – Near Threatened);
- Cape Vulture (Gyps coprotheres – Vulnerable);
- Red-billed Oxpecker (Buphagus erythrorhynchus – Near Threatened);
- Reddish-grey Musk Shrew (Crocidura cyanea – Data Deficient);

- Bushveld Gerbil (Tatera leucogaster – Data Deficient);
- Leopard (Panthera pardus – Near Threatened); and
- Brown Hyena (Parahyaena brunnea – Near Threatened).

Based on various ecological and biodiversity considerations the following faunal sensitivities are estimated for the terrestrial faunal habitats of the study area:

- Kirkia – Triaspis Woodland: medium-high faunal sensitivity;
- Lydenburgia – Vitex Open Woodland: medium-high faunal sensitivity; and
- Tristachya – Loudetia Grassland Slopes: medium-high faunal sensitivity.

Habitat availability at site DWR1 and SPS1 was recorded to be adequate during the September 2013 survey.

Based on the SASS5 results biotic integrity at all the site DWR1 in the Dwars river was classified as 'being "Moderately Impaired" (PES Class C). Biotic integrity at site SPS1 in the Sprinkaanspruit was reported to be "Poor". Limited habitat availability at this site together with water quality could be the attributing factor of the Poor state in terms of the biotic integrity based on the SASS5 results.

5.6.4 Discussion

The diversity of animals recorded in the study area during the brief survey attest to the untransformed nature and diversity of the habitats of the study area. In particular, the confirmed presence of two large Red Data carnivores, (Brown Hyena and Leopard), attests to the high ecological connectivity that exists between faunal habitats of the study area and surrounding areas, as well as the importance of the study area as a movement corridor and potential as sink and/or source habitats for many other species. The study site is located in a region that currently experiences significant pressures from mining activities. Untransformed, natural habitat situated to the east, southeast and northeast of the study site are fortunately not yet severely affected by mining activities and therefore represent significant and sensitive areas in terms of faunal conservation efforts.

Most of the study is therefore considered to exhibit a medium-high or high faunal sensitivity concerning the proposed Tailing Storage Facility and pipeline development.

5.7 Surface Water

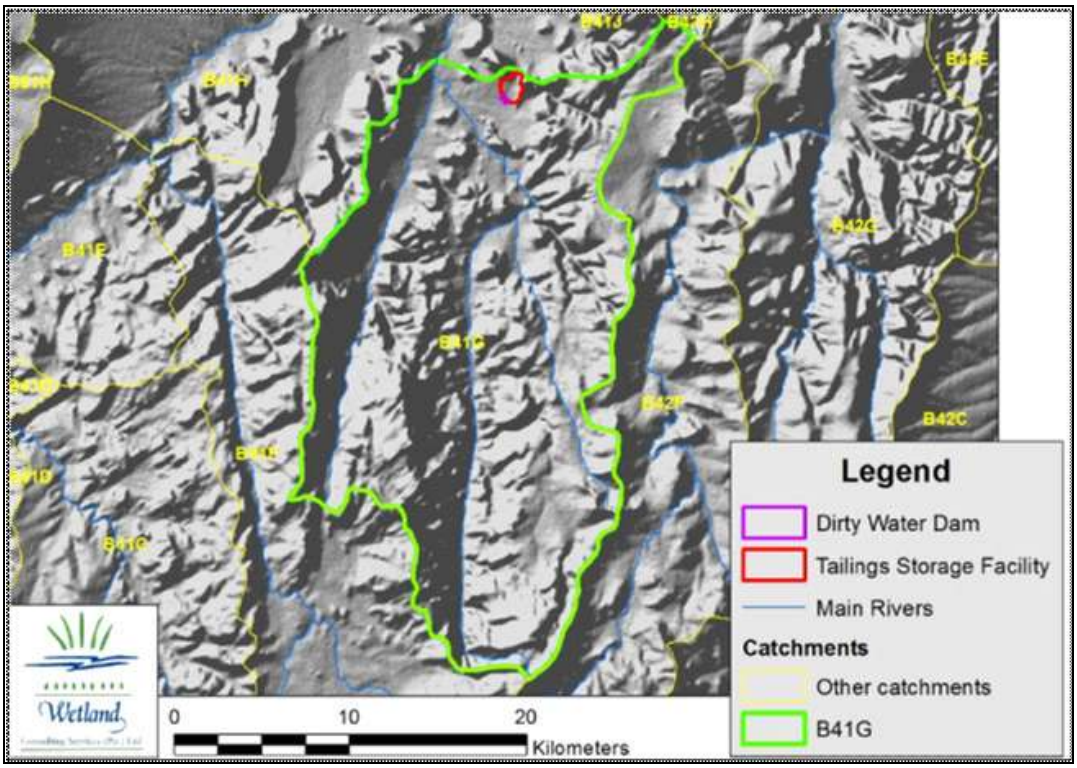
The Hydrological Assessment was undertaken by GCS in December 2012 which is attached under Appendix B-5. An additional floodline study was undertaken by GCS in September 2013, specifically for the finalized pipeline route. This study can be found in Appendix B-5a. The information below is extracted from both these reports.

5.7.1 Water Management Area and quaternary catchment

The project area is located within the B41G quaternary catchment (refer to Figure 5.10) of the Olifants Water Management Area (WMA), also referred to as WMA 4. The WMA is sub-divided into the four (4) sub-catchments, namely the Steelpoort and the Upper, Middle and Lower Olifants sub-catchments.

The Olifants River originates near Bethal in the Highveld of Mpumalanga, initially flowing northwards before curving eastwards and reaching Mozambique via the Kruger National Park. In Mozambique, the Olifants River joins the Limpopo River before discharging into the Indian Ocean.

The main tributaries of this WMA are the Wilge, Elands and Ga-Selati Rivers on the left bank, and the Steelpoort, Blyde and Klaserie Rivers.



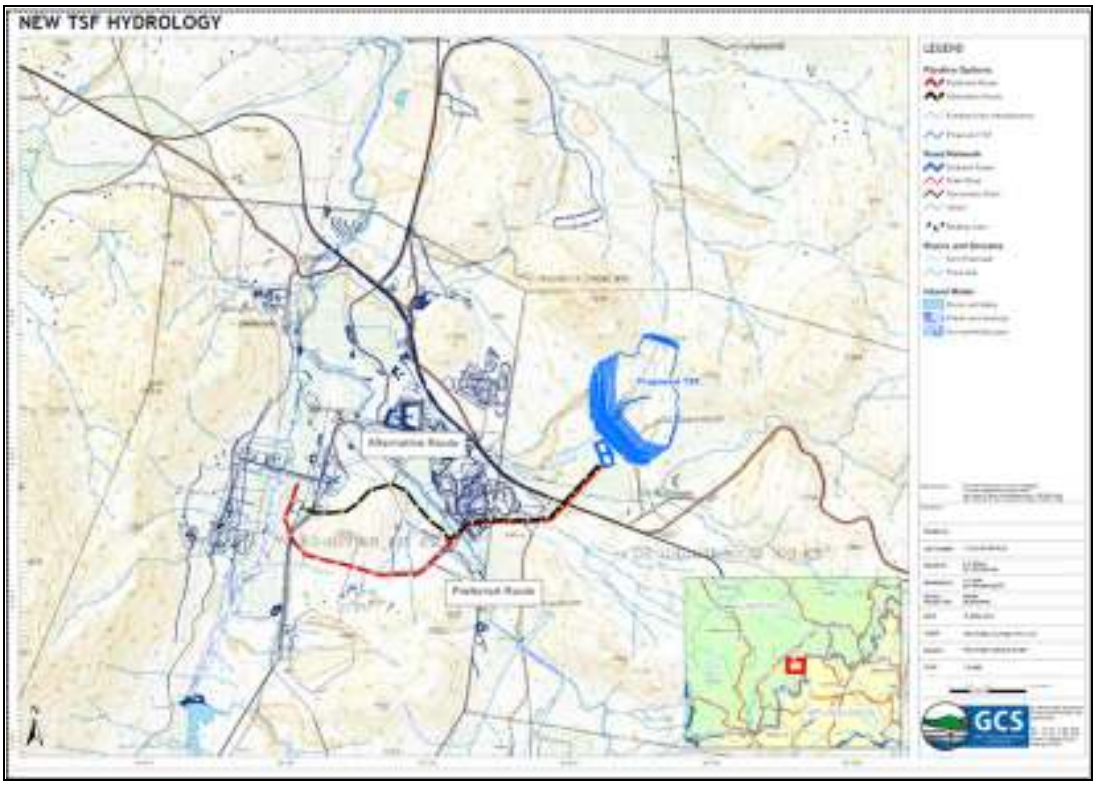
[FIGURE NOT TO SCALE – PLEASE REFER TO APPENDIX B-7]

Figure 5.10 Location of project area within quaternary catchment (Wetland Report, Appendix B-7)

5.7.2 Hydrology

The proposed New TSF area is traversed by non-perennial drainage channels which contribute to the Sprinkaanspruit, which is a non-perennial stream to the south of the site. The Springkaanspruit is a tributary of the Dwars River. The confluence of the Klein and Groot Dwars River is 3.5km to the west of the project area. The flow from these rivers contributes to the Steelpoort River, which is a tributary of the Olifants River.

The proposed tailings delivery pipeline will cross over several non-perennial tributaries of the Dwars River and the Sprngkaanspruit, as well as the Dwars River (please refer to Figure 5.11 below).



[FIGURE NOT TO SCALE – PLEASE REFER TO MAP ON THE ADJACENT PAGE]

Figure 5.11 General hydrology of the project area

5.7.3 Sub-catchment

The project area consists of a small sub-catchment (Refer to Figure 5.12). A few of the catchment properties are presented under Table 5.5.

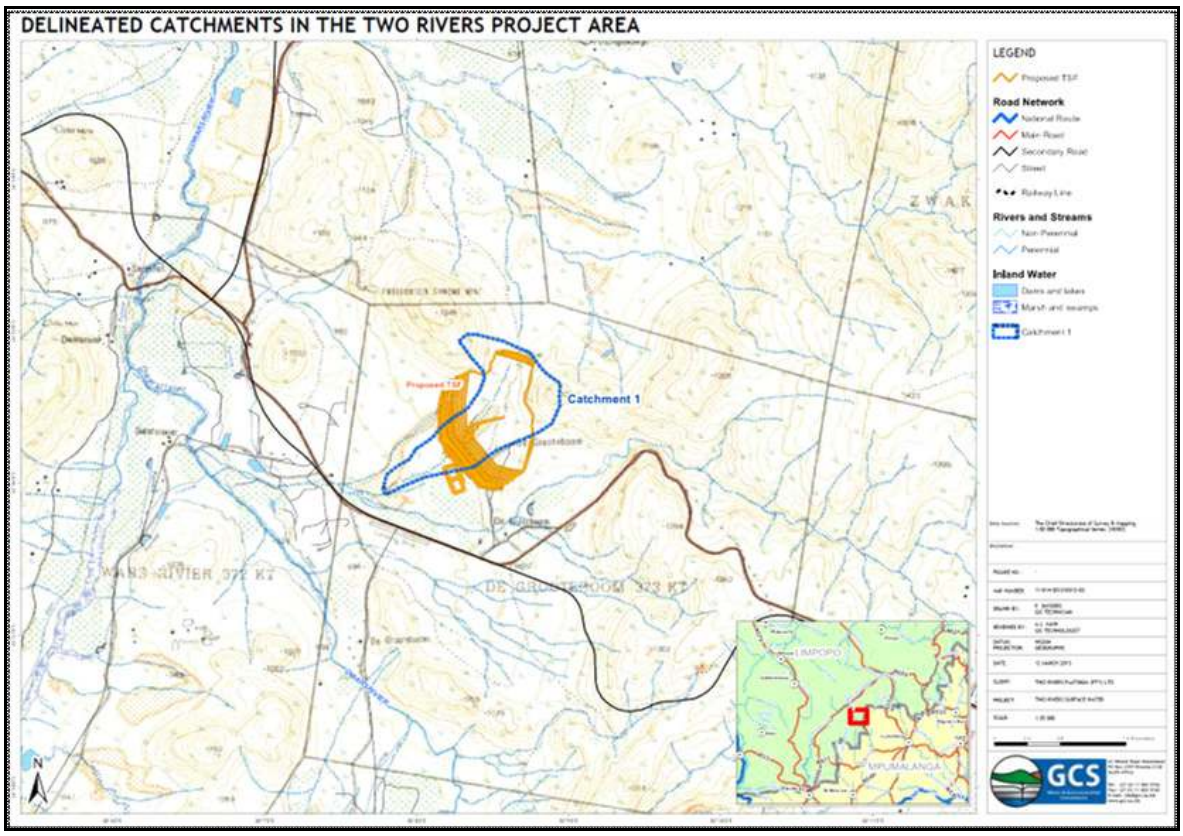
Table 5.5 Catchment properties

SUB-CATCHMENT	RIVER	SITE AREA		
		(m^2)	(km^2)	(Ha)
TSF sub-catchment	TSF stream	1 500 000	1.5	150

The catchment is rural. Some of the assumed properties of the catchment are shown in Table 5.6.

Table 5.6 Summary of Assumptions

SUMMARY OF ASSUMPTIONS WITH REGARDS TO MAIN CATCHMENT PROPERTIES	
AREA DISTRIBUTION (% OF TOTAL)	
Urban	0%
Lakes	0%
Rural area	100%
SURFACE SLOPE (% OF TOTAL AREA)	
Lakes & Pans	0%
Flat area	80%
Hilly	20%
Steep	0%
PERMEABILITY (% OF TOTAL AREA)	
Very permeable	20%
Permeable	50%
Semi-permeable	30%
Impermeable	0%
VEGETATION (% OF TOTAL AREA)	
Thick bush & forest	20%
Light bush & cultivated land	40%
Grasslands	40%
Bare	0%



[FIGURE NOT TO SCALE –REFER TO MAP ON ADJACENT PAGE]

Figure 5.12 Delineated TSF Catchment

5.7.4 Mean Annual Runoff (MAR)

The description of the calculations undertaken to derive the mean annual runoff (MAR) values for Sub-catchment 1 and the TSF area is described in section 6.5 of the Hydrology Report (Appendix B-5).

The MAR values are presented in Table 5.7, which also shows the percentages of the runoff from sub-catchment 1 and the proposed TSF area that make up the relevant quaternary catchment and water management areas.

These very low numbers indicate that the proposed TSF development will not have a significant impact on the runoff in the immediate or greater areas.

Table 5.7 Mean Annual Runoff for the Two Rivers sites

CATCHMENT	CORRECTION FACTOR MAR	BASIC MAR	% QUATERNARY CATCHMENT AREA	% WATER MANAGEMENT AREA
Sub-catchment 1	9.643E-06	0.083076923	0.34	0.035
TSF area	1.294E-05	0.093046154	0.38	0.04

5.7.5 Peak flows

The design depths (Refer to Table 5.8) are representative of a 24hour rainfall event over the catchments. It was decided to use the results of the TR102 data as these data are widely used throughout the professional hydrological and engineering industries and are associated with a high confidence level. These data were used within the Standard Design Flood methodology (Alexander, 2002) used to calculate peak flows for the catchment.

Table 5.8 Design rainfall depths for the Two Rivers area

RETURN PERIOD (YEAR)	MAARTENSHOOP RAIN DEPTH (TR102) (MM)	DESIGN RAINFALL ESTIMATION FOR SOUTH AFRICA (MM)
1: 50	129	153.4
1: 100	148	173.8

Four (4) methodologies were utilized to calculate and compare the peak flows for the catchment for the 1:50 and 1:100 year return periods. The results of these calculations are presented in Table 5.9.

Table 5.9 Peak flows as calculated using four methods

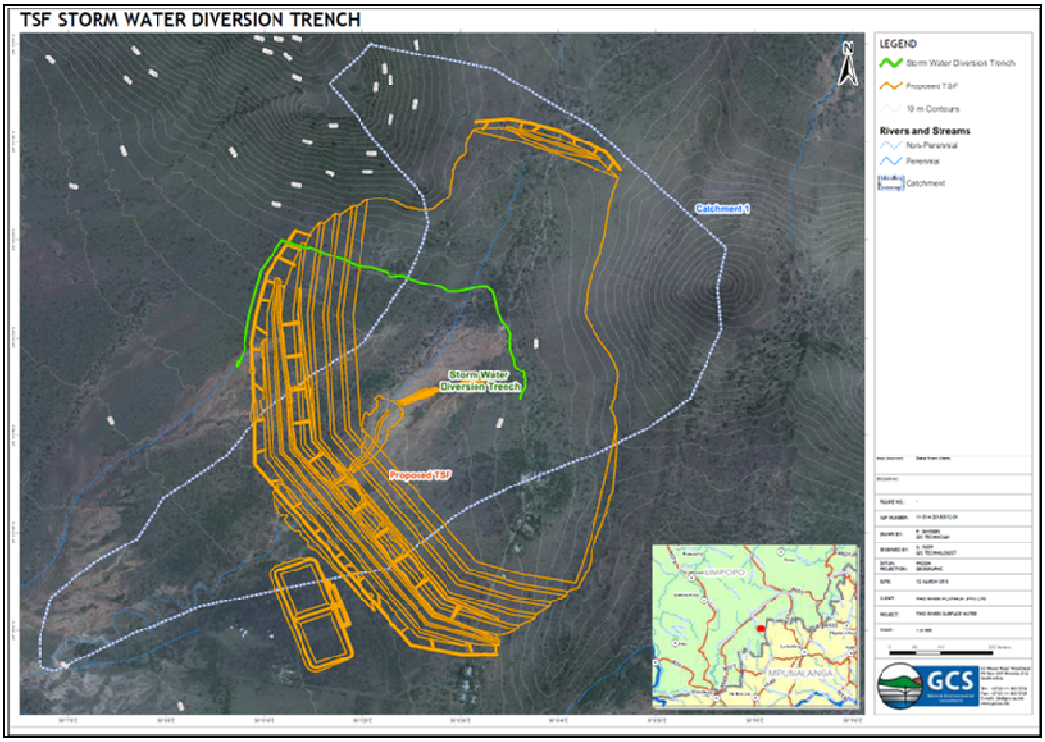
CATCHMENT	METHOD							
	RATIONAL		ALTERNATIVE RATIONAL		SDF		EMPIRCIAL	
	1:50	1:100	1:50	1:100	1:50	1:100	1:50	1:100
Catchment 1	21.69	32.18	26.80	37.20	40.30	50.5	24.79	31.22

Of the methodologies used here, the results using the SDF method were chosen to represent the peak flows in this catchment. This is because these results agree generally with the results calculated using the other methods; it is a conservative method; it is specifically set up for South African conditions; and it is widely used and accepted within the hydrology industry.

5.7.6 Floodlines and Stormwater Diversion

Floodlines were not necessary for the proposed TSF footprint as this area is located on top of a stream with other mining infrastructure around it. Stormwater will be diverted around the TSF shows the position of the proposed temporary stormwater diversion trench (Fig 5.13). On the outside of this trench is clean water and on the inside of this trench is dirty water.

For the pipeline route, he river sections were modeled in HEC-RAS by creating cross sections at various intervals or at positions in the river where the flow regime is anticipated to change. The resulting flood lines were calculated and can be seen in Section 7 of Appendix B5a . As the area in the immediate vicinity around the river channels is mostly flat and the soils are sandy, floods are attenuated and the flood lines reflect this. An exclusion zone was also indicated around the relevant river channels, in accordance with GN704 regulations.



[FIGURE NOT TO SCALE –REFER TO MAP ON ADJACENT PAGE]

Figure 5.13 Proposed Temporary Stormwater Diversion at TSF site

5.7.7 Surface Water Quality

Water samples taken from a sampling point in the vicinity of the proposed TSF site (named TR SW1, refer to the location map in Appendix B-5) were assessed. Sampling was done at TR SW1 for a spring period during September 2012 and serves as a baseline description of the quality of surface water on site. A laboratory analysis of the pH and chemical elements such as Sulphate and Magnesium (among others) did not show an impact from mining operations.

The water chemistry results were compared to the following standards:

- SANS 241: 2006: South African National Standards (SANS) for Drinking Water; and
- South African Water Quality Guidelines (SAWQG) Volume 1: Domestic Use (DWAF, 1996).

The water chemistry results were plotted in geochemical graphs in order to determine the type of water and the major chemical characteristics.

The water quality designation is either:

- *Not Impacted*, where the chemistry is compliant with the SAWQG (DWAF, 1996) and SANS Standards (SANS, 2006) target values, or did not indicate an impact of mining;
- *Possible Impact*, where there is a possible indication of coal mining influence (i.e. slightly elevated sulphate but still compliant with guideline values)
- *Impacted*, where there is a clear impact from mining operations (i.e. elevated and non-compliant concentrations of salts and sulphate).

The water quality analysis indicated sample TR SW1 (Figure 5.14) had slightly elevated conductivity, total dissolved solids, calcium, magnesium and metals, namely iron, manganese and aluminum.

The magnesium and metal concentrations were non-compliant for both the SANS and SAWQG standards. In terms of health effects, pronounced aesthetic effects (taste) along with problems with plumbing may be caused by the elevated iron concentration noted. Slight health effects in young children and sensitive individuals may be possible. Aluminium concentrations indicate no acute health effects are expected except at very high concentrations, however severe aesthetic effects (discolouration) may occur in the presence of iron or manganese (DWAF, 1996). No effects on health are expected from the manganese concentrations.

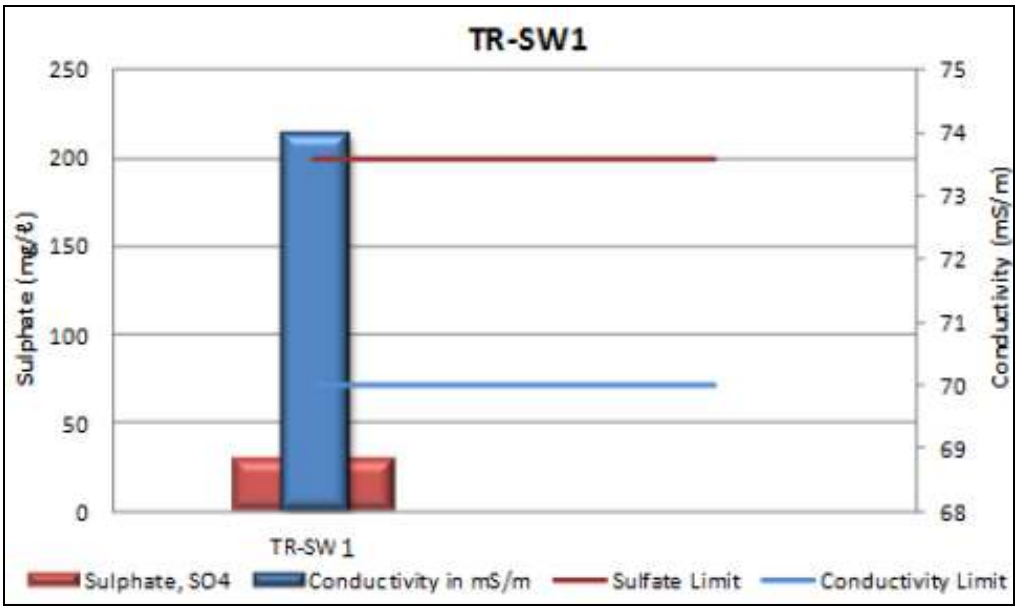


Figure 5.14 Sulphate and conductivity time series graph for TR SW 1

5.7.8 Downstream Water Users

The Lower Olifants Irrigation area consists of two (2) quaternary catchment areas downstream of the confluence of the Olifants and Doring Rivers. This area mainly comprises the irrigated farming area that occurs along the lower Olifants River valley and within the floodplain down to the estuary. This area also includes several small urban areas (DWA, 2011). The major concerns revolve around the limited availability of water during dry periods and the tendency for concentrations of salts and metals to increase during drought periods. Sulphates and other mining pollutants tend to facilitate cation exchanges that exacerbate water quality problems in Kruger Park, including aluminium toxicity that has been linked to cancer in fish populations and liver problems in crocodile populations.

Within South Africa, irrigation from the Olifants River below Steelpoort is rather limited. WR2005 indicates a total of approximately 3000ha of irrigated agriculture, concentrated mainly between the Steelpoort and Blyde Rivers (although large irrigation schemes exist on tributaries of the Olifants River). The river does, however, act as the primary source of drinking water for a number of small rural communities. Reduction of low flow rates and of water quality will have a significant impact on these communities. The quality of water (especially during periods of low flow) that flows through the Kruger National Park is important. In Mozambique, flow rates are effectively balanced by the large Masinga Dam, but salinity is a major problem in the roughly 100 000ha irrigation schemes served by this dam (Middleton & Bailey, 2009).

Using the WARMS Database (DWA, 2002), the following downstream users in catchments B41G and B41H were identified:
Catchment B41G comprises predominantly mining water users. Water for irrigated agriculture also makes up a significant portion of the water use in the catchment. The remainder of water used in the catchment is for watering livestock and non-urban industrial uses. Catchment B41H comprises mainly mining and irrigated agriculture. Schedule 1 users (water used for domestic purposes that does not need to be licensed) make up a smaller, but significant portion of the water users in the catchment and urban and non-urban industrial users, as well as urban users make up the remainder in small proportions.

5.8 Groundwater

The information in this section has been extracted from the Hydrogeological Impact Assessment Report, attached hereto as Appendix B-1.

Groundwater in the study area has been reported to be mostly controlled by a primary/shallow aquifer with some structurally controlled flow in the secondary aquifer. According to available data from the NGDB as well as previous reports (which included drilled borehole data) the water levels in the site area vary from 0.18 to 60.45 metres below ground level (mbgl).

5.8.1 Aquifer Description

The aquifers of the Bushveld Igneous Complex are characterised by a shallow weathered aquifer, and a low yielding fractured aquifer underlying it. Some primary aquifers are associated with the larger rivers, but these do not play a role at the proposed new TSF site.

According to the Johannesburg Hydrogeological map (Barnard, 1999) the dominant yield classes for this area may vary from 0.1 - 0.5 l/s. Some weathered zones can provide yields of between 2.0 - 5.0 l/s. This was confirmed by the drilling of boreholes near the proposed new TSF site.

5.8.2 Hydrocensus

The hydrocensus was conducted within a 2km maximum radius of 2km around the proposed new TSF site.

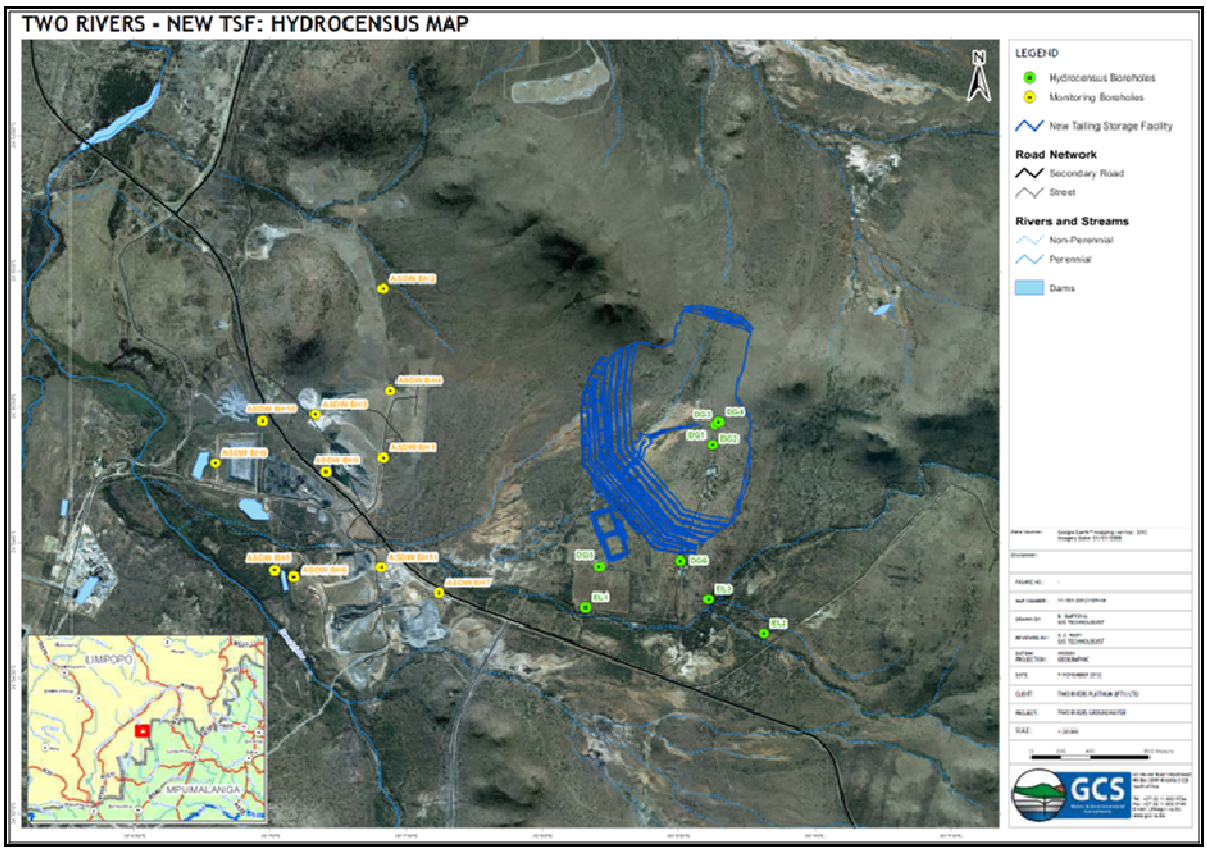
The hydrocensus data is presented in Table 5.10 and location of the boreholes identified is presented in Figure 5.15 (the Assmang Dwarsrivier Chrome Mine (Dwarsrivier Mine) monitoring

boreholes are also included in the map). A photographic record of the boreholes visited is included in Appendix A of the Hydrogeological Report.

A total of eight (8) boreholes and one (1) off-site spring were identified during the hydrocensus.

The following general groundwater usage was evident during the hydrocensus (Fig 5.15):

- One (1) borehole is solely used for domestic purposes (Annetjie, De Grooteboom – Challenger Drilling rents the property);
- Two (2) boreholes (DG1, EL3) are used for stock watering and irrigational water supply;
- The off-site spring water (DGF1) is used for domestic, stock watering and irrigational water supply (Annetjie, De Grooteboom – Seven (7) households renting); and
- Five (5) boreholes (Dg2, DG3, DG4, EL1 and EL2) were found not to be used by the owners.



[FIGURE NOT TO SCALE –REFER TO MAP IN THE GROUNDWATER REPORT APPENDIX B-1]

Figure 5.15 TSF Groundwater Hydrocensus

Table 5.10 Summary of hydrocensus results

BH ID	Coordinates (WGS84 LO31)		Property	Owner	Elevation	SWL	Collar	SWL-Collar	Field Measurements				Uses				Equipment	Comments
	E	S			(mamsl)	(mbgl)	(cm)	(mbgl)	pH	EC (mS/m)	TDS (ppt)	Temp. (°C)	Domestic	Stock water	Irrigation	None	(Pumps)	
DG1	-86493.36	-2758282.30	De Grooteboom	Annetjie	993	10.89	0.26	10.63	7.66	148	0.76	21.00	x	x	x		Submersible	Not often used - Supplies 7 Households
DG2	-86488.35	-2758276.72	De Grooteboom	Annetjie	1027	-	GL	-	-	-	-	-				x	None	Blocked @ 7.45m
DG3	-86474.04	-2758141.48	De Grooteboom	Annetjie	1044	12.01	0.26	11.75	7.63	153	0.84	21.40				x	None	
DG4	-86451.93	-2758123.61	De Grooteboom	Annetjie	1046	-	GL	-	-	-	-	-				x	None	Blocked @ 15.50m
DGF1	-	-	De Grooteboom	Annetjie	-	-	-	-	8.57	125	0.62	13.70	x	x	x		Pipeline	Fountain main supply for water - Supplies 7 Households
DG5	-87185.12	-2759115.34	De Grooteboom	Annetjie	993	Locked	-	-	-	-	-	-	x				Submersible	Borehole locked in a steel box
DG6	-86683.03	-2759073.72	De Grooteboom	Annetjie	1014	-	-	-	-	-	-	-	-	-	-	-	-	No Access Allowed
EL1	-87263.05	-2759091.46	Escal Lodge (De Grooteboom)	Reyno le Grange	989	5.10	0.20	4.90	-	-	-	-				x	Mono pump	
EL2	-86164.09	-2759560.89	Escal Lodge (De Grooteboom)	Reyno le Grange	1044	11.60	0.46	11.14	7.83	150	0.68	23.80				x	None	
EL3	-86506.96	-2759330.40	Escal Lodge (De Grooteboom)	Reyno le Grange	1018	Busy Pumping	GL	-	7.65	133	0.57	21.40	x	x	x		Submersible	Pumped to keep tank full - Level switch in tank
ASDW BH1	-88526.28	-2758380.56	Dwarsrivier	Dwarsrivier Chrome Mine	968	19.48	-	19.48	8.56	69.00	0.34	26.90				Monitoring	None	Data acquired from Dwarsrivier Chrome
ASDW BH2	-88535.73	-2757228.46	Dwarsrivier	Dwarsrivier Chrome Mine	964	13.58	-	13.58	8.63	89.00	0.45	26.20				Monitoring	None	Quarterly monitoring data last taken in August
ASDW BH3	-88950.45	-2758087.50	Dwarsrivier	Dwarsrivier Chrome Mine	950	17.94	-	17.94	8.63	63.00	0.31	25.20				Monitoring	None	
ASDW BH4	-88486.80	-2757922.76	Dwarsrivier	Dwarsrivier Chrome Mine	974	7.46	-	7.46	8.56	33.00	0.17	25.90				Monitoring	None	
ASDW BH5	-89193.07	-2759149.29	Dwarsrivier	Dwarsrivier Chrome Mine	936	7.85	-	7.85	8.97	75.00	0.38	21.00				Monitoring	None	
ASDW BH6	-89075.61	-2759193.95	Dwarsrivier	Dwarsrivier Chrome Mine	939	8.34	-	8.34	8.81	96.00	0.48	22.20				Monitoring	None	
ASDW BH7	-88175.92	-2759296.71	Dwarsrivier	Dwarsrivier Chrome Mine	968	9.38	-	9.38	8.74	56.00	0.28	24.50				Monitoring	None	
ASDW BH8	-88881.23	-2758480.34	Dwarsrivier	Dwarsrivier Chrome Mine	954	-	-	-	-	-	-	-				Monitoring	None	BH destroyed
ASDW BH9	-89566.52	-2758422.75	Dwarsrivier	Dwarsrivier Chrome Mine	927	2.98	-	2.98	8.91	84.00	0.42	24.50				Monitoring	None	
ASDW BH10	-89275.43	-2758135.03	Dwarsrivier	Dwarsrivier Chrome Mine	937	4.76	-	4.76	8.19	91.00	0.45	22.70				Monitoring	None	
ASDW BH11	-88531.56769	-2759127.279	Dwarsrivier	Dwarsrivier Chrome Mine	958	14.75	-	14.75	8.94	54.00	0.27	24.50				Monitoring	None	

mbgl – metres below ground level
SWL – static (ground) water level

5.8.3 Groundwater Levels

The static water levels in the site area measured during the hydrocensus ranged between 2.98 and 19.48 mbgl. The water levels of the boreholes located within the footprint area (DG1, DG2, DG3 and DG4) ranged from 8.82 to 11.75mbgl. Borehole EL3 could not be measured due to the pump installation.

The data includes information obtained from the neighboring Dwarsrivier Mine.

The average groundwater elevation for the study area was calculated to be 960 mamsl and ranged between 924 mamsl to 1033 mamsl.

Figure 5.16 shows the linear correlation between topography and groundwater level acquired from boreholes in the study area, i.e. a correlation of 98% (RMS). This suggests that groundwater flow generally follows the topography.

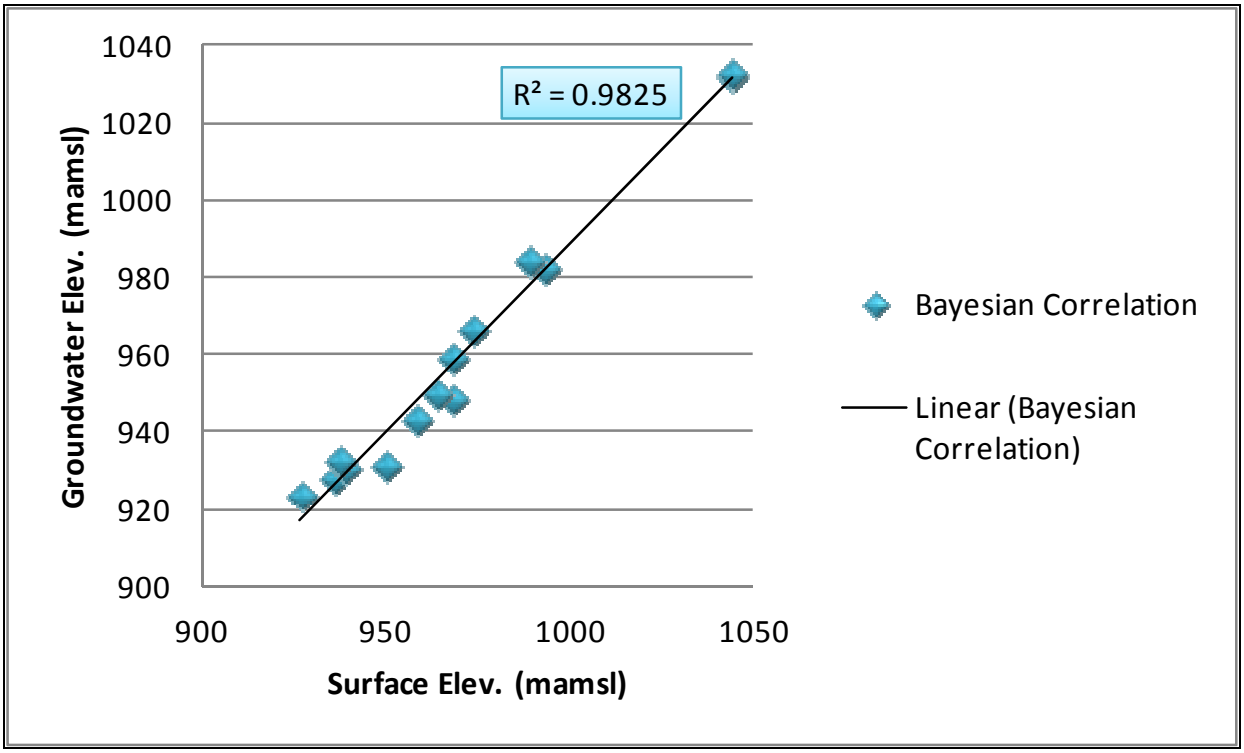
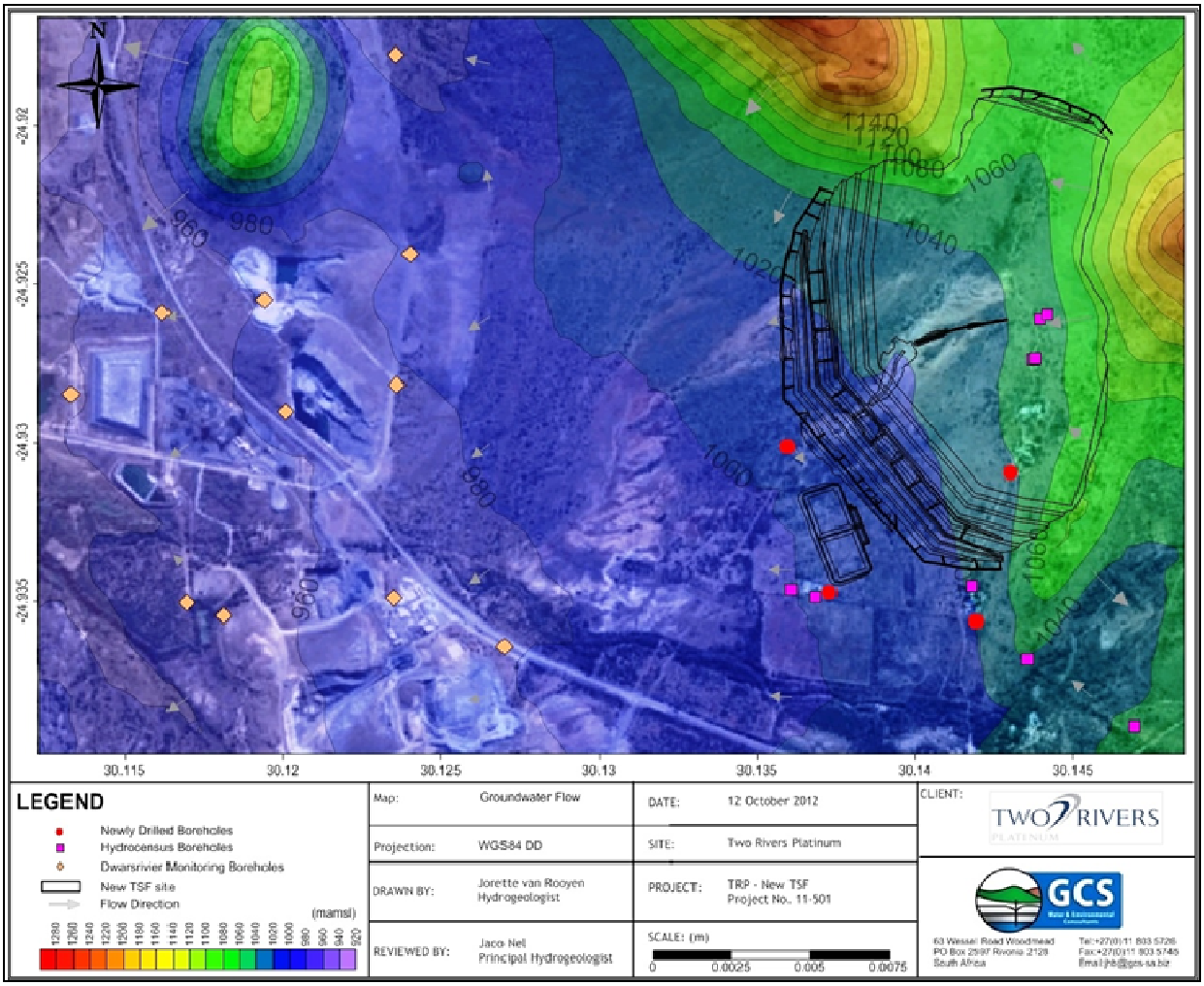


Figure 5.16 Linear relationship between topography and water elevation

A linear correlation was made between groundwater levels and surface topography elevations in order to extrapolate ambient groundwater elevations and flow directions. The interpreted groundwater level elevation contours are shown in Figure 5.17. Groundwater flow is general in a south westerly direction, towards the Groot Dwarsrivier and the Springkaanspruit.

The Groot Dwarsrivier is the main receptor of groundwater flow within the area. However, the Springkaanspruit could locally receive groundwater baseflow, especially in the wet season. Water was noted in the Springkaanspruit channel during the field investigation in the dry season (July 2012), suggesting some groundwater baseflow contribution.



[FIGURE NOT TO SCALE- REFER TO GROUNDWATER REPORT IN APPENDIX B-1]

Figure 5.17 Groundwater flow contours taken from the Groundwater Report in Appendix B-1

5.8.4 Geophysical Investigation

Ground geophysical methods were used to investigate the areas surrounding the proposed new TSF in an attempt to identify structures which could potentially enhance aquifer development. The magnetic method was applied in the identification of such structures, and once the data from the relevant traverses were analysed, the targets were demarcated

and drilled. The geophysical interpretation graphs are included in Appendix B of the Hydrogeological Report.

5.8.5 Aquifer Testing

5.8.5.1 Drilling Summary

A total of four (4) hydrogeological test or monitoring boreholes were drilled, between 4 and 7 September 2012, with borehole depths ranging between 30m and 40m. The drilling results are summarised in Table 5.11, and detailed geological logs are presented in Appendix C of the Hydrogeological Report. The newly drilled boreholes are included in Figure 5.17

The drilling results can be summarised as follows:

- TRP GWM18, situated down gradient (south) of the proposed TSF, was drilled to a total depth of 40 m and the final blow out yield was 4l /s encountered in the shallow weathered zone;
- TRP GWM19, situated down gradient (southwest) of the proposed TSF, was drilled to a total depth of 40m. The borehole intersected two(2) water strikes during the drilling, namely at depths of 25 and 36 m, with a final blow-out yield of 2.5l/s; and
- TRP GWM20 and TRP GWM21 (downgradient towards the southeast of the proposed TSF) yielded no significant groundwater with only shallow seepage intersected at 10 and 8m respectively.

Table 5.11 Drilling summary

BH ID	COORDINATES (WGS 84 LO31)		ELEV.	DEPTH	WATER STRIKE	BLOW-OUT YIELD	COLLAR	SWL	GEOPHYSICAL STATION
	E	S	(mamsl)	(mbgl)	(mbgl)	(l/s)	(m)	(mbgl)	(m)
TRP GWM18	-87138.76	-2759098.43	989	40	20	4	0.46	11.54	L1_355m
TRP GWM19	-87277.34	-2758590.81	993	40	25 & 36	2.5	0.51	20.49	L4_205m
TRP GWM20	-86669.42	-2759198.48	1013	40	10	Seepage	0.57	10.21	L2-75m
TRP GWM21	-86562.60	-2758677.12	1030	30	8	Seepage	0.5	8.32	L3_25m

mbgl – metres below ground level
SWL – static (ground)water level

5.8.5.2 Pump Test Results

Pumping tests were conducted from 2 to 5 October 2012 on all four (4) newly drilled boreholes.

The constant discharge pumping tests were tested at abstraction rates that ranged between 0.40 and 1.45 l/s. Test duration for the constant discharge tests ranged between 25 to 480 minutes. The constant discharge pumping tests were followed by recovery testing.

The pumping test data was interpreted using the Cooper-Jacob (1946) method, for drawdown data, and the Theis residual drawdown method, for the recovery data. The two (2) methods were used so that the results of both methods could be compared to ensure the accuracy of the results obtained. Table 8.6 represented a summary of the aquifer test results and the aquifer test plots and interpretations were presented in Appendix D of the Hydrogeology Report. The transmissivity1 values, as calculated from the pumping test data, are about 2 m^2/day for boreholes with measurable water-strikes.

Table 5.12 Aquifer testing summary

BH ID	MAIN WATER STRIKE	SWL	CD ABSTRACTION RATE	CD TEST DURATION	MAXIMUM DRAWDOWN FOR CD TEST	RECOVERY TEST DURATION	TRANSMISSIVITY (M^2/D)	
	(mbgl)	(mbgl)	(l/s)	(min)	(m)	min (%)	Cooper-Jacob Method	Theis Recovery Method
TRP GWM18	20	12.06	1.45	480	0.27	90 (90%)	2.1	1.8
TRP GWM19	25	21.11	1.45	480	0.49	90 (80%)	1.9	1.9
TRP GWM20	10	10.94	0.4	90	27.06	200 (90%)	0.002	0.0019
TRP GWM21	8	8.77	0.4	25	18.23	120 (97%)	0.003	0.0016

mbgl – metres below ground level
SWL – static (ground)water level
CD – Constant discharge pumping test

5.8.6 Groundwater quality

A total of six (6) groundwater samples were analysed. Samples were collected during the GCS 2012 hydrocensus as well as from the newly drilled monitoring boreholes. Three (3) samples were collected from the existing TSF to identify chemicals of concern as result of

[1] Transmissivity is a measure of the ease with which groundwater flows in the subsurface. It is the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.

plant processes. The process and tailings water quality from the existing TRP TSF and RWD is expected to be similar for the proposed new TSF.

The chemistry data was compared to the DWA's South Africa Water Quality Guidelines (SAWQG, 1996) for Domestic Use target values and the South Africa National Standard Drinking Water Standard (SANS241:2011) maximum allowable concentrations (Table 5.13).

The following observations were made from the results:

- Except for the nitrate (N) values in TRP GWM21, which exceeds the max allowable standards for drinking water, all boreholes showed compliance with the maximum allowable standards for all constituents. The high nitrate can be a result of the nearby house septic system combined with some livestock kraals;
- All boreholes exceeded the SAWQG Domestic Use target values for magnesium (Mg). Elevated magnesium concentrations are often encountered in Bushveld Igneous Complex aquifers due to natural groundwater and host rock chemical reactions;
- All boreholes but one (DGF1) exceeded the SAWQG Domestic Use target values for drinking calcium (Ca). Elevated calcium is also often typical of ambient Bushveld Igneous Complex aquifers;
- TRP GWM18 and TRP GWM18 exceeded the SAWQG Domestic Use target values for total dissolved solids (TDS) but remained compliant with the max allowable Drinking Water Standards;
- TRP GWM18 exceeded the SAWQG Domestic Use target value for nitrate (N). This borehole is close to a chicken brooder and some small cattle kraals, which might contribute to the nitrate concentration.
- All samples from the existing TSF (pool water, slurry water and return water dam) exceed the maximum allowable standard for drinking water, with regard to electrical conductivity, nitrate and sodium. These elevated concentrations are probably due to plant processes and the recirculation of water exposed to evaporative processes.

Table 5.13 Groundwater and surface water quality within the study area

Parameter (mg/l)	DWA SAWQG Domestic Water (Target Values)	SANS 241-1: 2011 Drinking Water Standards (Max Allowable)	TRP GWM18	TRP GWM19	TRP GWM20	TRP GWM21	DGF1	EL3	Existing TSF Slurry Water	Existing TSF Pool Water	Existing TSF Return Water Dam
pH	6-9	5-9.7	7.65	7.72	7.75	7.79	8.57	7.87	8.58	7.78	8.39
Conductivity mS/m	<70	<170	107.4	77.6	91	118.7	67.7	88.4	201.1	211.3	201.2
Total Dissolved Solids	<450	<1200	492	395	448	577	326	417	880	938	1085
Total Alkalinity as $CaCO_3$	NS	NS	406.83	357.85	396.23	385.07	321.9	403.1	206.81	205.77	235.35
Chloride, Cl	<100	<300	23.8	5.86	10.85	43.53	5.55	12.93	149.07	131.82	179.63
Sulphate, SO_4	<200	<500	53.82	44.55	43.43	60.98	26.09	29.48	171.47	206.44	323.8
Nitrate as N	<6	<11	9.12	0.615	4.15	31.9	<0.057	0.163	95.6	110	58.4
Free and Saline Ammonia as N	<1	NS	0.127	0.107	0.117	0.131	0.199	0.37	31.34	31.34	15.89
Orthophosphate, PO_4 as P	NS	NS	0.24	0.085	0.12	0.091	0.169	0.106	0.101	0.103	0.036
Fluoride, F	1	1.5	0.186	<0.183	0.189	0.209	<0.183	0.189	0.907	1.121	0.382
Calcium, Ca	<32	NS	67.38	56.02	80.19	119.17	27.37	44.53	18.16	26.4	46.52
Magnesium, Mg (mg/l)	<30	NS	79.7	58.47	54.51	74.97	67.96	78.93	49.85	57.93	61.46
Sodium, Na	<100	<200	13.62	13.94	16.22	15.2	5.42	8.13	204.69	212.72	227.51
Potassium, K	<50	NS	0.36	0.44	0.26	0.32	0.49	0.15	34.61	36.66	30
Aluminium, Al	<0.15	NS	<0.006	<0.006	<0.006	<0.006	0.088	<0.006	0.067	<0.006	<0.006
Iron, Fe	<0.1	2	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.463	<0.006	<0.006
Manganese, Mn	<0.05	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Chromium, Cr	NS	0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.019	<0.002	<0.002
Copper, Cu	<1.0	2	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.004	<0.001
Nickel, Ni	NS	<0.15	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Zinc, Zn	<3	5	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Cobalt, Co	NS	<0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium, Cd	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead, Pb	<0.01	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Hardness as CaCO3	NS	NS	496	381	425	606	348	436	251	304	369
Silicon, Si	NS	NS	22.94	26.34	25.09	25.47	26.62	30.31	9.314	13.5	8.961
Silver, Ag	NS	NS	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron, B	NS	NS	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium, Ba	NS	NS	0.036	0.007	0.017	0.017	0.005	0.013	0.021	0.025	0.048

Beryllium, Be	**NS**	**NS**	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Bismuth, Bi	**NS**	**NS**	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.01
Gallium, Ga	**NS**	**NS**	0.012	0.012	0.012	0.013	0.01	0.012	0.008	0.009	0.01
Lithium, Li	**NS**	**NS**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001
Molybdenum, Mo	**NS**	**NS**	0.025	0.026	0.026	0.026	0.026	0.027	0.063	0.056	0.085
Rubidium, Rb	**NS**	**NS**	0.157	0.114	0.164	0.158	0.069	0.146	0.146	0.144	0.124
Strontium, Sr	**NS**	**NS**	0.29	0.25	0.29	0.41	0.1	0.21	0.09	0.12	0.32
Tellurium, Te	**NS**	**NS**	0.04	0.04	0.04	0.05	0.04	0.04	0.06	0.05	0.05
Thallium, Tl	**NS**	**NS**	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09	<0.09
Vanadium, V	**<0.1**	**<0.2**	0.015	0.013	0.01	0.011	0.009	0.02	<0.003	0.005	0.006

The groundwater and surface water quality results were plotted on a Piper diagram (Figure 5.18). The Piper diagram is a trilinear plot that groups the water chemistry of the samples according to main cations and anions, assisting with the identification of different water types. The dominant water type for the area is magnesium, calcium – bicarbonate, typically of Bushveld Igneous Complex aquifers.

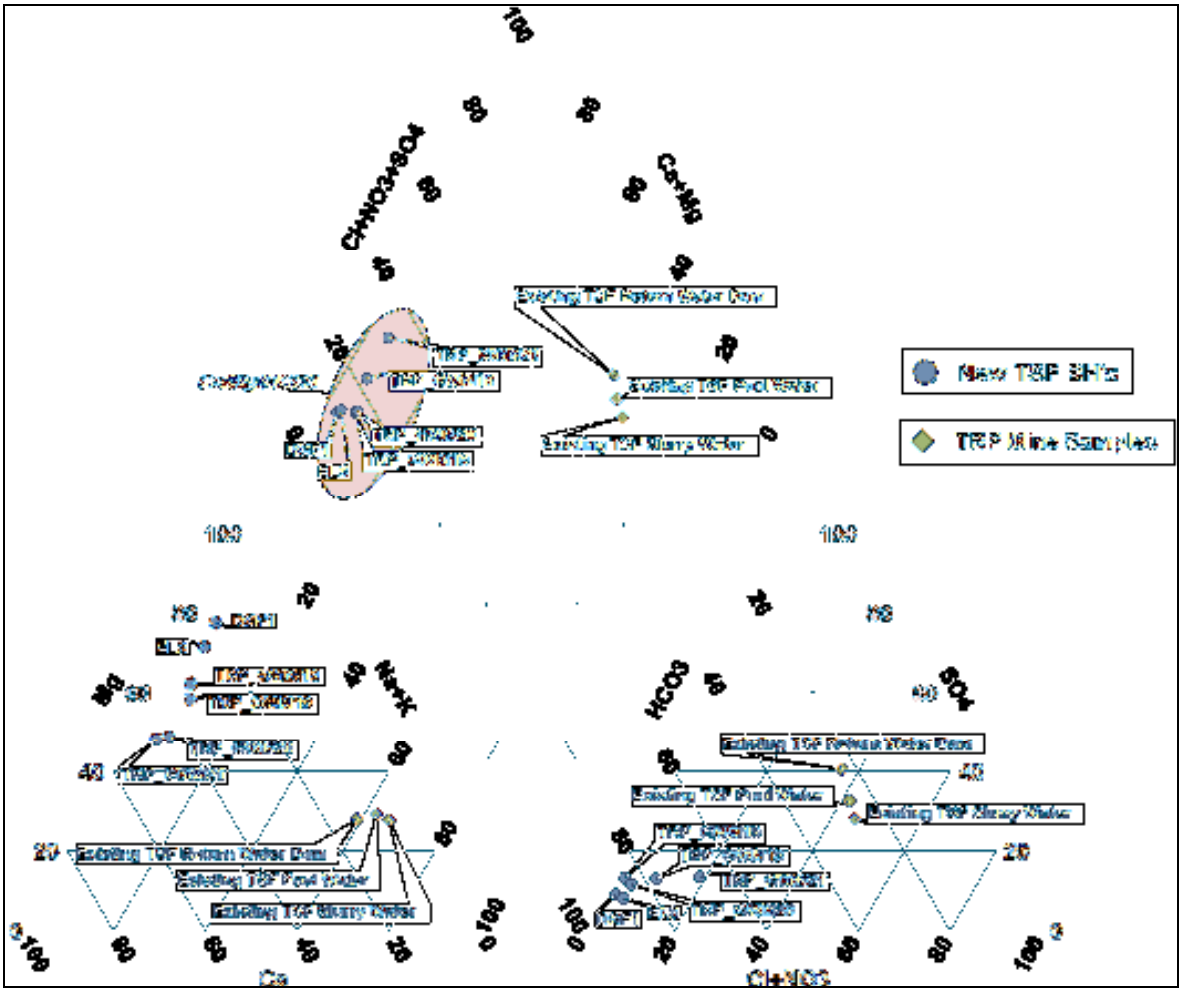


Figure 5.18 New TSF Piper diagram

The results were compared to the SAWQG Domestic Use target values and SANS Drinking Water Standards, maximum allowable concentrations, in order to identify the potential chemicals of concern2. The process and tailings water quality is expected to be similar for the proposed New TSF. Nitrate is the main chemical of concern. The elevated sodium, sulphate and chloride concentrations could also contribute to groundwater contamination.

[2] Chemicals of concern – specific constituents that are identified for evaluation in the risk assessment process. The term is used in this report for constituents of non-compliance and which may be of concern in terms of groundwater contamination.

5.9 Air Quality

An Air Quality Assessment was undertaken in December 2012 by Airshed Planning Professionals. Refer to Appendix B-8. The information contained in this section has been extracted from this report which was undertaken with the focus on the TRP current and future operations.

The sensitive receptors closest to the TRP mine (approximately 3km to the west of the proposed TSF site) are two informal settlements, referred to as Village 1 and Village 2 in the air quality report and the residential areas of Ga-Mampuru, Kokwaneng, Madimola and Didingwe River Lodge (Refer to Figure 5.19).

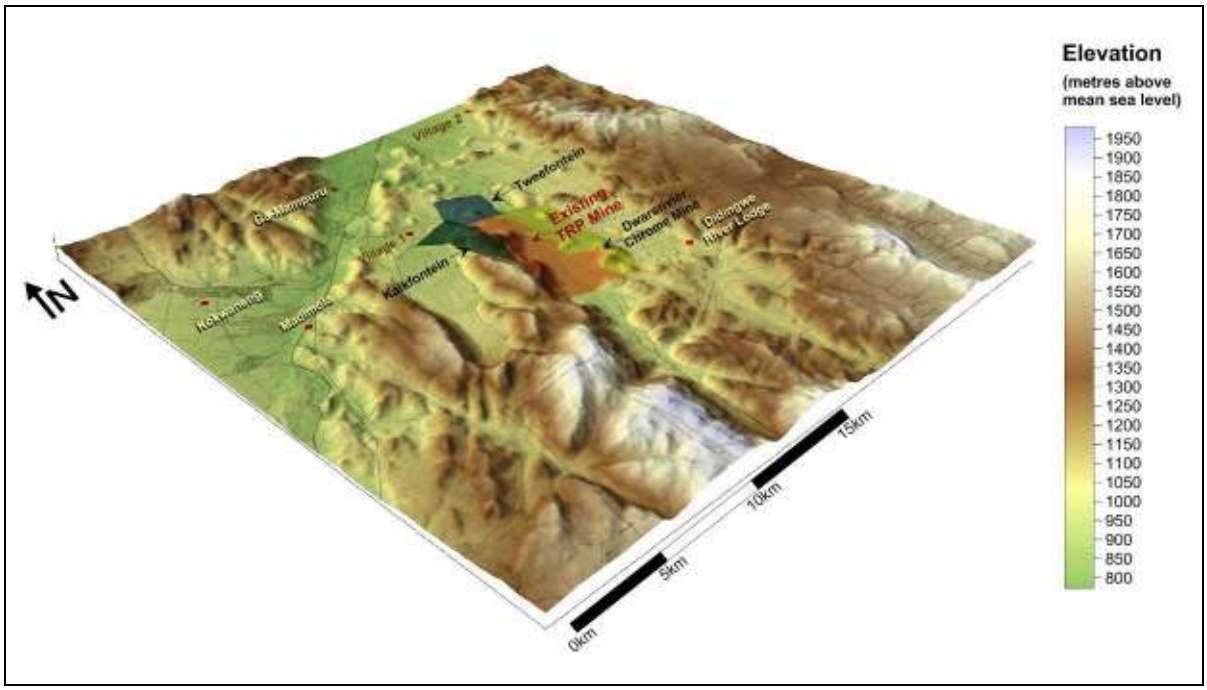
Local source contributors to ambient PM10 (airborne particulates) concentrations in the vicinity of the study site are:

- Domestic fuel burning and vehicle activity in residential areas/sensitive receptors close to the mine;
- Surrounding chrome and platinum mining activities;
- Cattle ranching in the Steelpoort Valley;
- Agricultural activities and limited cultivation in fertile areas adjacent to the Steelpoort River.

It can be assumed the surrounding chrome and platinum mining activities is the largest source contributor in the area. The existing mines in the vicinity of the project area shown in Figure 5.20. The rock dumps, gravel roads, crushing of ore, possible open pit operations and TSFs associated with these mines produce dust which contributes to the overall atmospheric dust load in the area.

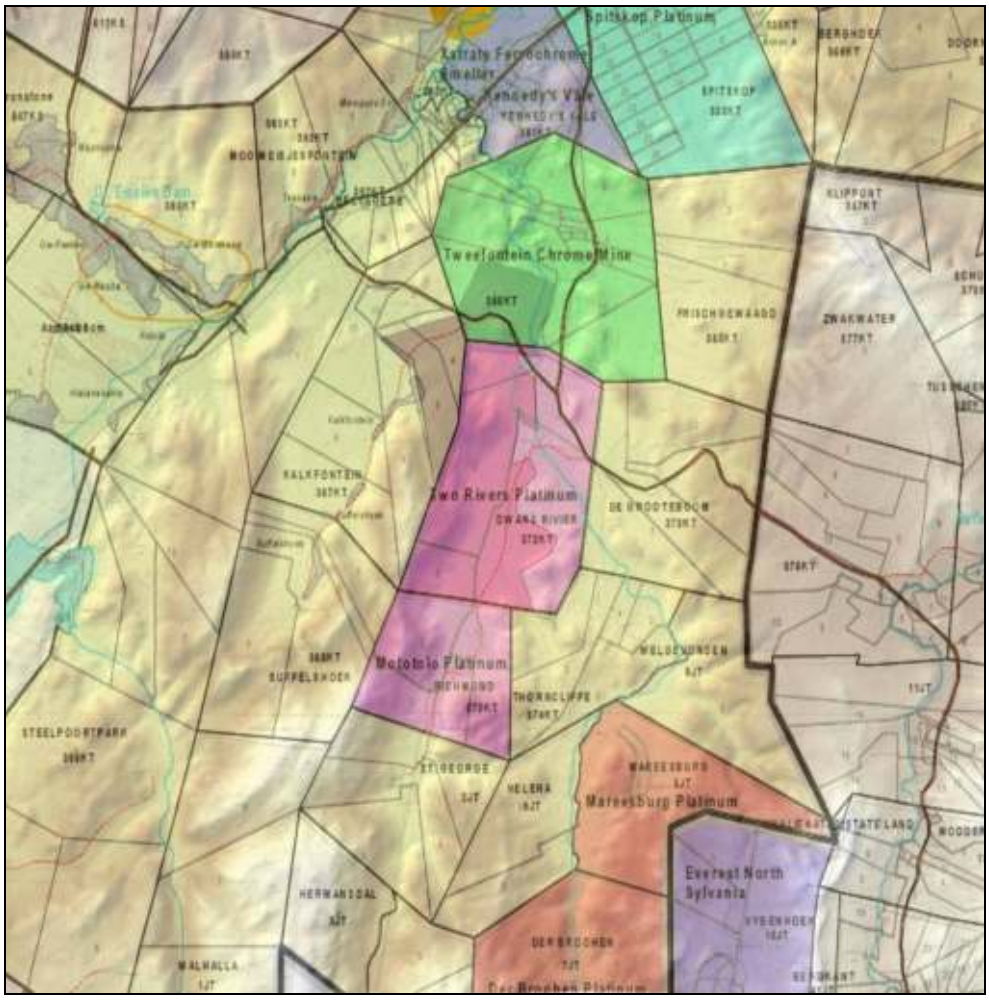
The results of the predictions of the ambient PM10 concentrations due to operations at the adjacent Dwarsrivier Chrome Mine (sourced from the online available Environmental Management Report for Dwarsrivier Chrome Mine by EScience Associates, 2010) show no exceedance of the PM10 annual average standard and only a marginal exceedance of the PM10 daily average standard at the western mine boundary (shared with TRP).

However, the pollutants originating at the TRP may also impact the air quality of surrounding areas, and cumulative impacts may be of some environmental significance.



[FIGURE NOT TO SCALE]

Figure 5.19 Sensitive receptors in the vicinity of the project area



[FIGURE NOT TO SCALE]

Figure 5.20 Existing mines in the vicinity of the project area

5.10 Noise

The existing noise levels in the vicinity of the proposed New TRP site include traffic on the R555 road and mining activities. Environments which are recognized as being noise sensitive include residential areas, offices, educational facilities and health and church buildings.

None of these sensitive environments exist in close proximity to the TRP mining area.

5.11 Visual

A Visual Impact Assessment (VIA) was undertaken by GCS in December 2012 (Refer to Appendix B-3). The information in this section is extracted from this report. Please note that a number of queries regarding the visual impact assessment were raised during the draft EIA phase. The Visual Impact Assessment Report has been updated with new information accordingly. **A second visual impact assessment was also conducted in September 2013, specifically for the New TSF pipeline route**, and this study was incorporated with the initial Visual Impact Assessment Report.

5.11.1 Visual Quality and Character

Although the proposed TSF site and tailings delivery route are located within a remote area, the presence of mining and heavy industry within the greater precinct of the project area detracts from the natural charm of the natural landscape and vegetation.

The transport network within the area comprises of a network of secondary roads that connect a number of the mines in the region to the R555, approximately 10km north east of the TRP Mine, and the R577. No major roads (e.g. R555 and R577) form part of the 'zone of visual influence'.

5.11.2 Sense of place

Central to the concept of sense of place is that the landscape requires uniqueness and distinctiveness. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area.

The project area lies in the valley of the Dwars and Groot Dwars Rivers, surrounded by large hills which form part of the Schurinksberg range. The majority of the land use is occupied by thicket / bushland with mining activities forming a major part of the greater precinct. The area has a rural, bushveld atmosphere with mining activity forming a major part of the regional economy (Refer to Photo 5.3 and Photo 5.4).

It has been established that the study area presents a moderately disturbed sense of place primarily due to the existing mining activities. Although it is disturbed, the pleasant scenery and rural atmosphere adds attraction to the region.

Photo 5.3 Sense of place: Mining activities north-west of proposed TSF

Photo 5.4 Sense of place: Surrounding thicket and bushland

5.11.3 Viewer Groups

Areas with relatively high volumes of traffic such as the secondary road running adjacent to the proposed TSF and residential homesteads were regarded as critical view zones against which the visual impact would be evaluated.

Viewer groups are a collection of viewers that are involved with similar activities and experience similar views of a development. The visual receptors are grouped according to the similarities in views. The visual receptors included in this study are:

- **Residents:** In the case of static views, such as views from buildings, the visual relationship between an activity and the landscape will not change. The cone of vision is relatively wide and the viewer tends to scan back and forth across the landscape.

Residents of the affected environment are therefore classified as visual receptors of high sensitivity owing to their sustained visual exposure to the proposed development as well as their attentive interest towards their living environment. Residential dwellings were identified within the TSF footprint area. These were excluded as it is assumed that a relocation programme is in place for these receptors;

- **Tourists:** Tourists are regarded as visual receptors of exceptionally high sensitivity. Their attention is focused towards the landscape which they essentially utilise for enjoyment purposes and appreciation of the quality of the landscape. No tourists were identified as visual receptors; and
- **Motorists:** Motorists are generally classified as low sensitivity receptors due to their momentary views and experience of the proposed development. Under normal conditions, views from a moving vehicle are dynamic as the visual relationship between the activity is constantly changing as well as the visual relationship between the activity and the landscape in which they are seen. The view cone for motorists, particularly drivers, is generally narrower than for static viewers. Motorists will therefore show low levels of sensitivity as their attention is focused on the road and their exposure to roadside objects is brief. Motorists were identified as those travelling along the secondary road adjacent to the proposed TSF. The simulation from this road was from approximately 2km south east of the proposed TSF.

The visual receptors will be affected because of alterations to their views due to the proposed project. Residents and motorists were the sensitive viewers identified within the zone of influence.

5.12 Archaeology and Heritage

A Heritage Impact Assessment (HIA) was undertaken by Archaetnos Culture and Cultural Consultants in October 2012 (Refer to Appendix B-6**). A second HIA was undertaken in September 2013, also by Archnaeotos, specifically for the Proposed TSF pipeline route**, this report is contained in Appendix B-6a.

5.12.1 Field survey of the TSF site footprint

A field survey was undertaken of the proposed 158.3ha TSF footprint area by the archaeologist (Refer to Figure 5.21).

Figure 5.21 GPS track of HIA survey area

The area that was surveyed shows some signs of disturbance by past human interventions, but mostly seems to be undisturbed. Over-grazing also appears to have contributed to the disturbance of the area.

Erosion dongas have formed in the southern part of the project area, one of which is being used to dispose of refuse (Refer to Photo 5.5 and Photo 5.6). A very small portion of the land within the southern part of the project area was once a ploughed field.

Photo 5.5 One of the erosion dongas within project area

Photo 5.6 Refuse within an erosion donga

A number of farm and other buildings are found along a road in the south-east. None of these have any heritage significance.

No sites of cultural heritage significance were located in the surveyed area. Three (3) Middle Stone Age tools and one (1) Iron Age potsherd were however found, in different locations in the erosion dongas.

5.12.2 Stone Age

The Stone Age is the period in human history when lithic material was mainly used to produce tools (Coertze & Coertze 1996: 293). In South Africa the Stone Age can be divided in three periods (according to Korsman & Meyer (1999: 93-94)). These dates, however, are relative and only provide a broad framework for interpretation:

- Early Stone Age (ESA) 2 million – 150 000 years ago;
- Middle Stone Age (MSA) 150 000 – 30 000 years ago; and
- Late Stone Age (LSA) 40 000 years ago – 1850 - A.D.

No Stone Age sites are indicated in a historical atlas of this area. However this may only indicate a lack of research in the area. The closest Stone Age sites indicated in the atlas is Middle and Late Stone Age sites close to Ohrigstad (Bergh 1999: 5). Stone Age material was however found during various surveys in and around Steelpoort. This includes rock paintings at the TRP Mine (Archaetnos database). During a survey done on neighboring

farms, some Middle Stone Age material was also recorded (Stegmann & Roodt (2012a & 2012b).

The environment would be supportive to Stone Age activities. The nearby mountain gives natural shelter and material to make stone tools from. The streams would have attracted animals as a water source, which have attracted people hunting these animals. The natural rock, however, includes calcrete and other soft stones, which would have limited the resources from which to make stone tools. Tool-making would most likely have been limited to the mountain tops. The possibility exists for the discovery of stone tools during construction work on the site.

The three (3) Middle Stone Age tools found in different locations during the survey were most likely washed down from the top. One of these is a very fine example of a point which was also used as a scraper (Refer to Photo 5.7).

Photo 5.7 Middle Stone Age tool found during the survey

5.12.3 Iron Age

The Iron Age refers to the period of human history when metal was mainly used to produce metal artifacts (Coertze & Coertze 1996: 346). In South Africa it can be divided in two separate phases according to Van der Ryst & Meyer (1999: 96-98), namely:

- Early Iron Age (EIA) 200 – 1000 A.D; and
- Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however, indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

- Early Iron Age (EIA) 250 – 900 A.D;
- Middle Iron Age (MIA) 900 – 1300 A.D; and
- Late Iron Age (LIA) 1300 – 1840 A.D.

The closest Early Iron Age site to the surveyed area is the sites at Lydenburg and Klingbeil to the south-east of the surveyed area. A large number of Late Iron Age sites have previously been identified in an area roughly stretching between Lydenburg, Nelspruit and Badplaas (Bergh 1999: 6-7). Other sites have also been identified by Archaetnos during surveys in the area (Archaetnos database). Stegmann & Roodt (2012a) has also found Iron Age remains on nearby farms.

Such sites may also be found higher up in the mountains. It is therefore most likely that the single undecorated Iron Age potsherd which was picked up in one of the erosion dongas was washed down from the mountain. No site was however identified.

The environment of the surveyed area is suitable for Iron Age people. The mountain would give shelter and building material and the valley would provide grazing for livestock as well as water.

5.12.4 Historical Age (graves)

The Historical Age started with the first recorded oral histories in the area. It includes the in-migration of people that were able to read and write. It is also known that one of the early trade routes passed along the Steelpoort River (Bergh 1999: 9).

At the beginning of the 19th century the area was inhabited by the Koni, Tau, Pedi and Roka who are all of Sotho origin. During the Difaquane, in ca.1822, the Ndebele of Mzilikazi entered this area from the south. In 1825 a Zulu group under Zwide attacked the Ndebele here. As a result these other groups fled to the north. They returned later on (Bergh 1999: 10-11).

None of the early travelers who visited the old Transvaal visited this area. In 1836 the Voortrekker groups of Tregardt and Van Rensburg passed to the west of the Steelpoort River (Bergh 1999: 13-14). The land around Lydenburg, including the Steelpoort River Valley was traded from the Swazi in 1846 and the first white settlers then started farming here (Bergh 1999: 16, 130-132).

Historical structures, such as farm houses and infrastructure may therefore be found in the area. Such buildings have been identified on neighboring farms during past surveys (Archaetnos database). Stegmann & Roodt (2012a & 2012b) also have identified settlement remains in the vicinity. Signs of the earliest historical mining activities were also identified on adjacent farms (Archaetnos database; Stegmann & Roodt 2012a).

Many graves from this period are also known from other nearby farms (Archaetnos database; Stegmann & Roodt 2012a & 2012b). Farm workers on De Grooteboom, who have been living there for eighteen years, however indicated that they do not know of any graves on the surveyed area.

5.12.5 Field survey of the TSF Pipeline Route

During the survey no sites of cultural heritage significance was located in the area to be developed. A few stone tools were however found. Refer to Appendix B-6a which gives a full description of the study that was undertaken on the pipeline route.

5.13 Wetlands and Riparian Zones

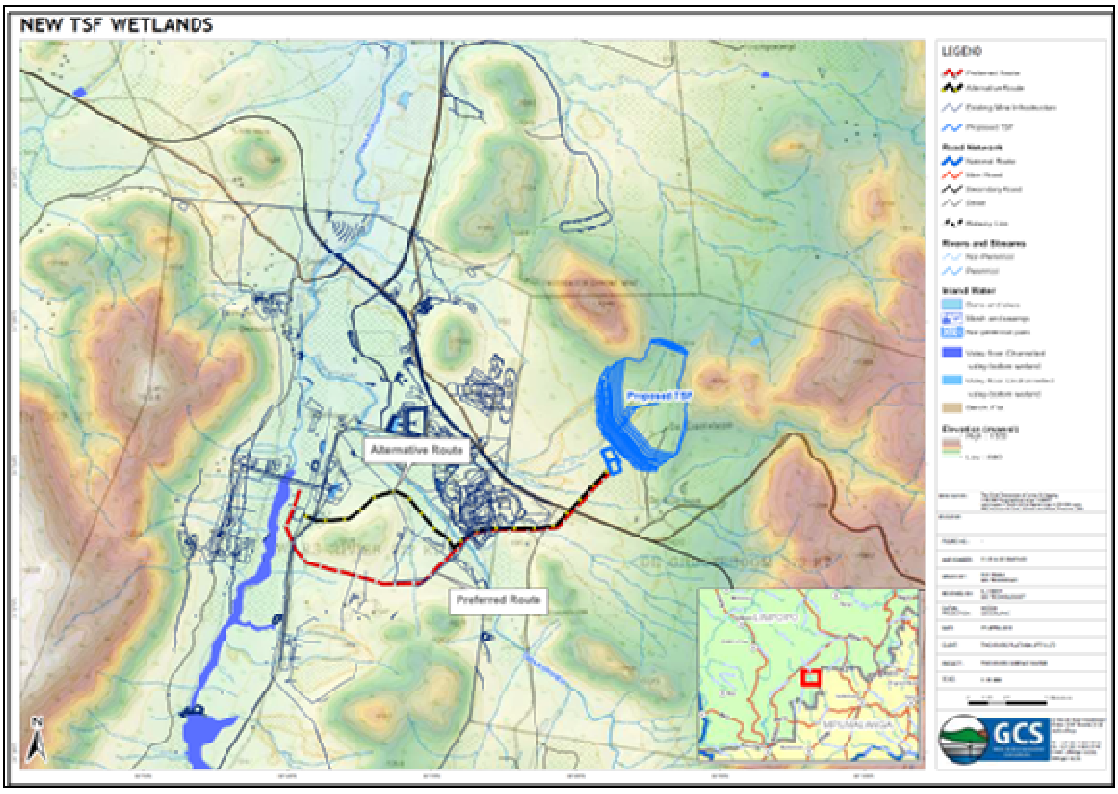
A Wetland Delineation and Riparian Assessment was undertaken by Wetland Consulting Services (Pty) Ltd in December 2012 (Refer to Appendix B-7). **An additional Biodiversity Study, incorporating Wetlands, was undertaken by GCS in September 2013, specifically for the New TSF pipeline route. Refer to Appendix B-4a.**

5.13.1 Wetlands

The NWA defines wetlands as: *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

No wetlands were found to occur within the proposed TSF area during the survey undertaken in 2012. No wetlands were identified on the pipeline route during the survey conducted in September 2013.

Figure 5.22 below indicates the general occurrence of wetlands in the study area.

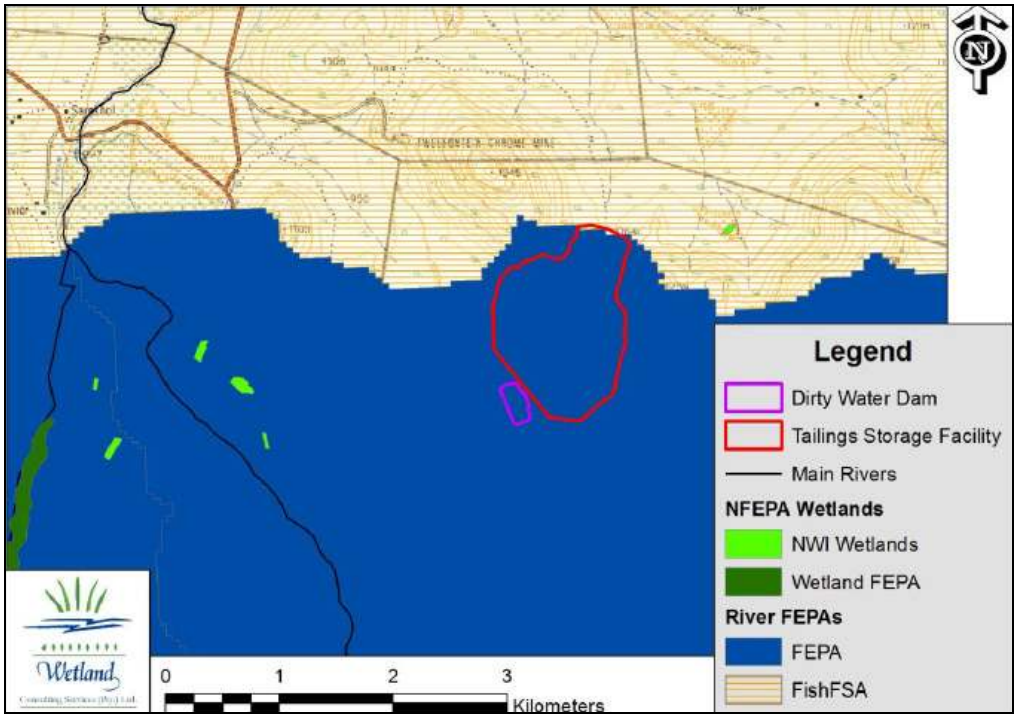


[FIGURE NOT TO SCALE -PLEASE SEE MAP ON ADJACENT PAGE]

Figure 5.22 Wetlands within the project area

5.13.2 National Freshwater Ecosystem Priority Areas

The Atlas of Freshwater Ecosystem Priority Areas in South Africa (Nel et al, 2011a) (The Atlas) which represents the culmination of the National Freshwater Ecosystem Priority Areas project (NFEPA), provides a series of maps detailing strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. An extract of the NFEPA database is illustrated in Figure 5.23.



[FIGURE TAKEN FROM THE WETLAND STUDY REPORT- FIGURE NOT TO SCALE]

Figure 5.23 Extract of the Atlas of Freshwater Ecosystem Priority Areas in South Africa (net et al., 2011)

The following important observations can be made from **the** Figure 5.23**:**

- No wetlands or wetland FEPAs are indicated as occurring on site; and
- The study area (proposed TSF and tailings delivery pipeline) falls within the catchment of a river FEPA. The River FEPA is associated with the Klein-Dwars and Groot-Dwars Rivers

The following explanations are taken from the Atlas (Nel et al, 2011):

River FEPA: River FEPA's achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category). The FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. For river FEPA's the whole sub-quaternary catchment

is shown in dark green, although FEPA status applies to the actual river reach within the sub-quaternary catchment. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.

5.13.3 Riparian zones

The NWA defines riparian zones as: *"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas."*

5.13.3.1 Delineation of riparian zones

The Sprinkhaanspruit, which is associated with a well-developed riparian zone, flows past to the south of the proposed TSF site, at its closest point being roughly 300m from the TSF site. The Sprinkhaanspruit is considered a perennial stream and was flowing strongly at the time of the site visit in November 2012.

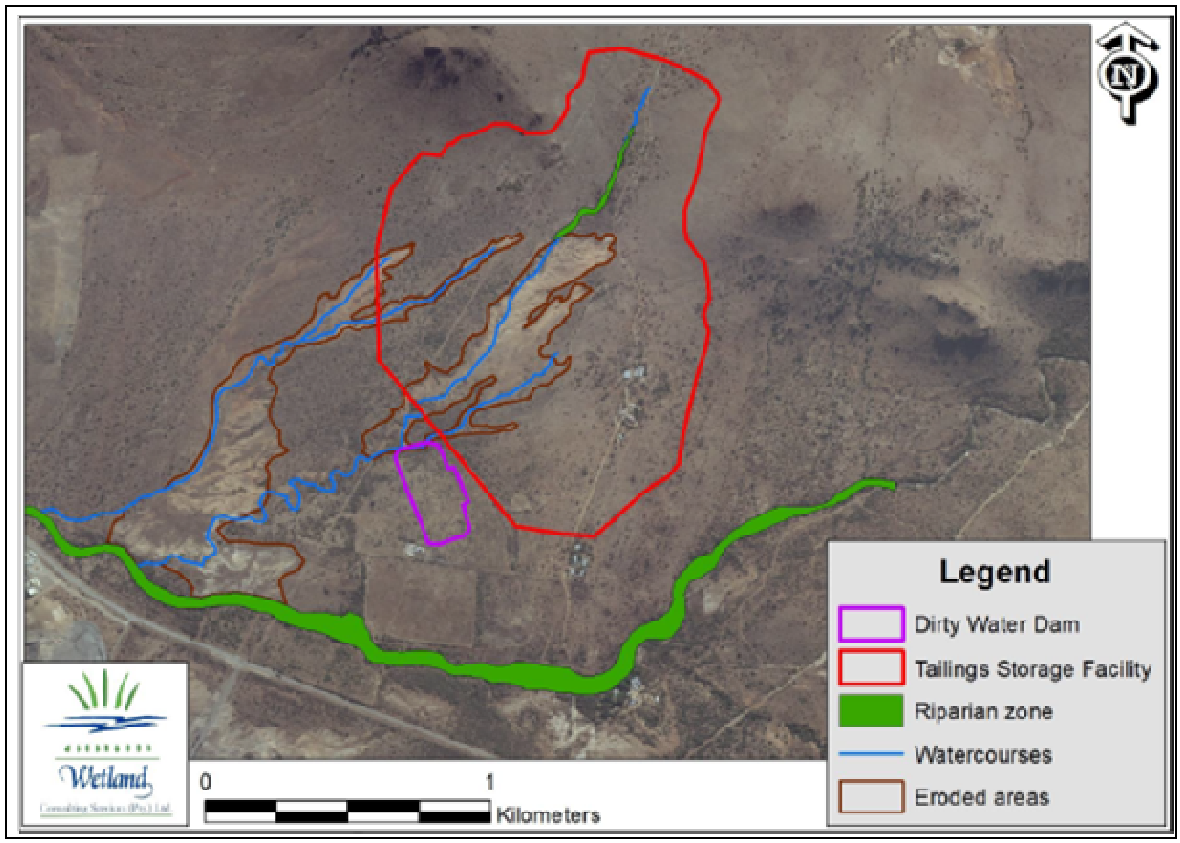
The riparian zone is well developed (Refer to Figure 5.24) and was dominated by River Bushwillow (*Combretum erythrophylum)* trees. Other typical riparian species observed included *Ficus sp.*, *Acacia schweinfurthi*, *Celtis africana*, *Peltophorum africanum* and *Dichrostachys cinerea*. In close proximity to human residence, a number of alien species were also observed, *Ricinus sp.*, Jacaranda, and *Melia azedarach*.

Two (2) small tributaries of the Sprinkhaanspruit extend onto the TSF site, both of which are characterised by large eroded areas which together cover roughly 14.6 % of the TSF site (19.5 ha). In places the eroded areas are more than 5m below the surrounding landscape.

The eroded areas are largely bare of vegetation, though the fact that large *Catha transvaalensis* trees have established along the watercourse through the eroded area indicates that the erosion occurred a long time ago and is not a recent development.

The eroded areas are also already captured on the 1:50 000 topographical maps dated from the mid-80's. The exact cause of the erosion is not known, but is assumed to be due to bad/incorrect land management practices. The mountains of the area represent a naturally eroding landscape, and erosion scars are characteristic of the area. However, it is assumed that the erosion has been exacerbated and speeded-up by bad land use management.

Within the eroded areas, the watercourses are not associated with a defined riparian zone. However, upstream of the eroded area a riparian zone is established along the main watercourse within the TSF site. The watercourse in this area is characterised by an active channel varying in width from less than 1m to around 2m. A narrow band of dense vegetation on either side of the channel makes up the riparian zone. Typical tree species observed include *Catha transvaalensis, Combretum heroense, Ziziphus mucronata, Peltophorum africanum* and *Bolusanthus speciosus,* while other species included *Themeda triandra, Melinis repens, Tristachya leucothrix, Heteropogon contortus*, and *Setaria sp.*



[FIGURE NOT TO SCALE- REFER TO THE WETLAND STUDY REPORT, APPENDIX B-7]

Figure 5.24 Map of riparian zones with project area

To the south of the TSF site, and specifically in the vicinity of the proposed Return water dam, the soils differ significantly from the remainder of the site. These soils are heavy, black clays that show expansive properties as evidenced by cracking on the soil surface. This area is not considered wetland habitat and was in fact previously cultivated, but the expansive clays do retain water and, once expanded, water ponding on the surface can occur following heavy rain.

5.13.3.2 Functional Assessment

The WET-EcoServices tool (Kotze et al, 2009) typically used to describe the likely functions performed by wetlands is not applicable to non-wetland habitats such as riparian zones and watercourses. No similar tool exists for the assessment of these systems. However, a general discussion of functions typically associated with water courses is possible.

The watercourses and riparian zones on site are considered likely to play a role in supporting the following functions:

- Watercourses convey surface runoff from the site to the Dwars River and contribute to flows within the Dwars River. However, the ephemeral nature of the watercourses which flow only immediately following rainfall implies that the watercourses act as conduits only and do not perform a significant role in flow regulation;
- The binding action of the roots of the vegetation growing within these watercourses aids in reducing erosion from concentrated surface runoff. The highly erosive nature of some of the soils in the area is clearly illustrated in the large erosions scars across the landscape;
- The linear nature of the watercourses allows these systems to play a role as migration and movement corridors for wildlife; and
- The vegetation of the watercourses does not differ significantly from the surrounding terrestrial vegetation, limiting the role of the watercourses in biodiversity support. However, certain species are nonetheless mostly restricted to this habitat on site, e.g. *Catha transvaalensis*. The riparian habitat in contrast is likely to play a more significant role in biodiversity support.

5.13.3.3 Present Ecological Status (PES) Assessment

The tools typically used to assess the present ecological status of wetlands (e.g. WET-Health or Wetland-Index Habitat Integrity) are not applicable to riparian zones and watercourses. The riparian zone on site, as well as the riparian zone associated with the Sprinkhaanspruit, is considered to be largely natural (PES category B), while the watercourses within the eroded areas are considered moderately modified (PES category C), based on the assumption that the erosion is a natural process, though likely accelerated by anthropogenic impacts.

5.14 Socio-Economic Environment

The information in this section was extracted from the Social Impact Assessment Report compiled after the study undertaken by GCS during 2012 (Refer to Appendix B-8). This study has now been completed to include the stakeholder consultation process conducted during the Draft EIA Phase.

5.14.1 Regional context

The abundance of mineral resources in the Limpopo Province, makes mining an essential sector of the economy in the province, contributing 22% of the Gross Geographic Product (GDP) for the province.

The Limpopo Province is divided into five (5) District Municipalities (DMs), namely the Waterberg, Capricorn, Vhembe, Mopani and Sekhukhune DM.

The Sekhukhune DM covers an area of approximately 13 264 m^2, most of which is rural with only an estimated 5% of the population living in urban areas. The DM lies to the north west of the Limpopo Province and the south of the Limpopo Province (www.sekhukhune.gov.za).

The main urban centres within the Sekhukhune DM are Groblersdal, Marble Hall, Burgersfort, Jane Furse, Ohrigstad, Steelpoort and Driekop. Outside these major towns, one finds almost 605 villages which are generally sparsely populated and dispersed throughout the DM. The Sekhukhune DM economy is driven largely by agriculture, mining and tourism activities (www.sekhukhune.gov.za).

5.14.2 Municipality

The Sekhukhune DM is divided into the five (5) LMs, namely the Elias Motsoaledi, Ephraim Mogale, ***Greater Tubatse***, Fetakgomo, and Makhuduthamaga LM.

The main towns within the Greater Tubatse LM (GTLM) are Burgersfort, Marota, Ohrigstad, Penge and Steelpoort.

The GTLM is divided into thirty-one (31) wards and is predominately rural in nature. There is also a strong presence of tribal authorities in the region, with traditional leaders being responsible for the day to day running of these areas. There are currently 23 recognised traditional leaders within the GTLM, with 11 of these are representing at the GTLM Council (IDP, 2012/3).

According to the GTLM Integrated Development Plan (IDP) (2012/3), Steelpoort has been identified as a District Growth Point area. Steelpoort, as compared to Burgersfort, comprises more manufacturing type industries and suppliers of mining related resources, whilst the latter is dominated by the retail and service centre. There are currently approximately six (6) operational mines around the town of Steelpoort, but the town is still characterized by a mixed land use; including heavy engineering enterprises; suppliers to the mines; transport facilities; building material suppliers; distributors/ wholesale, medium density housing and a small retail component.

5.14.3 Demographic profile

The population of the GTLM including the size, racial composition, age groups and education levels are discussed in this section.

Population and household profile

The population size (persons) for the GTLM increased steadily over the 1995 to 2010 time period, growing by 33.04% since 1995. Households have followed the same trend over the specified time period, growing at a slightly more accelerated pace of 35.58% since 1995. The Sekhukhune DM population grew at a slightly less accelerated speed of 18.39%, with the Limpopo Province showing the lowest overall growth of 16.17% over the same time period.

Population group

The GTLM population in 2010 was composed of mostly Black African persons (99.96%) followed by 2.19% White persons. The number of Black African person has increased by 17.56% since 1995, whereas the number of Coloured and Indian or Asian persons since 1995 has increased by 53.98% and 57.14% respectively. The LM reflects the demographics of the DM and the province, with respectively 99.78% and 97.52% of the population being Black African.

Age

The age distribution of persons is important as it helps determine both the current and future needs of an area. Figures for 2010 indicate that the GTLM had a similar child population (36.37%) as compared to the Sekhukhune DM (36.63%) and Limpopo Province (34.68%). This trend continues when comparing the working age population for each of the 3 regions, where 59.78% of the GTLM population forms part of the economically active population (EAP) of the area (16 to 64 years), as compared to 59.78% and 60.45% respectively for the Sekhukhune DM and Limpopo Province. These persons normally have more work experience and usually fall within the higher skilled and higher salary bracket.

The elderly population (65 and older) for each of the regions are comparatively small (ranging between 4.95% for the DM and 3.85% for the LM), which means that less burden is placed on the EAP to support persons that are no longer economically active.

When comparing the 2010 data with that of 1995, one will note a large increase in the total population for GTLM (33.04%), the working age population (46.44%) as well as the aged population (31.00%). The child population for the Sekhukhune DM and Limpopo Province have declined by 4.21% and 8.34% respectively, whereas the GTLM child population has increased by 11.24%.

The age dependency ratio3 for the Limpopo Province has been steadily decreasing, from a high 97.1 in 1995 to 65.4 in 2010. The Sekhukhune DM has improved significantly from a 105.5 age dependency ratio in 1995 to 71.2 in 2010. A similar trend can be seen for the Tubatse LM (109.1 in 1995 vs. 67.3 in 2010). Even though the province has improved its age dependency ratio, it still reflects poorly against that of South Africa as a whole (70.9 in 1995 vs. 56.2 in 2010).

Education

The largest percentage (11.78%) of the GTLM population has obtained a Grade 10 qualification, more than the percentage for the Limpopo Province (10.11%) or the Sekhukhune DM (10.86%). However, 6.19% of the population have not received any form of schooling. Only 2.13% of the population achieved an academic level higher than Grade 12.

According to the GTLM IDP (2012/3), there are 247 schools (primary and secondary) situated in the LM. Steelpoort, Ohrigstad and Burgersfort each have one (1) government primary school. The IDP indicates that it is the norm for rural or semi-rural areas such to have a high prevalence of primary schools, since many pupils leave school at an early age in order to find employment to assist and support the family. The privileged scholars, who can afford to further their education, either attend the secondary schools in the area or secondary schools located in larger towns outside the region.

5.14.4 Economic profile

This section provides a delineation of the study area and a brief economic status quo pertaining to employment and labour profile.

[3] The ratio of the combined child population (0-14 years) and the aged population (65 years and over) - persons in the dependent ages - to every 100 people of the intermediate age population (15-65 years) - economically active ages. Where more detailed data are lacking, the age-dependency ratio is often used as an indicator of the economic burden the productive portion of a population must carry - even though some persons defined as dependent are producers and some persons in the productive ages are economically dependent (Quantec Research (Pty) Ltd)

The GTLM IDP reports that the northern section of the GTLM has the most marginalised economy of the region and has no economic base. However, with the development of mines in the LM, the area has started to benefit economically mines in many ways (2012/3). The IDP, however, also highlights that although there are several mines in the area, the existing resources remain unexploited. The LM views investment in this sector as very important as it brings with it investment in infrastructure, results in creation of job opportunities, etc.

According to the GTLM IDP (2012/3), the region's main economic drivers and future development thrusts are the following:

- Mining cluster development;
- Horticulture development;
- Meat cluster development;
- Tourism cluster development;
- Nodal development; and
- Informal sector development.

The main challenges facing economic development within the GTLM are (IDP, 2012/3):

- Brain drain;
- High level of illiteracy;
- Lack of infrastructure for agriculture and tourism development;
- Migration and immigration; and
- High level of HIV/Aids.

Employment and labour profile

The employment status of the population has a variety of important implications. Economically active and employed persons can contribute to the overall welfare of a specific community by paying their taxes, looking after the youth and aged and by stimulating the economy. However, should a community have a large number of economically inactive and/or unemployed persons, the burden on the EAP of that community are amplified.

The GTLM unemployment increased dramatically between 1995 and 2010, increasing by 31.17%. This is considerable when comparing the slight increase of 2.49% for Limpopo Province and the significant decrease of 15.31% for the Sekhukhune DM. The province has, however, seen a decrease of 21.41% in the number of employed persons, with this number increasing for both the Sekhukhune DM (15.86%) and GTLM (44.67%).

The community, social and personal services industry is currently creating the most employment opportunities within the. The mining and quarrying industry has been the strongest industry within the LM over the same period.

5.14.5 Services and infrastructure profile

Social service delivery centres on the provision of health, education and community development facilities and services. The concept of service delivery also comprises various elements such as affordability, quality, efficiency and access.

This indicator therefore examines the level of service provision in the study area. Services assessed include sanitation, water, housing and electrification. There are three priority services (water, sanitation and electricity) for the promotion of health, convenience and quality of life.

Housing

The GTLM has a similar housing profile as that of the DM. A house or brick structure on a separate stand or yard is the noted most frequently, while informal dwellings/shacks NOT in a backyard are found the most frequent out of any other type of housing, excluding a house or brick structure on a separate stand or yard.

According to the GTLM IDP (2012/3), approximately 50% of the land in GTLM area is currently under land claims. The claims are almost exclusively in rural areas that were part of the former Lebowa territory. The only land claim was lodged near an urban area, was in Steelpoort with none in Burgersfort and Ohrigstad. In the first quarter of 2007 the records of the Limpopo Land Claims Commissioner indicated that, out of 52 land claims that were lodged in the LM, 13 have been gazetted and 39 are in the process of being gazetted. Nearly 48 % of land claims have been submitted by the communities, 24 % by tribal authorities, and 18 % by individual persons (private claimants).

Energy use

Table 5.14 indicates that the use of electricity for lighting in the GTLM has increased between 1995 and 2010 by 76.50%. With the increase in electrification, the Limpopo Province and the DM has shown a decrease in all other methods of creating light. The use of solar/other/unspecified sources has increased by 5.70% and the use of gas has increased with 12.61% for the LM between 1995 and 2010.

Table 5.14 Percentage change in use of energy from 1995 to 2010

	LIMPOPO PROVINCE	GREATER SEKHUKHUNE DM	GTLM

	LIMPOPO PROVINCE	GREATER SEKHUKHUNE DM	GTLM
Solar/other/unspecified	-0.03%	-122.01%	5.70%
Electricity	**62.86%**	**59.99%**	**76.50%**
Gas	-82.25%	-23.15%	12.61%
Paraffin	-508.99%	-330.20%	-162.23%
Candles	-90.56%	-118.06%	-50.18%

Source: Quantec Research (Pty) Ltd

Water

Table 5.15 illustrates that Greater Tubatse LM has incrementally increased the level of water supply to households with the biggest improvement in piped water inside a yard. Households with access to piped water inside their dwellings have increased at a slightly slower rate. The LM has shown the best improvement within these categories, as compared to the Limpopo Province and the DM. The use of water from a dam, river, stream or spring has reduced across all three regions over the 1995 – 2010 time period.

Table 5.15 Percentage change in form of water supply from 1995 to 2010

	LIMPOPO PROVINCE	GREATER SEKHUKHUNE DM	GTLM
Piped water inside dwelling	26.81%	25.82%	55.38%
Piped water inside yard	43.92%	37.21%	64.03%
Piped water on community stand: <200m from dwelling	33.08%	42.69%	52.93%
Piped water on community stand: 200m> from dwelling	26.89%	25.09%	36.19%
Borehole/rain-water tank/well	3.77%	13.58%	8.41%
Dam/river/stream/spring	**-24.85%**	**-23.20%**	**-20.84%**
Water-carrier/tanker/Water vendor	57.75%	69.67%	81.62%

Source: Quantec Research (Pty) Ltd

Healthcare

HIV/AIDS in South Africa has increased rapidly over the past decade. The social and economic consequences of the disease are far reaching and affect every facet of life in South Africa. Despite South Africa creating a progressive and far-sighted policy and legislative environment for dealing with HIV/AIDS, the prevalence of HIV/AIDS continues to increase. This indicates that policies and laws have not been adequately implemented and have not impacted significantly on the ground.

The number of HIV positive persons living within the GTLM in 2010 has increased by 90.80% since 1995. The number of HIV related deaths has increased by 96.53% over the same period, with the number of other deaths increasing slightly by 27.55%. These numbers in each case are higher than that of the Limpopo Province or the DM.

According to the GTLM IDP (2012/3), there are 11 medical facilities in the LM, which mainly constitute regional clinics, and can be found in areas such as Burgersfort, Bothashoek, Praktiseer, Ga-Makofane, Motshana, Ga-Mashabela, Ga-Motodi, Ga-Rantho Ga-Riba, Leboeng, Malokela, Mampuru, Montwaneng, Mophalema, Phiring, Taung, Motlolo and Ga-Selala. Clinics previously operated by the National Health Department can be found in Steelpoort, Ohrigstad and Burgersfort. These clinics offer improved service to the previously mentioned as they are equipped with better infrastructure. Specialist treatment is exclusively available at the major hospitals outside of the municipal area.

Roads

The Greater Tubatse LM has three major transportation corridors along which major spatial activities are taking place, these are (IDP, 2012/3):

- Dilokong and Burgersfort (R37) Corridor;
- Stoffberg (R555) Corridor;
- Ngwaabe Corridor to Jane Furse; and
- The Hoedspuit (R36) Corridor.

The major roads allow for the development of nodes or settlements at certain appropriate points along the corridor which become an anchor of spatial development agglomeration, such as Burgersfort, Ohrigstad and Steelpoort.

6 PUBLIC PARTICIPATION PROCESS

This section of the Report documents the process, which was followed with respect to consultation of interested and affected parties (I&APs / Stakeholders) and the Government Authorities, in accordance with Regulation 31(2) (e) of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include-*
	(e) details of the public participation process conducted…

6.1 Purpose of Public Participation

Public Participation Process (PPP) is a requirement of the EIA/EMP process and ensures that all relevant I&APs are consulted and involved. The process ensures that all stakeholders have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures for a complete comprehensive environmental study.

The purpose of PPP and the engagement process is to:

- Introduce the proposed project;
- Explain the EIA/EMP and PPP processes to be undertaken;
- Determine and record public issues and concerns;
- Provide opportunities for public input and gathering of local knowledge;
- Inform a broad range of stakeholders about the project and the environmental process to be followed;
- Establish lines of communication between stakeholders and the project team;
- Identify all the significant issues in the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent environmental impacts, associated with the project.

Once the concerns of I&AP's have been established, the EIA/EMP study will aim to address these concerns.

6.2 Public Participation Methodology

A comprehensive PPP was initiated at an early stage in the Scoping Phase in order for the concerns of I&APs, authorities and the wider public to be notified. The PPP is an on-going process undertaken throughout the EIA/EMP.

6.2.1 Legislative Requirements

6.2.1.1 Method of notification

Regulation 54 of the NEMA Regulations advises that notice must be given by:

- Fixing a notice board at a place noticeable to the public at the boundary or on the fence of the site where the activity is to be undertaken as well as any alternative sites being considered.
- Giving written notice to –
    - The owner or person in control of that land if the applicant is not the owner or person in control of the land;
    - The occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    - Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to an alternative site where the activity is to be undertaken;
    - The municipal councilor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
    - The municipality which has jurisdiction in the area;
    - Any organ of state having jurisdiction in respect of any aspect of the activity; and
    - Any other party as required by the competent authority.
- Placing an advertisement in:
    - One local newspaper.
- Placing an advertisement in at least one provincial newspaper or national newspaper if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or local municipality and an advertisement is not being placed in any official Gazette.
- Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is unable to participate in the process due to illiteracy; disability and any other disadvantage.

6.2.1.2 Content of the notice, notice board or advertisement

When notifying I&APs of an application by way of notice, notice board or an advertisement, the person conducting public participation must:

- Give details of the particular application and state:
    - That the application has been submitted to the competent authority in terms of the regulations;

- Whether a Basic Assessment or S&EIR procedures are being applied, in case of an application for Environmental Authorisation;
- The nature and location of the activity to which the application relates;
- Where further information on the application or activity can be obtained; and
- The method and the person to whom representations in respect of the application may be made.

6.2.1.3 Proof of notification

The NEMA Regulations require that notices, notice boards and advertisements; notifying potentially I&APs in relation to the application; have been given, displayed or placed. In meeting this requirement, the EAP must submit the following to the competent authority:

- A copy of the newspaper advertisement (newspaper clipping) that was published, indicating the name of the newspaper and date of publication and of such quality that the wording in the advertisement is legible;
- A site map showing where the site notice was displayed, a dated photograph showing the notice displayed on site and a copy of the text contained in the notice;
- Copies of written notices that have been sent to I&APs, as well as:
  - If the notice was sent by registered mail, a copy of all registered mail receipts which show the registered mail number, the name of the person the notice was sent to, the address of the person and the date on which the notice was posted; and
  - If the notice was sent by facsimile, a copy of the facsimile report;
  - If the notice was sent by electronic mail, a copy of the electronic mail; and
  - If the notice was hand delivered, proof of the hand delivered copy.

6.2.2 Introductory (Scoping Phase) Authorities Meeting

The authorities were notified of the scoping meeting, held on 6 February 2013, at the Two Rivers Main Office Boardroom via fax, email and registered mail. Telephonic conversations regarding the project have also taken place with LDEDET after the NEMA Application was submitted, and accepted.

The purpose of the meeting was to:

- Introduce the proposed project;
- Provide opportunities for the authorities' input;
- Establish lines of communication between the authorities and the project team; and
- Identify significant issues in the project.

Table 6.1 lists the issues raised during the meeting held with the authorities, dated 6 February 2013.

Table 6.1 Issues and concerns raised in authorities meeting dated 6 February 2013

ISSUE/CONCERN	RAISED BY	RESPONSE BY GCS AND TRP
Is TRP involved with the Olive Project, conducted in the Kalkfontein area?	Khumbelo Sirakalala LDEDET	TRP: the olive tree plantation is a Dwarsriver project and accordingly TRP is not involved. TRP's underground operations, on Portions 4, 5 and 6 of Kalkfontein, will not affect the Olive Project.
Groundwater will be affected by the mining activities. Limited water for the Olive Project.	Khumbelo Sirakalala LDEDET	TRP: there will be no surface activities at the Kalkfontein operation, the existing North Shaft will be utilized and therefore the proposed mining activities will not have an impact on the Olive Project. A specialist groundwater and surface water study will be conducted as part of the EIA phase, which will determine any possible impacts related to water.

The minutes of the meeting are contained in Appendix C-9

6.2.3 Identification of Authorities

A comprehensive list of authorities was compiled during the early stages of the project.
The authorities as listed below have been invited to become involved in the process by inviting them to the introductory authorities meeting.

- Department of Minerals and Resources (DMR)- Regional Office- Polokwane;
- Limpopo Department of Economic Development, Environment and Tourism (LDEDET);
- Department of Water Affairs (DWA)- Regional Office Lydenburg;
- South African Heritage Resources Agency (SAHRA);
- Limpopo Department of Agriculture (LDA);
- Sekhukune District Municipality;
- Greater Tubatse Local Municipality (GTLM); and
- Ward Councilor.

6.2.4 Identification of I&APs

All I&APs on the existing TRP database were contacted at the start of the project in terms of Regulation 55 of NEMA as I&APs in relation to the application. During the consultation with I&APs, as well as with the mine, additional parties were identified and included to provide an updated database. Numerous I&APs were notified by word of mouth. Parties who

responded to the advertisements and notifications were included in the final database. Refer to Appendix C-1 for the stakeholder database.

GCS has developed and will maintain an electronic database for the duration of the project where stakeholder details are captured and automatically updated as and when information is received from I&APs.

6.2.5 Notification of Stakeholders

6.2.5.1 Site notices

In accordance with Regulations 54(2) (a) and 54(4)(a) of NEMA, A2 laminated site notices have been placed on and around the project area at the following co-ordinates: These were placed on 25 January 2013, and further notices were placed on 4 July 2013.

Table 6.2 Site Notice placements

LOCATION (STREET NAME/OTHER)	NAME OF THE TOWN/PUBLIC PLACE	GPS CO-ORDINATES (WGS84 DECIMAL DEGREES)
Buffelsfontein Tribal Office	Buffelsfontein Tribal Office	East: 30 02.395
		South: 24 57.238
Kalkfontein (Isaac Masha)	Kalkfontein (Isaac Masha)	East: 30 03.987
		South: 24 53.223
Malekane Tribal Office	Malekane Tribal Office	East: 30 00 526
		South: 24 53.485
Masha Royal House/tribal office	Masha Royal House/tribal office	East: 30 00.543
		South: 24 53.475
Ranto Tribal house	Ranto Tribal house	East: 29 58.0111
		South: 21 52.499
Maphopa Tribal House	Maphopa Tribal House	East: 29 57.708
		South: 24 51 201

Refer to Appendix C-2 for a copy of the site notices and the photographs taken at each location.

6.2.5.2 Media advertisements

In accordance with Regulations 54(2)(c) and 54(3)(b) of NEMA, advertisements regarding the project background and the assessment process followed were placed in the following newspaper:

- The Steelburger: published on Friday, 11 January 2013.
- The Steelburger: published on Friday, 5 July 2013.

Refer to Appendix C-3 for a copy of the advertisements placed.

6.2.5.3 Background Information Documents (BIDs)

In accordance with Regulation 54(3) (b) of NEMA, Background Information Documents (BIDs) were sent to all I&APs on the existing TRP database, and were updated as new I&APs registered for the project. All I&APs were notified by way of fax, email or letter, depending on their preferred method of contact. The BID was made available in English. Alternative languages were considered due to the rural location of the proposed New TSF, but it was decided to provide translated documents should language be raised as a concern. The local communities did not raise this as a concern.

The BID included details of the proposed project as well as the EIA/EMP purpose, requirements and process. It also included relevant contact details and a comment/registration sheet. I&APs/Stakeholders were invited to register and send responses by fax, telephone or e-mail to GCS (Pty) Ltd.

Refer to Appendix C-4 for the BID.

6.2.6 Scoping Public Meeting

The registered I&AP's were notified and invited to attend the scoping meeting on 7 February 2013 at 11h00 held at the Tubatse Chrome Club via fax, email and registered mail. The registered I&AP's were also notified of the scoping meeting via the site notices, distribution of BIDs and advertisements.

A public meeting was held on the 7 February 2013 at 11h00 at the Kalkfontein Community Hall due to the initial venue's objection to the meeting, on the day before the meeting was scheduled to take place. Transport was provided from the initial venue to the new venue to ensure that no stakeholders were excluded due to the last-minute change of venue. The meeting time was also delayed, to allow stakeholders more time to reach the new venue.

Refer to Appendix C-5 for the minutes of the public meeting.

6.2.7 Issues and Responses Trail

At the public meeting and through ongoing consultation, issues have been raised and will be raised during the process. This is an ongoing process and will therefore be updated as comments and responses from the authorities and public are made regarding specific issues about the project. All issues and comments have been formally addressed in the EIA/EMP.

The issues and comments made by I&APs as well as other stakeholders are presented in Table 6.3 and Table 6.4.

Table 6.3 Issues and concerns raised in public meeting held on 7 February 2013

ISSUE/CONCERN	RAISED BY	RESPONSE BY GCS AND TRP	REFERENCE
The public meeting was not planned well enough. The community was not notified properly and most of the information presented did not address the current issues at Kalkfontein.	Isaac Masha	GCS: GCS as the Environmental Assessment Practitioner (EAP) is required to advertise the public meeting two (2) weeks prior to the date of the public meeting. In this case, an advert was placed in the Steelburger newspaper on Friday, 11 January 2013; site notices were placed on site and at the entrance to the TRP mine, Background Information Documents (BIDs) and Scoping Reports, were placed at the Tribal Offices, including Kalkfontein. The last minute change of venue was not planned and GCS apologised in that regard. The topic of the public meeting was to specifically introduce TRP's current environmental authorisation applications. This is possibly not relevant to the current issues at Kalkfontein which should be addressed via a different forum.	The notification methodology 6.2.1 and the proof of notifications presented under Appendix C.

Table 6.4 Issues raised via email and fax during the Scoping Phase

ISSUE/CONCERN	RAISED BY	RESPONSE BY GCS AND TRP	REFERENCE
Negative impact on living conditions and business also on possible sale to township developers.	J.R. Le Grange	The issues will be addressed in the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) phase.	The issue is addressed in section 8.2, 8.3 and 8.4 of this report as well as the SIA Report attached under Appendix B-8.
Holder of the prospecting rights on the targeted area. Requests the geological information with regards to the position of the dam.	Henk Moen	GCS added Mr. Moen to the database and requested the coordinates, date of issue and mineral prospected for. Mr. Moen was referred directly to TRP for further discussions as his queries were of a legal nature.	The geology underlying the proposed TSF area is presented under section 5.1 of this report.

Team work, punctuality, safe work, care, respect, integrity, commitment. Would like more information on the mining sector.	Johannes Ratshotshi	GCS acknowledged receipt of the comments and added Mr. Ratshotshi's details to the database.	The required worker behavior with regards to environmental best practice and emergency response is discussed in the Environmental Awareness and Emergency Response Plan attached under Appendix The information regarding the mining sector within the Limpopo Province is discussed briefly in section 5.14 of this document.
In favour of the proposed project. The project will assist employees in obtaining clarified water and it will also address the situation of un-purified water, as has been raised before.	Intshame Sipho Ngoane	GCS acknowledged receipt of the comments and added Mr. Ngoane's details to the database.	This application relates to the proposed new TSF only and will involve any water treatment.
Lebalelo Water User Association (LWUA) does not supply water to TRP. However, the Association has a pipeline crossing the farms Tweefontein 360 and Dwars Rivier 372 with a pump station and appurtenant works on the farm Dwars Rivier 372. The servitude is not registered yet but is in the process. From the map shown, it cannot be seen that the new mining activities would have any influence on the infrastructure mentioned. Keep I&AP informed and updated of the EIA progress.	Ossie Rossouw (CEO of the Lebalelo Water User Association)	GCS noted the pipeline information and added Mr Rossouw to the database. He will be kept informed.	Comment noted. This application does not address any mining activities. The issues related to mining will be addressed in the report for the UG2/Merensky expansion being undertaken parallel to this application process.

The objector raised the following issues • "fatally flawed" PPP; • More information regarding the NEMA section 24G application in respect of the existing TSF extension; • The extension of the existing TSF had not been considered as an alternative; • The EAP did not apply for all necessary listed activities in terms of the relevant acts; • The limited information provided in the Scoping Report is not sufficient to identify potential issues and impacts. • The objector raised the issue of the impact on the non-perennial drainage lines and requested a copy of the WUL. • The alternative TSF site should be considered in the EIA; • The social impacts (from an environmental, historical and health perspective), but this has been ignored by the EAP in the site selection process. • A noise impact assessment should be undertaken.	J.R Le Grange	A response was sent to the LDEDET and Bokamoso Mr. Le Grange, dated 15 May 2013. Due to the length of the response, this has not been discussed here, but is attached under Appendix C-7 for your reference.	Refer to Appendix C-7 for the objection and response letters.

6.3 EIA Phase Stakeholder Consultation

The Draft EIA report was made available for review from 1 August to 16 September 2013. All stakeholders were informed of the availability of the report at the TRP security office and on the GCS website. Copies of the report were submitted directly to the authorities by delivery or registered mail, and copies were also provided on CD to Bokomoso Environmental Consulting.

Three meetings were arranged during the EIA phase to present the draft EIA report to the registered stakeholders. A poster presentation was used to summarise the contents of the Draft EIA reports that were submitted to the relevant authorities for consideration. Details of the meetings are discussed in sections that follow.

6.3.1 Public meeting (Open day)

The registered I&APs were notified and invited via phone, fax and/or email to attend the EIA/EMP phase Open day which was held as follows:

- Date: Wednesday, 21 August 2013
- Time: from 13h00 till 17h00
- Venue: Ga – Malekana Tribal hall

Refer to Appendix C-11 for the attendance register and minutes of this meeting. Most of the comments made at the open day were not related to the TRP environmental authorization applications.

6.3.2 Focus Group meeting with landowners

A focus group meeting was held at Didingwe Lodge on 22 August 2013 to present the Two Rivers draft EIA reports to the registered stakeholders including land and business owners, and neighbouring mines. The attendance register and Minutes of this meeting can be seen in Appendix C-12. No specific queries or issues of an environmental nature were raised at the meeting.

6.3.3 Authorities meeting – EIA Phase

Authorities were invited to an EIA phase Authorities meeting, which was scheduled as follows:

- Date: Thursday, 22 August 2013
- Time: from 12h30 till 14h00
- Venue: Didingwe Lodge

There were no attendees at the Authorities' meeting; as such no issues could be documented. Most of the Authorities attended the Scoping phase meeting and project site visit, and therefore refused the invitation to a second meeting. Record of the meeting is contained in Appendix C-10.

6.3.4 Objection Letters from Bokomoso

Bokomoso Environmental Consulting represents an objector to the proposed New TSF (Mr Le Grange who owns the remainder portion of De Grooteboom), and who will directly be impacted upon by the proposed TSF development. Two letters of objection were received, during the Scoping, and Draft EIA phases. A meeting was also held with Mr Le Grange, his lawyer, and Bokomoso, on 22 October 2013. The letters contain a large number of issues that have been addressed by GCS and the specialist consultants. The full details of which are contained in Appendix C9 of this report.

6.3.5 Other comments received during the Draft EIA Phase

Comments on the Draft EIA report were received from LDEDET as follows (Refer to Appendix C-12):

1. Proof of submission of the Water Use Licence Application (WULA) must be included with the Final EIA. GCS Response: The WULA will be made available for public review at the same time as the Final EIA report. Proof of submission of the WULA will be attached with the Final EIA to LDEDET on submission, and will be included in Appendix C-12.
2. Specialist Declaration Forms must be included with the specialist studies. GCS response: The declaration forms have been signed and have been included with each specialist report Appendix.
3. All issues raised by Bokomoso must be addressed. GCS response: Refer to Appendix C-8. GCS has addressed all issues received in two letters, and conducted a meeting with Bokomoso on 22 October 2013. A consolidated response document is presented in Appendix C-8.

No other comments from any party were received during the Draft EIA phase.

6.3.6 Document Review

The Scoping Report was made available for review by I&APs for a 40 day commenting period from 21 January 2013 until 1 March 2013 at the TRP security office. All registered I&APs were informed of the report's availability in writing. If I&APs required a copy on CD, it was provided. The document was also available on the website of GCS at www.gcs-sa.biz .

After comments from the public were received the document was updated to include the comments in the Issues and responses table. Thereafter further issues and responses were documented and incorporated in the draft and final EIA/EMP reports.

The Draft EIA/EMP was made available for review by I&APs from 31 July 2013 to 16 September 2013. The final EIA/EMP report was made available for review at the TRP security office, on the GCS website, and distributed to stakeholders on CD via post or delivery. The public review period for the Final EIA reports was 5 November 2013 to 4 December 2013, a period of 30 days. This is longer than the recommended 21 days prescribed by the regulations.

7 ACTIVITIES AND ENVIRONMENTAL OBJECTIVES

In order to assess the potential environmental impacts which may be created by the proposed TSF; the activities associated with the establishment, operation and decommissioning of the proposed TSF must be identified. These activities are discussed in this chapter.

7.1 Activities Associated with the new TSF

The proposed infrastructure associated with the TSF is described in detail in Chapter 2 of this report. The activities required to establish, operate and decommission the mine are described in the sections which follow.

The main activities which will create impacts during the life of the proposed TSF were assessed and mitigation and management measures developed thereto (Refer to chapter 7 of this document). The main activities are summarised in Figure 7.1.

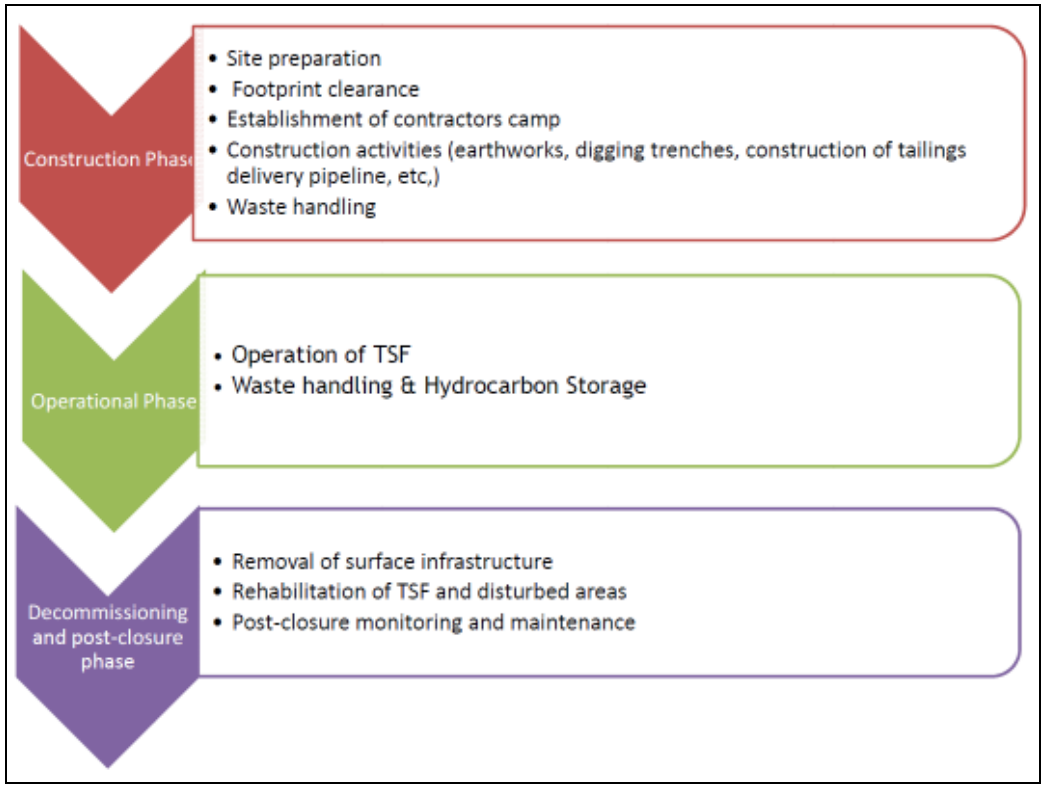


Figure 7.1 Activities associated with the proposed TSF

7.1.1 Construction

The following activities will be undertaken during the construction phase:

- *Site preparation*: this will comprise activities such as fencing off the construction area (TSF and pipeline route) and the establishment of stormwater management infrastructure such as berms and a pollution control dam to capture any dirty water which may runoff from the construction site;
- *Footprint clearance:* this will comprise the removal of vegetation and topsoil. Topsoil will be stockpiled for the use in concurrent rehabilitation of the TSF;
- *Construction activities*: This will consist of earthworks, digging of trenches, installation of drains, the tailings delivery pipeline and other equipment; and
- *Waste handling*: this includes the generation and disposal of general waste and the storage of diesel and management of fuel and oil spills. All refuelling of vehicles will take place within the contractor's camp area. The size of the contractor's camp area will be reduced and the area which is no longer in use will be rehabilitated at the end of the construction period.

7.1.2 Operation

The operational phase will comprise the following activities:

- *Operation of TSF:* The Merensky and UG2 tailings will be deposited onto the TSF via cycloning over a 20 year life of operation. Water management will be undertaken by means of berms and trenches to prevent clean water from entering the dirty water catchment. Supernatant water and harvested stormwater will be collected in a pool within the TSF from where it will be pumped to the return water dam;
- *Waste handling:* this includes the generation and disposal of general waste and the management of fuel and oil spills.
- *Diesel storage:* This will include the correct management and storage of hydrocarbons.

7.1.3 Decommissioning and Aftercare

The decommissioning and post closure activities will comprise the following activities:

- *Removal of infrastructure:* This will involve the removal of the TSF infrastructure such as pipelines, electrical and mechanical equipment; and the desilting of the RWD, silt trap and sump;
- *Rehabilitation of TSF and surrounding areas:* This will involve the rehabilitation of the side slopes of the TSF and the disturbed areas around the TSF. Rehabilitation of surrounding areas will comprise the ripping of compacted soils and re-vegetation of disturbed areas;

- *Post closure monitoring and maintenance:* This will comprise post-decommissioning inspections and monitoring until closure is obtained.

7.2 Environmental Management Objectives

This section of the report presents the environmental management objectives which have guided the formulation of the proposed measures to mitigate and manage the identified environmental impacts during the life of the proposed new TSF.

7.2.1 Construction Phase

The objectives which will guide the implementation of the management and mitigation measures during the construction phase of the project are listed in this section.

7.2.1.1 Site preparation

The environmental management objectives associated with the site preparation are:

- To ensure that all relevant environmental authorizations and permits are obtained, and that access to land is granted to all relevant portions of land before any activities may begin;
- To ensure the construction footprint has been correctly demarcated before areas are fenced off;
- To ensure that stormwater management infrastructure is placed in accordance with the stormwater management plan (SWMP); and
- To ensure that the stormwater management infrastructure blends in with the natural environment as far as possible.

7.2.1.2 Footprint Clearance

The environmental management objectives associated with footprint clearance and removal of vegetation for construction purposes within the proposed new TSF and tailings delivery, as well as the tailings delivery pipeline route are:

- To limit activities to the indicated and approved areas to ensure that no new additional land surface, vegetation and habitats outside of the project area are destroyed, disturbed and/or alienated;
- To clearly demarcate areas where construction activities will take place;
- Removal of weeds and other invasive species within and around the project area where possible (weeds must be destroyed and not stored with any plants to be used for rehabilitation purposes);
- To prevent any cumulative impact associated with the removal of vegetation and footprint clearance;

- To reduce the dust dispersion as a result of the removal of earth material as far as possible;
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical; and
- The topsoil stockpile will be contoured so as to blend with the natural environment and will be stabilised with vegetation.

The closure requirements will determine the topsoil stripping and stockpile volumes during the construction phase (the stripping volumes will be calculated by a soil scientist). As far as possible, topsoil will be stockpiled within the vicinity of the proposed rehabilitation areas.

7.2.1.3 Establishment and use of contractor's camp

The environmental management objectives associated with the establishment, use and rehabilitation of the contractor's camp:

- To ensure the minimum amount of vegetation clearance;
- To strictly manage the activities taking place within the contractor's camp by implementing clear and effective rules; and
- To rehabilitate the areas which have been disturbed once the contractor's camp area has been reduced (smaller camp size is required for the operational phase).

7.2.1.4 Construction activities

The environmental management objectives associated with the construction of the proposed new TSF and associated infrastructure, as well as the tailings delivery pipeline are:

- To remain within the approved project area;
- To ensure that no new land surface, vegetation and habitats outside of the approved footprint areas are destroyed, disturbed and/or alienated;
- To ensure that the area over which the infrastructure will be placed is stable;
- To reduce the noise associated with the construction and operational activities as far as possible;
- To manage any other nuisance which may occur as a result of the establishment of new infrastructure;
- To accommodate the use of natural material and colours where possible to reduce the potential visual impact on the surrounding area;

- To ensure that stormwater management infrastructure are establishment prior to the main construction activities so as to control runoff from the construction site; and
- To rehabilitate the area as per the closure objectives in order to address all environmental impacts as far as possible and practical.

7.2.1.5 Waste handling

The objectives for waste generation and handling of domestic waste:

- Ensure that temporary storage of waste produced at the construction site takes place in such a manner as not to cause any pollution to the environment;
- Ensure that waste disposal is undertaken with recycling principles;
- Ensure that storage facilities comply with best practice guidelines;
- Prevent any pollution of water resources by ensuring that an effective surface runoff control system is in place; and
- Prevent, contain and clean up any spillages as and when they occur to reduce and control impacts on the environment.

7.2.2 Operational Phase

The objectives which will guide the implementation of the management and mitigation measures during the operational phase of the project are listed in this section.

7.2.2.1 Tailings Deposition

The environmental management objectives associated with the operation of the TSF are:

- To limit surface water captured and stored within the TSF footprint according to best practices;
- To maintain water management infrastructure so as to prevent the failure of these systems;
- To maintain all pollution control systems in such a manner as to reduce any possibility of dirty water entering the natural or clean water systems;
- To maintain the silt trap and RWD system to prevent siltation of the dam, thereby maintain the required 0.8m freeboard;
- To undertake the required monitoring programme and produce reliable, good quality data that can be used to continuously update the numerical model and water balance;

- To ensure that the correct health and safety procedures are followed and that the correct inspections of the TSF and equipment are monitored to prevent dam failure; and
- To ensure that the tailings delivery pipeline is inspected regularly to detect and immediately remediate any spillage.

The groundwater monitoring information should be used to update the numerical groundwater model used during the operational phase. The updated groundwater model will be used in the closure modeling and closure planning.

The environmental management objectives for the clean and dirty water system:

7.2.2.2 Waste Handling

The objectives for the generation and handling of domestic waste as well as diesel are:

- Ensure that storage takes place in such a manner as not to cause any pollution to the environment;
- Ensure that storage facilities comply with best practice guidelines; and
- Prevent any pollution of water resources by ensuring that an effective surface runoff control system is in place.

7.2.2.3 Hydrocarbon storage

The environmental management objectives for hydrocarbon storage are:

- To ensure that all hydrocarbons are stored in a manner which will prevent any harm to the environment;
- To prevent spillages of hydrocarbons;
- To capture, contain and manage any spillage; and
- To ensure that any area which has been affected by a hydrocarbon spill is suitably rehabilitated and monitored until rehabilitation efforts have been successful.

7.2.3 Decommissioning and Closure

According to the DWA Best Practice Guideline (BPG) for Mine Residue Deposits (Guideline A2), the overall objectives which must be considered before the decommissioning of a TSF are:

- Minimisation of long-term post-closure water quality impacts;
- Long-term stabilisation of the TSF;
- Minimising the environmental impacts of the TSF;
- Creating an acceptable aesthetics closure scenario; and

- Determining the post-closure maintenance requirements.

The decommissioning phase must ensure that the proposed new TSF is left, at closure, in a state where it will be able to withstand the effects resulting from the maximum probable precipitation appropriate to the location of the TS with minimal detrimental consequences.

7.2.3.1 Removal of surface infrastructure

The environmental management objectives for removal of infrastructure are:

- To ensure that the removal of infrastructure is done in a manner which has the smallest possible impact on the environment; and
- To limit all rehabilitation activities and the movement of people to within the disturbed area footprint.

7.2.3.2 Rehabilitation of disturbed areas

The environmental management objectives for the rehabilitation of disturbed areas are to:

- Ensure the removal of all contaminated soils and material;
- Ensure that the RWD and silt traps are desilted and that these are in a good condition;
- Ensure that all compacted areas have been ripped; and
- Ensure that all disturbed areas are topsoiled and vegetated.

7.2.3.3 After monitoring and maintenance

The environmental management objectives for after care monitoring and maintenance are:

- Ensure that an inspection of the water management infrastructure such as solution trenches, sumps, etc. is undertaken regularly to identify which components need to be replaced to ensure long term functionality, until such time that monitoring indicates that there is no more potential for contamination;
- Ensure that the inspector makes assessment of the presence or extension of slope failures; erosion of slopes, siltation of paddocks, berms, etc; vegetation within paddocks as well as possible erosion damage to ditches and trenches;
- Ensure that monitoring takes place until rehabilitation measures are considered successful; and
- Ensure that storm water management infrastructure is rehabilitated and the area is made free-draining only once rehabilitation is completed.

8 ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PLAN

This chapter fulfils the report requirements set out in Regulations 31 and 33 of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*	
	(d)	A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;
	(h)	An indication of the methodology used in determining the significance of potential environmental impacts;
	(j)	A summary of the findings and any recommendations of any specialist report or a report on a specialized process;
	(k)	A description of all environmental issues that were identified during the environmental impact process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
	(l)	An assessment of each identified potentially significant impact including:
	i.	Cumulative impacts;
	ii.	The nature of the impact;
	iii.	The extent and duration of the impact;
	iv.	The probability of the impact occurring;
	v.	The degree to which the impact can be reversed;
	vi.	The degree to which the impact can cause irreplaceable loss of resources and; and
	vii.	The degree to which the impact can be mitigated.
Regulation 33	A draft environmental management programme must comply with section 24N of the Act and include-	
	(f)	As far as is reasonably practical, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principal of sustainable development ,including ,where appropriate, concurrent or progressive rehabilitation measures;

8.1 Environmental Impact Assessment Methodology

To ensure uniformity, the assessment of potential impacts was addressed in a standard manner so that a wide range of impacts is comparable. The ranking criteria and rating scales was applied to all specialist studies for this project.

Each impact identified was assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value is linked to each rating scale.

The following criteria were applied to the impact assessment for the EIA/EMP:

Occurrence

- Probability of occurrence (how likely is it that the impact may occur?); and
- Duration of occurrence (how long may impact last?).

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?); and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?).

In order to assess each of these factors for each impact, the following ranking scales were used:

Status of Impact +: Positive (A benefit to the receiving environment) N: Neutral (No cost or benefit to the receiving environment) -: Negative (A cost to the receiving environment)	
Probability:=P 5 – Definite/don't know 4 – Highly probable 3 – Medium probability 2 – Low probability 1 – Improbable 0 – Not applicable/none/negligible	*Duration:=D* 5 – Permanent 4 - Long-term (ceases with the operational life) 3 - Medium-term (5-15 years) 2 - Short-term (0-5 years) 1 – Immediate 0: Not applicable/none/negligible
Scale:=S 5 – International 4 – National 3 – Regional 2 – Local 1 – Site only 0 – Not applicable/none/negligible	*Magnitude:=M* 10 - Very high/don't know 8 – High 6 – Moderate 4 – Low 2 – Minor 0: Not applicable/none/negligible

Once the above factors had been ranked for each impact, the environmental significance of each was assessed using the following formula:

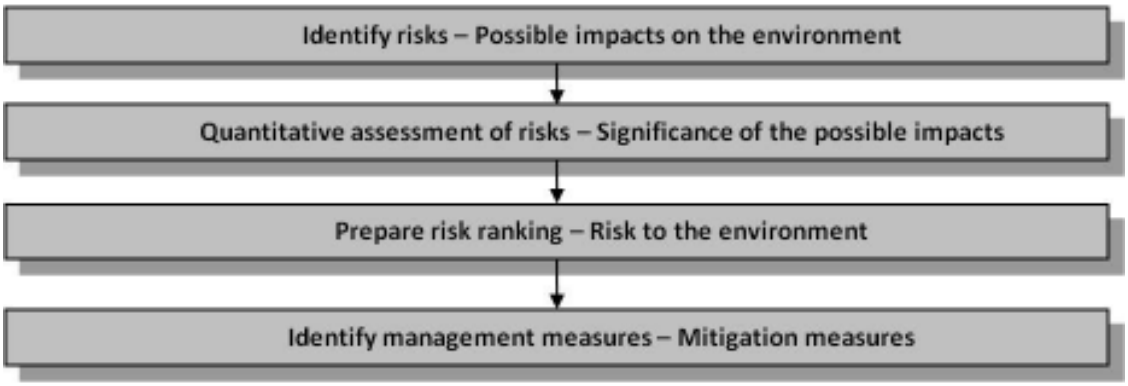
SP = (magnitude + duration + scale) x probability

Impacts are also negative, positive, or neutral.

Table 8.1 Impact Significance Ratings

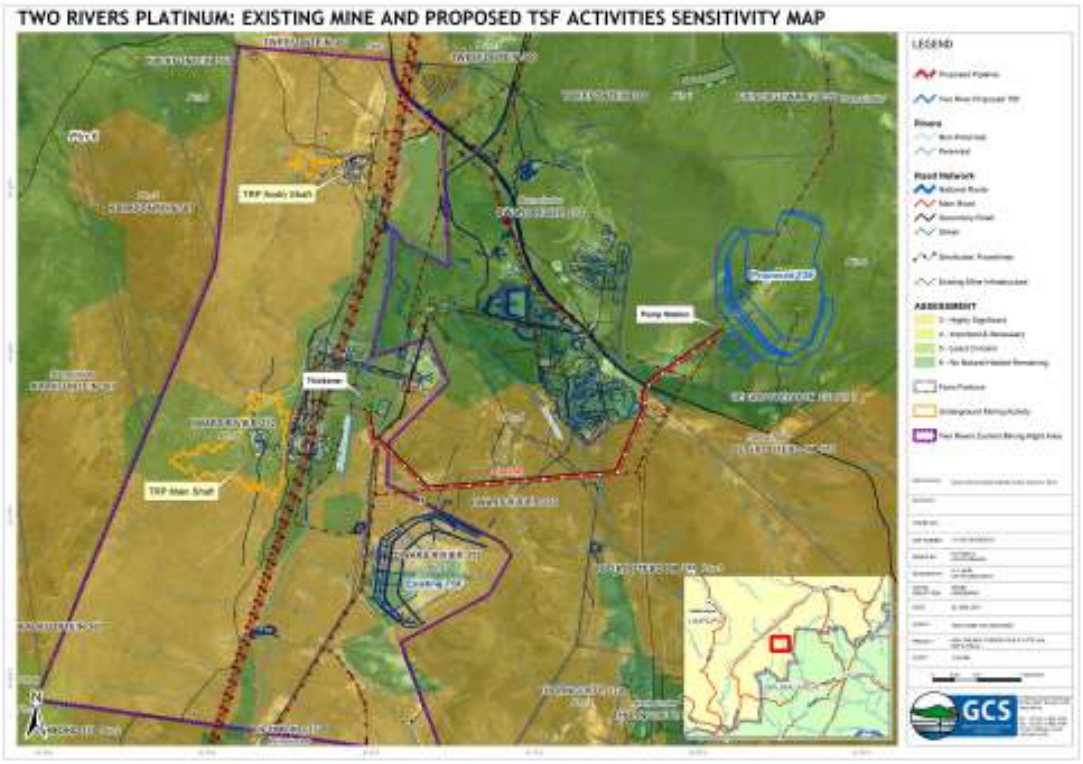
SIGNIFICANCE	ENVIRONMENTAL SIGNIFICANCE POINTS	COLOUR CODE
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	<-60	H

The following process was followed:



8.2 General Sensitivity of the proposed New TSF site and pipeline route

Refer to Figure 8.1 indicating sensitivity of the proposed New TSF site and pipeline route. Data is taken from the South African National Biodiversity Institute (SANBI), 2010. The New TSF Site and pipeline is located across areas classified from 'no natural habitat remaining' to 'important'. The site of the tailings dam is deemed to be of 'least concern'.



[Figure not to scale, refer to map on adjacent page]

Figure 8.1 Environmental Sensitivity: New TSF and Pipeline Route

8.3 Construction Phase

The environmental impacts associated with the construction phase which were identified are discussed in this section. The assessment of the significance of these impacts (as described in section 8.1 of this report) as well as the proposed mitigation measures and environmental management plan (including timeframes for specific actions and responsible persons). Refer to Table 8.3 at the end of this section which summarises the impacts, mitigation measures, and environmental management action plan.

8.3.1 Geology

No impacts on the geology of the area are anticipated during this phase.

8.3.2 Topography

The topography of the project area will be impacted on by the clearance and construction activities. The remote location of the project area makes this an impact of low significance. The impact should however, be limited to the approved footprint and be mitigated by the implementation of clean and dirty water systems prior to the construction of the facility and designing the TSF with closure in mind (design taking cognisance of the natural relief and geomorphologic setting).

8.3.3 Soils, Land Use and Land Capability

The majority of the identified impacts on soil in the area will occur during the construction phase, these include: soil erosion, topsoil degradation, soil compaction, chemical soil pollution and loss of wilderness and grazing land capability in the project area.

The following management measures are proposed to limit the impact of the TSF construction:

- Keep as much landcover as possible: Do not strip too large an area, because this exposes the stripped surface to the risk of water and wind erosion (which will create dust and sediment). However, if the stripping face is too close to the construction activity, it will result in the loss of valuable soil material.
- Supervise stripping to ensure soils are stripped correctly: When too little soil is stripped, valuable rehabilitation materials are lost, when too much, good quality soil is contaminated with poorer quality and unsuitable materials which are frequently highly compactable and tend to cement when exposed at surface.

Monitoring requires assessment of the depth stripped the degree of mixing of soil materials and the volumes of material replaced directly or placed on stockpiles.

- Avoid vegetation clearance and earthworks during the rainy season: The chances of runoff are the highest during the rainy season. The construction period should be planned to avoid vegetation clearance, stripping and earthworks during this period.
- Strip and replace in one action where possible: Where possible, stripping and replacing of soils should be done in a single action to both to reduce compaction and to increase the viability of the seed bank contained in the stripped surface soil horizons. Stockpiling both increases compaction and decreases the viability of the seed bank, and should only be done when no areas of reshaped impacted land are available for direct placement.
- Locate soil stockpiles so that re-handling of soil is minimised: Soil stockpiles should not be moved after initial stripping unless the soil is being replaced in its final location in the rehabilitated profile. Damage to soil structure; compaction and soil losses occur each time soils are handled. While it may cost more initially, it is better to place stockpiles in areas where they will not have to be moved.
- Ensure free draining location: Placing soil stockpiles in drainage a line causes the waterlogging of soils (soils thereby lose desirable physical and chemical characteristics) and increases the risk of loss of soil materials due to erosion. Ideally, stockpiles should be placed on a topographical crest which provides free drainage in all directions. Alternatively, a side-slope location with suitable cut-off berm construction upslope is acceptable and with a down gradient berm to prevent sedimentation of the surrounding receiving environment.
- Minimise compaction during stockpile creation: Soils should be stockpiled loosely. If shovel and truck are used, the ideal is for soils to be dumped in a single lift. The use of heavy equipment over soil piles results in soil structure damage. If direct dumped soil piles are too low, then it is possible to increase stockpile height using a dozer blade or back-actor bucket to raise the materials.
- Running trucks over the piles or using bowl scrapers or graders to level and shape stockpiles, is not recommended. When the only alternative to losing soil material is the use of unsatisfactory (i.e. bowl scraper) equipment, compaction damage can be reduced to some extent by stripping as thick a cut as possible and by dumping it as thickly as possible. In addition, deposition in a single track line may reduce to some extent the overall compaction of the dumped or replaced soil through the minimisation of the footprint area of disturbance.
- Strip soils only when moisture content will minimise compaction risk. Most soils are highly susceptible to compaction, which is usually greatest when soils are moist. ***Stripping and replacement of soil should be done during the dry season when***

rainfall is at its lowest and soils are driest. If not practical, every effort must be made to minimise compaction by the methods used for soil stripping, stockpiling and replacement.

8.3.4 Flora and Fauna

The following impacts are relevant to this particular type of development:

- Impacts on flora species of conservation importance (including habitat suitable for these species);
- Impacts on fauna species of conservation importance (including habitat suitable for these species);
- Impacts on sensitive or protected habitat types (including loss and degradation);
- Loss of sensitive/ natural habitat types (including plant diversity & abundance);
- Displacement of fauna species, human-animal conflicts & interactions (including diversity & abundance);
- Impacts on ecological connectivity and ecosystem functioning; and
- Indirect impacts on surrounding habitats.

Refer to table 8.3 which details mitigation and action plans. Due to the sensitive nature of the fauna and flora in this region, it is recommended that a biodiversity offset area be identified, should the New TSF be authorized.

8.3.5 Surface Water

The risks identified and mitigation measures proposed for the TSF site are focused on pollution of surface water. The proposed development of the TSF is unlikely to pose significant risks to local surface water resources if appropriate measures are in place.

The TSF construction will permanently alter the flow of water from the non-perennial drainage lines within the TSF area. According to the Hydrology Report:"… the proposed TSF area is already situated on top of a stream with other mining infrastructure around it. Stormwater will be diverted around the TSF."

The proposed development of the tailings delivery pipeline is not considered to pose significant risks to the environment providing that sound environmental management measures are implemented during construction. An important safety check will also be the review process which will be undertaken by the environmental officers and engineers at the DWA with regards to the water uses which must be applied for in terms of the Section 21 (c) and (i) of the NWA. The DWA engineers will approve the conceptual designs during the review process, and the detailed designs before actual construction may begin.

Refer to table 8.3 which details mitigation and action plans.

8.3.6 Groundwater

It is not expected that any significant impact on groundwater quality will occur during the construction phase, due to its short duration. Planning for managing the impact on groundwater quality during later phases is essential during the construction phase of the project.

Groundwater management measures that are proposed for the TSF include:

- Minimise dirty water volumes by diverting clean water away from the dirty water system. Increases in water volumes are directly linked to increases in infiltration. Reduction if contaminated water volumes will reduce the risk of contaminant water infiltration into the aquifer;
- Contain dirty water in adequately sized holding dams to avoid spillage and overflow into the catchment. The RWD will be constructed to the southwest of the site and will be lined with HDPE;
- Clearing of topsoil in footprint area. The soils in the TSF footprint area are highly dispersive and do not compact well. The dispersive soils have the potential to wash into the under drain network, blocking it and therefore do not provide suitable material to construct the under drains for the TSF. The top soil should be removed to construct the starter embankment and serve as topsoil cover during rehabilitation. The erosion gullies can also be backfilled using selected soils with low hydraulic conductivities. By clearing the topsoil, blockage of the under drains is reduced and an improved drainage of seepage water to the under drains could occur;
- Installation of drains underneath the TSF. It was assumed that the TSF is unlined and that the drains will be capable of removing 50% of the seepage generated in the TSF, reducing the infiltration into the groundwater;
- The efficient operation of the under drains, in combination with the low permeability bedrock eliminates the need for HDPE liner system at the TSF;
- Sealing of boreholes in footprint area. The boreholes in the footprint area of the TSF should be sealed to prevent preferential pathways of contaminants to the aquifer;
- Continuation of the monitoring programme (including the proposed expansions to the monitoring programme).

The construction phase impacts on groundwater are expected to have a **low** significance. The mitigation measures are expected to reduce the cumulative impact during the

operational and decommissioning phases. No impacts on groundwater are expected during the pipeline construction.

8.3.7 Air Quality

The creation of dust during the footprint clearance and construction activities is the only potential impact identified. However the lack of sensitive receptor communities within the close proximity of the construction sites means that this impact is not considered significant.

This impact can be controlled by means of dust suppression spraying and the use of correct PPE by workers to prevent inhalation of dust.

8.3.8 Noise

Although noise will be created during the construction phase, the lack of sensitive noise receptors makes this impact of low significance. Noise levels can be controlled by the careful use and maintenance of vehicles and equipment. Refer to table 8.3 which details mitigation and action plans.

8.3.9 Visual

Significance or magnitude of visual impacts is a measure of the response of viewers to the changes that occur. It represents the interaction between humans and the landscape changes that they observe. The response to visible changes in the landscape may vary significantly between individuals (refer to the description of viewer group under section 5.11.3).

The potential visual impact of the proposed activity will primarily result from changes to the visual character of the area within the viewshed. The nature of these changes will depend on measurable factors such as viewing distance, the visual absorption capacity (VAC) of the surrounding landscape and the scale of the surrounding environment and landform. Other factors are subjective, such as the visual perception of individuals viewing the activity.

The magnitude of visual impact is determined using the viewshed, viewing distance, VAC and the viewer sensitivity criteria.

Table 8.2 summarises the results of the criteria used to determine the magnitude of the visual impact. These results are based on worst-case scenarios when the impact of all aspects is taken together.

Table 8.2 Magnitude evaluation for the proposed TSF (Construction Phase)

	QUALITY OF VISUAL RESOURCE	VIEWSHED	VISUAL DISTANCE	VAC	SENSITIVITY	VISUAL IMPACT (MAGNITUDE)
Prior to construction	***MEDIUM***					
Construction Phase & Operational Phase Assuming mitigation is successful)		***Moderate***	***High***	***Medium-High (Medium-Low Impact)***	***Moderate***	***Moderate***

According to the results tabulated in Table 8.2, the magnitude of visual impact associated with the proposed TSF area during the construction phase will be **moderate**, assuming that mitigation measures are successful.

Specific issues to be addressed include dust pollution as a result of landscape and vegetation clearing, and the presence of construction vehicles.

The management measures proposed in the impact tables are described briefly below:

- Landscaping

The minimum amount of existing vegetation and topsoil should be removed from construction areas. Ensure, wherever possible, all existing indigenous vegetation is retained or salvaged and kept in a controlled environment such as a nursery, for future re-planting otherwise the contractor must be contractually obliged to replace any indigenous trees that are destroyed. Eradication of vegetation should be done in a 'natural manner', avoiding harsh straight lines.

Due to the large footprint (130Ha) of the TSF, an offset area should be considered.

An ecological approach to rehabilitation and vegetative screening measures, as opposed a horticultural approach to landscaping should be adopted. For example communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. This ecological approach to landscaping costs significantly less to maintain than conventional landscaping methods and is more sustainable. A registered landscape architect should be consulted for this purpose, particularly for areas that have had terrain and topographic alterations.

Trees and shrubs can be used to screen structures and break stark contrasting lines if carefully planned and positioned. For any long-term (greater than 15 years) and permanent impacted areas, planting of indigenous trees can screen the affected area completely from the surrounding environment. This should also be planned in consultation with a professional landscape architect / botanist.

- Access Roads

During construction of the TSF, construction and access roads will require an effective dust suppression management program, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface.

Where a paved surface is required use dark paving materials that complement the natural brown colours and textures of the soil and rock in the area rather than light coloured materials i.e. concrete colours should be avoided.

- Areas of cut and fill

To minimise the visual impact of any areas to be cut and filled, such as the TSF area, the design of the slopes should be as gradual as possible. A slope of 1:2, 5 or 1:3 is preferred. However where the reserve width requires a slope steeper than 1:2 the cut face or fill slope must be stabilised by means of a retaining wall that should allow for planting. A slope of 1:2 and steeper increases the potential of soil erosion during heavy rain events, hampering the growth of the covering vegetation. Concurrent re-vegetation and rehabilitation is recommended for the proposed TSF area.

- Site vegetation and rehabilitation

It is noted that TSF design and construction have to follow very specific and rigid engineering principles. The above recommendations are not always feasible / possible.

Ensure that all disturbed areas are re-vegetated. Ensure that continuous rehabilitation of the affected areas is undertaken as mining is completed. Ensure that the topography of backfilled, rehabilitated areas is consistent with the pre-mining landscape.

8.3.10 Archaeology and Heritage

No impacts on the archaeology or heritage resources of the proposed TSF footprint area are anticipated. The construction team will, however, be made aware that the possibility always exists for uncovering subterranean artifacts during construction activities and that a qualified archaeologist must be called in to assess such discoveries.

No survey was undertaken for the proposed tailings delivery pipeline route as yet, as the route was finalized shortly prior to completion of this report. Since the pipeline route largely intersects the Dwasrivier mine property, existing studies will be consulted before commissioning a heritage survey of the route. Further information will be available in the Final EIA Report.

8.3.11 Riparian Zones

No wetlands were identified within or in the vicinity of the project area; therefore no environmental impacts on any wetlands are anticipated.

The non-perennial surface water resources within and around the TSF footprint area were assessed however, and various environmental impacts were identified:

- Loss and disturbance of riparian vegetation: The four small drainage lines, one of which is associated with a narrow riparian zone, which fall within the proposed footprint and will be permanently destroyed by the TSF. Loss of these habitats will also result in the loss or displacement of the biodiversity associated with the habitats.

Construction activities, if not strictly controlled, could also result in additional disturbances to the water resources and riparian habitat adjacent to the site, through for example injudicious driving, fire, or temporary stockpiling of material. Such disturbances can lead to increased erosion (e.g. preferential flow paths created by vehicle tracks), displacement of associated fauna, changes in riparian vegetation and invasion by alien vegetation.

8.3.12 Socio-economic

The SIA undertaken by GCS assessed the impact of both the proposed TSF and the proposed UG2 & Merensky mining expansion within the TRP mining right area. The impacts identified have been separated for the purpose of this EIA/EMP reports which are being done separately due to the fact that separate NEMA applications were submitted for each proposed development.

The following social impacts (positive and negative) were identified:

- *Resettlement:* Resettlement implies proper compensation, as compared to displacement, which refers to the process by which a projects cause people to lose land and/or assets (e.g. homes, agricultural land or other areas on which they depend on for resources) and/or access to resources, without (adequate) compensation. Negotiations with the landowner of the De Grooteboom 373 KT, Portion 1 (TSF footprint area) must include discussions with regards to compensation.
- *Waged labour:* This impact changes the number of available jobs in an area. The construction of the new TSF is expected to be completed within 18 months and the majority of the tasks are expected to be undertaken by a specialist contractor. Such a contractor would usually use their own teams of personnel to undertake the construction activities; especially those specialised tasks. Approximately 120 employment opportunities will be created during the construction phase.
- *Employment creation and decrease in unemployment*: Development directly influences changes in employment and income opportunities in communities. An estimated 120 temporary employment opportunities will be made available during the construction of the new TSF and a total of 30 permanent employment opportunities during operations.
- *Conversion and diversification of land use*: This refers to the change in the way land is used in terms of the extent of land, the intensity of the use of the land, whether there are areas of land not used for production, the type of land use activities and the pattern or mix of those activities. It is expected that the land use on the farm De Grooteboom will change from agriculture and grazing to mining due to the construction of the new TSF. Since the affected landowner will be compensated for this land, this is not anticipated to have a large negative impact on the land use of the region, especially since the land is not extensively used for agriculture or grazing.
- *Impact equity*: This refers to fairness of the distribution of impacts (positive and negative) across the community. People who will benefit from the mine expansion must also share in carrying the costs. The project will lead to gain on a regional level (mining royalties paid to Limpopo Province), whereas the local communities will not necessarily benefit in terms of financial benefits and employment opportunities.
- *Feelings in relation to the project*: Proposed projects and developments often generate uncertainty, anxiety or fear and, sometimes, the impacts perceived in anticipation of the planned intervention can be greater than the impacts that ultimately result from the intervention (Burge and Vanclay, 1995).

- *Physical quality of the living environment (actual and perceived)*: Social impacts experienced in the physical environment relate to exposure to dust, noise, risk, odour, vibration, artificial light etc. During the construction phase for the TSF, it is expected that there will be a decrease in the quality of the physical environment. Noise levels and traffic volumes will increase as result of the construction activities. It is expected that the environment in which the TSF will be located will suffer a level of environmental degradation and that this may have a negative impact on the surrounding landowners. It is, however, not expected that any other receptors will be affected by the proposed new TSF.
- *Aesthetic quality of the living environment*: The TSF construction may impact on the "Sense of Place" and the visual quality or aesthetic appeal of the environment. The visual impact of the TSF was assessed (VIA, Appendix B-7) and mitigation measures proposed. From a social perspective, it is expected that the proposed TSF will have a minor negative impact on the aesthetic quality of the environment. The impact will be relatively small, since the landscape has already been impacted by mining infrastructure and holds minimal tourism value.
- *Personal safety and hazard exposure*: The potential impact can be twofold, i.e. personal safety and risk exposure due to the mine infrastructure itself, or due to the influx of strangers entering the local communities or farms.

  The safety of workers and property owners and other residents within close proximity to the study area may be impacted on during the expansion phase. These impacts are related to the movement of vehicles transporting goods and materials on the roads leading to the site (e.g. heavy machinery, heavy vehicles, and earthmoving equipment), in addition to the transport of construction personnel.

  A more direct threat is the potential of veld fires occurring due to the presence of construction workers and construction related activities on site. This could pose a threat to livestock, crops, residents and houses in the area.
- *Loss of natural and cultural heritage*: Protection of archaeological sites and cultural heritage is an important factor in mine planning. According to the Heritage Impact Assessment (HIA) that was conducted as part of the specialist investigations no sites of cultural importance were identified during the survey.

Table 8.3 Construction Phase Impacts, Mitigation and Management (Action) Plan

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE TRP MINE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	PHASE	PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CONSTRUCTION PHASE ACTIVITIES: SITE PREPARATION, FOOTPRINT CLEARANCE, INFRASTRUCTURE AND DECLINE CONSTRUCTION, WASTE HANDLING																				
TRP MINING AREA: NEW TSF & PIPELINE																				
GEOLOGY																				
Alteration of Geology	New TSF & Pipeline	**Construction** - Excavation	8	5	1	5	70	-	H	Mitigation not possible, geology is permanently altered	8	5	1	5	70	N	H	1. Ensure that construction remains within the mining right boundary	Construction	Engineer
TOPOGRAPHY																				
Change to natural topography	New TSF & Pipeline	**Site Preparation** - Storm water	4	4	1	4	36	-	M	Limit clearing to the footprint, maintain as much natural vegetation as possible	2	4	1	3	21	-	L	1. Designs should take cognisance of topographical features of the site	Site preparation & footprint clearance	Engineer
		Footprint Clearance & Levelling	4	4	1	3	27	-	L	Limit clearing and levelling activities to the footprint area only	2	4	1	2	14	-	L	1. Demarcate footprint clearly as per design. 2. Limit vegetation removal to the footprint only. 3. Limit levelling to within the footprint only.	Footprint clearance	Engineer
		Construction - infrastructure & dams	4	4	1	3	27	-	L	Mine design should take cognisance of the natural surroundings	2	4	1	3	21	-	L	1. Use natural colours to paint structures where possible (green or brown) 2. Revegetate exposed surfaces immediately after construction	Construction and post construction	Engineer
SOILS, LAND USE AND LAND CAPABILITY																				
Loss of grazing land	New TSF & Pipeline	**Site Preparation** - perimeter fence	1	5	8	5	70	-	H	No mitigation possible	1	5	8	5	70	-	H	N/A	N/A	N/A
Loss of fertile topsoil	New TSF & Pipeline	**Footprint Clearance** & Levelling	8	5	1	5	70	-	H	Minimise the stripping footprint as far as possible, and stockpile the topsoil for future use.	4	3	1	4	32	-	M	1. Demarcate the footprint area clearly 2. Stockpile the topsoil for future use 3. Fertilise and re-vegetate the stockpile at the end of the construction phase	Prior to construction	Engineer
Soil Erosion	New TSF & Pipeline	**Footprint Clearance & Construction -** exposed soil	6	5	1	4	48	-	M	Minimise Infrastructure footprint	4	3	1	3	24	-	L	1. Demarcate the footprint area clearly. 2. Manage storm water flow with temporary erosion control measures where possible (cut-off trenches or berms) 3.Schedule construction as soon as possible after site clearing.	Prior to and during construction	Engineer
Soil compaction	New TSF & Pipeline	**Footprint Clearance & Construction -** vehicle movement	6	3	1	4	40	-	M	Correct use of vehicles to prevent compaction, avoidance of work in wet conditions.	4	3	1	4	32	-	M	1. Use tracked vehicles instead of wheeled vehicles where possible 2. Avoid clearance and earthworks in the rainy season 3. Stockpile soils loosely and to a sufficient height to prevent vehicles driving over the stockpiles 4. Drive only on constructed roads	Prior to and during construction	Engineer

Soil Contamination	New TSF & Pipeline	**Waste Handling** - waste water and fuels	8	2	1	5	55	-	M	Prevent seepage of wastewater and spillage of fuel and oils.	2	2	1	2	10	-	L	1. Solid waste must be stored at site on an approved waste disposal area, and removed regularly by credible contractors 2.A berm should be constructed upslope of the construction footprint area, to direct clean water away from the dirty water area 3. Water from the development footprint must be captured and contained 4. Any spillages from the wastewater containment system must be managed immediately in accordance with the Emergency Response Plan 5. Chemicals and fuels to be stored in bunded areas. 6. Vehicles to be correctly maintained to prevent oil leakage	Prior to and during construction	Engineer
TERRESTRIAL BIODIVERSITY (FAUNA AND FLORA)																			
Loss of flora species of conservation importance (including habitat suitable for these species)	New TSF & Pipeline	**All construction activities**	10	4	2	4	64	-	H	Minimise the area to be cleared. Identify important species in the footprint areas	10	4	2	3	48	-	M	1.Conduct detailed, multi-seasonal walk-through prior to construction activities 2. Compile list of protected and RD species, compile relocation programme 3. Establish off-site nursery	Prior to vegetation clearing	Project Manager Ecologist Environmental Officer
Loss of fauna species of conservation importance (including habitat suitable for these species)		**All construction activities**	10	4	2	4	64	-	H	Minimise the area to be cleared. Identify important species in the footprint areas	10	4	2	3	48	-	M	1. Conduct detailed, multi-seasonal walk-through prior to construction activities 2. Compile list of protected and RD species 3. Compile relocation programme where necessary/practical	Prior to vegetation clearing	Engineer in consultation with Environmental Officer
Loss of unique or protected habitat types (including loss and degradation)		**All construction activities**	8	4	2	5	70	-	H	Implement a biodiversity offset area	6	5	2	4	52	-	M	1. Identify suitable offset area/s, taking cognisance of existing and formal (declared) conservation programmes in the immediate region. 2. Implement Biodiversity Offset Principles	Prior to vegetation clearing	Engineer in consultation with Environmental Officer
Displacement of fauna species, human-animal conflicts & interactions (including diversity & abundance)		**All construction activities**	4	4	2	5	50	-	M	Operational plans that allow for animal protection. Staff training and awareness.	4	4	2	4	40	-	M	2. Identify operational protocol that will allow for protection of animals during construction & operational phases 3. Awareness programmes 4. Catch and release protocol	Construction	Engineer in consultation with Environmental Officer
Loss of ecological connectivity and ecosystem functioning;		**All construction activities**	8	4	2	5	70	-	H	Very difficult to mitigate. Contain activities to the construction footprint only. Implement a biodiversity offset area.	6	4	2	4	48	-	M	1. Identify suitable offset area/s, taking cognisance of existing and formal (declared) conservation programmes in the immediate region. 2. Implement Biodiversity Offset Principles	Construction	Engineer in consultation with Environmental Officer
SURFACE WATER																			
Siltation of surface water resources & associated soil erosion	New TSF & Pipeline	**Footprint Clearance & Construction** - exposed soil	10	4	3	5	85	-	H	Ensure that clean and dirty water separation infrastructure is in place prior to the commencement of construction.	4	4	1	2	18	-	L	1. Installation of water management structures as a priority. 2. Compaction of the footprint area. 3. Sloping to allow free runoff to water control structures. 4. Management of runoff velocity to prevent erosion gullies. 5. Inspection and maintenance of water management infrastructure	Construction	Project Manager Contractor Environmental Officer
Reduced runoff to surface water resources & potential contamination due to incorrect dam sizing		**Construction** - diverted runoff	10	4	2	5	80	-	H	Appropriate design criteria for the 1:50 year storm event to be contained and re-used.	6	1	1	3	24	-	L	1. Maintenance of the on-site dams to contain water for re-use 2. Internal management of the site water balance	Design Construction	Engineer

Surface water contamination		**Waste Handling** - litter and building rubble	2	2	2	5	30	-	M	Builder's contracts should stipulate the appropriate storage and removal of builders' waste.	2	2	1	2	10	-	L	1. Solid waste must be stored at site on an approved waste disposal area, and removed regularly by credible contractors 2.A berm should be constructed upslope of the construction footprint area, to direct clean water away from the dirty water area 3. Water from the development footprint must be captured and contained 4. Any spillages from the wastewater containment system must be managed immediately in accordance with the Emergency Response Plan 5. Chemicals and fuels to be stored in bunded areas. 6. Vehicles to be correctly maintained to prevent oil leakage	Construction	Engineer
		Waste Handling - fuel and oil spills	6	3	3	3	36	-	M	Prevent seepage of wastewater and spillage of fuel and oils.	4	3	2	2	18	-	L		Construction	Engineer
		Waste Handling - Seepage to surface water resources from waste disposal areas.	10	4	2	5	80	-	H	Design criteria should prevent seepage (Refer the New TSF Hydrogeological study). Any seepage must be contained.	6	4	1	2	22	-	L		Construction	Engineer
RIPARIAN ZONES AND WETLANDS DOWNSTREAM OF THE SITE																				
Increased sediment transport into down slope water resources	New TSF & Pipeline	**Footprint Clearance and Construction** - dirty water runoff	6	2	2	5	50	-	M	Reduce sediment load of surface runoff	4	2	1	5	35	-	M	1. Rehabilitation should be undertaken within 3 months. 2.Where practically possible, the major earthworks should be undertaken during the dry season (roughly from June to September) to limit erosion due to rainfall runoff.	Pre-construction Construction	Engineer
Altered runoff characteristics of the landscape	New TSF & Pipeline	**Construction** - New structures	6	2	2	5	50	-	M	Minimise alteration of existing flow paths	4	2	1	5	35	-	M	1.Limit activities to the construction footprint only. 2. Landscape and re-vegetate exposed areas immediately after construction. 3. A shallow berm should be constructed between the proposed TSF footprint and the downstream (off site) wetlands to prevent sediment rich runoff.	Pre-construction Construction	Engineer
Erosion within watercourses	New TSF & Pipeline	**Construction** - Infrastructure, New TSF and river crossings	6	2	1	4	36	-	M	Prevent high velocity surface flow while surfaces are exposed during construction	4	2	1	4	28	-	L	1.Structures leading to flow concentration such as roads and ruts should be modified to ensure no concentrated, high velocity surface flows occur on site or are discharged into watercourses. 2.All storm water and clean water diversion discharge points should be protected against erosion and incorporate energy dissipators to prevent high velocity flows entering water resources. 3.Bidim walls should be installed at all discharge points to trap sediments. These bidim walls will need to be regularly inspected and repaired if required. With the establishment	Construction	Engineer Environmental Officer

Damage and contamination of riparian zones	MR Expansion New TSF	**Footprint Clearance & Construction** - pipeline and conveyor over streams and river. **Waste handling**	8	2	1	4	44	-	M	Minimise clearing & construction activities within riparian zones as far as possible	4	2	1	4	28	-	L	1. Limit construction footprint 2. No fuels or oils may be stored within the riparian zone 3. Limit the movement of vehicles within the riparian zone. 4.With the establishment of infrastructure, especially pipelines, ensure that adequately sized culverts are incorporated into the design where required to ensure the continuing flow for water within the catchment;	Clearance Construction	Engineer
GROUNDWATER																			
Removal of underground water (Dewatering)	New TSF & Pipeline	**Construction** - New Declines	6	4	1	3	33	-	M	Track water volumes and quality to enable early warning of potential impacts.	4	4	1	3	27	-	L	1. Implement water quantity and quality monitoring at the construction phase 2. Compile monthly water quality and quantity reports to assess potential impacts 3. Install flow meters to monitor the amount of water extracted from underground	Start of construction phase	Engineer
Impact on groundwater quality	New TSF & Pipeline	**Footprint Clearance -** exposure of soil	2	2	1	4	20	-	L	Prevent seepage of dirty water to the aquifer	2	2	1	2	10	-	L	1, Divert clean water away from dirty water systems 2. Construct storm water management structures prior to footprint clearance.	Prior to footprint clearance Construction	Engineer
	New TSF & Pipeline	**All activities -** containment of dirty water	2	2	1	4	20	-	L	Prevent seepage of dirty water to the aquifer	2	2	1	2	10	-	L	1. Line all dirty water dams with HDPE liner	Construction	Engineer
	New TSF & Pipeline	**Construction** - Drain installation beneath TSF	2	2	1	4	20	-	L	Implement design measures to control seepage to the aquifer	2	1	1	2	8	-	L	1. Toe drains, under drains and cut-off trenches must be installed to protect the shallow aquifer from seepage. 2. TSF dry wall should be installed into the weathered shallow material to cut off sub-surface seepage through the weathered aquifer material; 3.A cut off trench should be installed down gradient of the dry wall to capture contaminated TSF seepage 4. Coarse tailings should be placed to form a high permeability zone close to the starter embankment and inner toe drain, creating a low pressure zone.	Construction	Engineer
	New TSF & Pipeline	**Construction** - sealing of boreholes	2	2	1	4	20	-	L	Seal existing boreholes on the TSF footprint to prevent aquifer contamination	2	1	1	2	8	-	L	1. Boreholes located within the New TSF footprint should be sealed with a bentonite and concrete mixture to ensure that there are no artificial preferential pathways for contaminants into the aquifer.	Footprint Clearance	Engineer
AIR QUALITY																			
Dust creation	New TSF & Pipeline	**Footprint Clearance and Construction** - soil exposure	2	2	1	3	15	-	L	Reduce dispersion of dust to the atmosphere	2	2	1	2	10	-	L	1. Ensure the clearance footprint adheres to the design (minimum area) 2. Implement a programme of dust suppression if required 3. Implement dust monitoring	Construction phase	Engineer
VISUAL																			
Negative impact on aesthetics	New TSF & Pipeline	**Footprint clearance -** removal of vegetation	5	4	1	4	40	-	M	Limit clearance to the footprint only	4	5	2	4	44	-	M	1. Clearly demarcate construction footprint.	Prior to footprint clearance	Engineer

	New TSF & Pipeline	**Waste Handling -** improper storage of waste	6	2	1	4	36	-	M	Separate, store and remove waste regularly	4	2	1	3	21	-	L	1.Solid waste must be stored temporarily on site in waste skips 2. Waste must removed regularly by an credible contractor.	Construction	Engineer
	New TSF & Pipeline	**Construction** - New TSF, Access Road, Dams	5	4	2	4	44	-	M	Design parameters must take visual impacts into account as far as possible	5	3	2	3	30	-	M	1. Slope design to be as gradual as possible. 2. Concurrent rehabilitation and revegetation must be implemented	Design Construction	Engineer
	New TSF & Pipeline	**Footprint Clearance & Construction** - New TSF pipeline	4	4	2	4	40	-	M	Limit construction footprint and retain visual screening where possible;	4	4	2	3	30	-	M	1. Limit construction footprint. 2. Retain visual screening as far as possible	Construction	Engineer
Dust creation	New TSF & Pipeline	**Footprint clearance -** removal of vegetation	4	4	1	3	27	-	L	Control dust creation to reduce visual and visibility impacts	2	4	1	2	14	-	L	1. Limit construction footprint. 2. Retain visual screening as far as possible	Construction	Engineer
ARCHAEOLOGY AND HERITAGE																			
Possible impacts to heritage resources	New TSF and Pipeline	**Footprint Clearance & Construction**	0	5	1	1	6	-	L	An archaeologist must be consulted should any artefacts be uncovered.	0	5	1	1	6	-	L	1. It is not expected that any items of heritage significance will be destroyed, however, should artefacts be uncovered during excavation, activity must cease until an archaeologist has been consulted.	Prior to footprint clearance	Engineer
SOCIO-ECONOMICS																			
Waged Labour	New TSF & Pipeline	**Construction**	6	3	3	2	24	+	L	Sourcing local labour and offering skills development	6	3	3	4	48	+	M	1. Local labour should be employed as far as possible. 2. Establish an employment information desk (part of the community forum meetings)	Prior to footprint clearance	Engineer
Impact on the social dynamics of surrounding communities	New TSF & Pipeline	**Construction**	6	3	3	3	36	+	M	Employ local labour, but avoid the construction of labour camps	6	3	3	3	36	+	M	1. Attempt to employ labour locally. 2. House temporary workers at the closest town rather than in a labour camp.	Prior to footprint clearance	Engineer
NOISE																			
Increase in noise levels in the vicinity of the Mine	New TSF & Pipeline	**Footprint Clearance & Construction**	4	2	2	3	24	-	L	Limit construction activities to the day time; ensure that all equipment is regularly serviced	2	2	2	2	12	-	L	1. Limit construction to day time only. 2. Ensure vehicle maintenance to minimise engine noise	Clearance Construction	Engineer

8.4 Operational Phase

Refer to Table 8.8 at the end of this section which summarises the impacts, mitigation measures, and environmental management action plan.

8.4.1 Geology

No impacts on the geology of the area are anticipated.

8.4.2 Topography

The deposition of tailings and subsequent increase in height of the TSF will impact on the topography of the area. There is little potential for decreasing the significance of this impact.

8.4.3 Soils, Land Use and Land Capability

Impacts on the soil during the operational phase may occur due to compaction, and possible spillage of tailings as well as spillages of fuels and oils during operational and maintenance activities.

These potential incidences can be managed but timeous and effective management of the spillages and remediation of contaminated soils.

Refer to Table 8.8 detailing mitigation measures and the action plan.

8.4.4 Flora and fauna

Impacts to flora and fauna in the operational phase are limited to indirect impacts to surrounding plant and animal communities, and human-animal interactions. These impacts can be mitigated by ensuring mining activities are restricted to the mine footprint/site only, implement awareness and induction programmes for staff, and operate a catch and release policy for all animals encountered on site.

8.4.5 Surface Water

Surface water resources may be contaminated if tailings or fuel and oil spillages occur or if the stormwater management infrastructure is not well maintained.

The timeous management and remediation of spillage and regular inspections and maintenance of the stormwater management infrastructure will be needed to manage these impacts.
Refer to table 8.8 which details mitigation and action plans.

8.4.6 Groundwater

8.4.6.1 Impact summary

Without mitigation, the groundwater impacts are of medium significance and can be reduced to low with efficient implementation of the recommended mitigation measures:

- Infiltration of contaminated water into the groundwater system from the RWD if the liner gets damaged. The synthetic liner and would require regular surveys to detect possible damage. Clean water needs to be kept away from the RWD to minimise water volumes and risk of spilling from the site.
- Contaminated seepage from the TSF into groundwater system. Elevated concentrations SO_4, NO_3, Na, and Cl are expected. Results from the groundwater model indicate local impact of these contaminant plumes, migrating about 800m from the site. The contaminant plume is expected to affect one user borehole and is not expected to reach the Springkaanspruit or the Groot Dwarsriver. Toe drains, under drains and cut of trenches should be installed to reduce the risk of vertical and horizontal contaminant seepage to the aquifer. The TSF should be operated with a minimum pool size to limit the infiltration volumes. This is especially important during the first two years where the footprint of the TSF is small and the tailings underlying the pool are not very thick yet. The infiltration rate of pool water is expected to reduce with time as the tailings thickness increases. The low risk of the contaminant migration after the above mitigation measures negates any requirement for a HDPE liner.

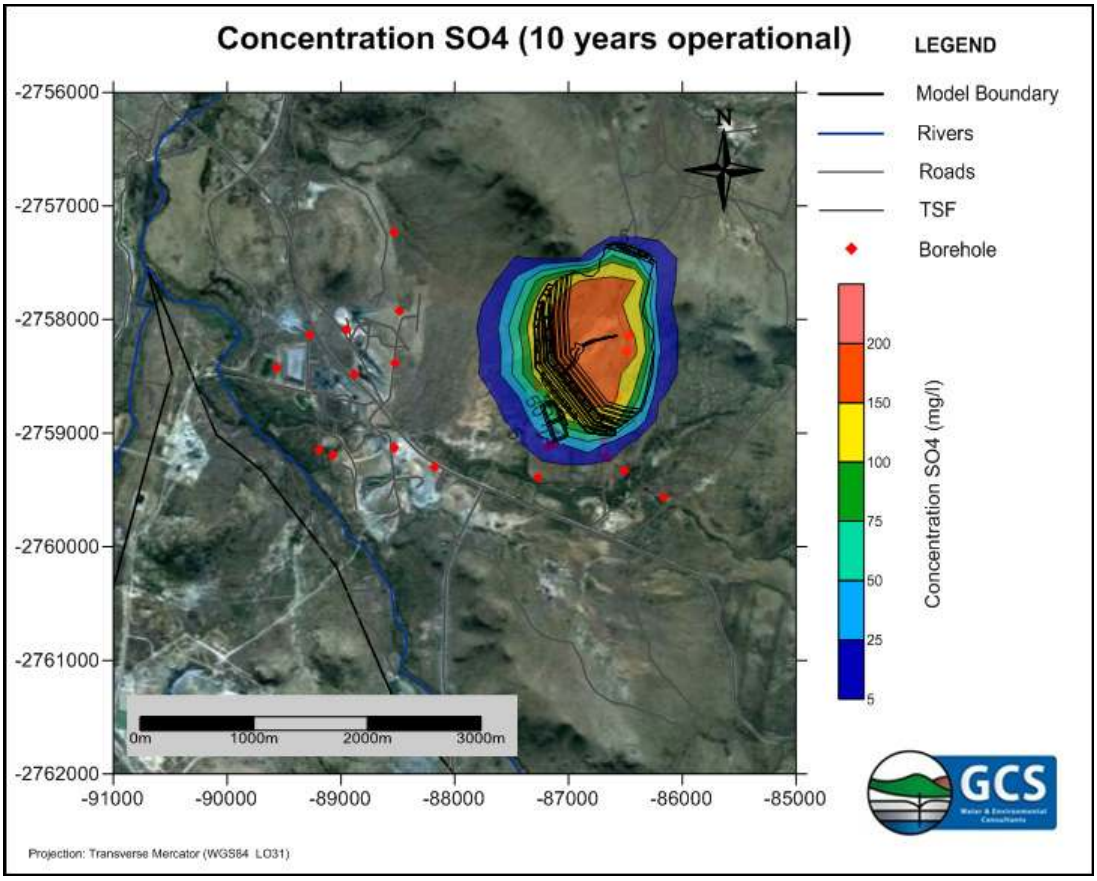
8.4.6.2 Groundwater contaminant transport from the new TSF

The contaminant transport model is discussed in detail on the Hydrogeology Report (refer to Appendix B-2).

During the 20 years of TSF operations, seepage infiltrating into aquifers below the TSF will migrate towards Springkaanspruit and Groot Dwarsrivier in a south-westerly direction. Contaminant transport of salts and nitrate over larger distances will mainly follow the groundwater flow direction. The ten (10) year and twenty (20) year operational contaminant plumes for sulphate (Figure 8.2 and Figure 8.3), chloride (Figure 8.4 and Figure 8.5) and nitrate were (Figure 8.6 and Figure 8.7) modelled.

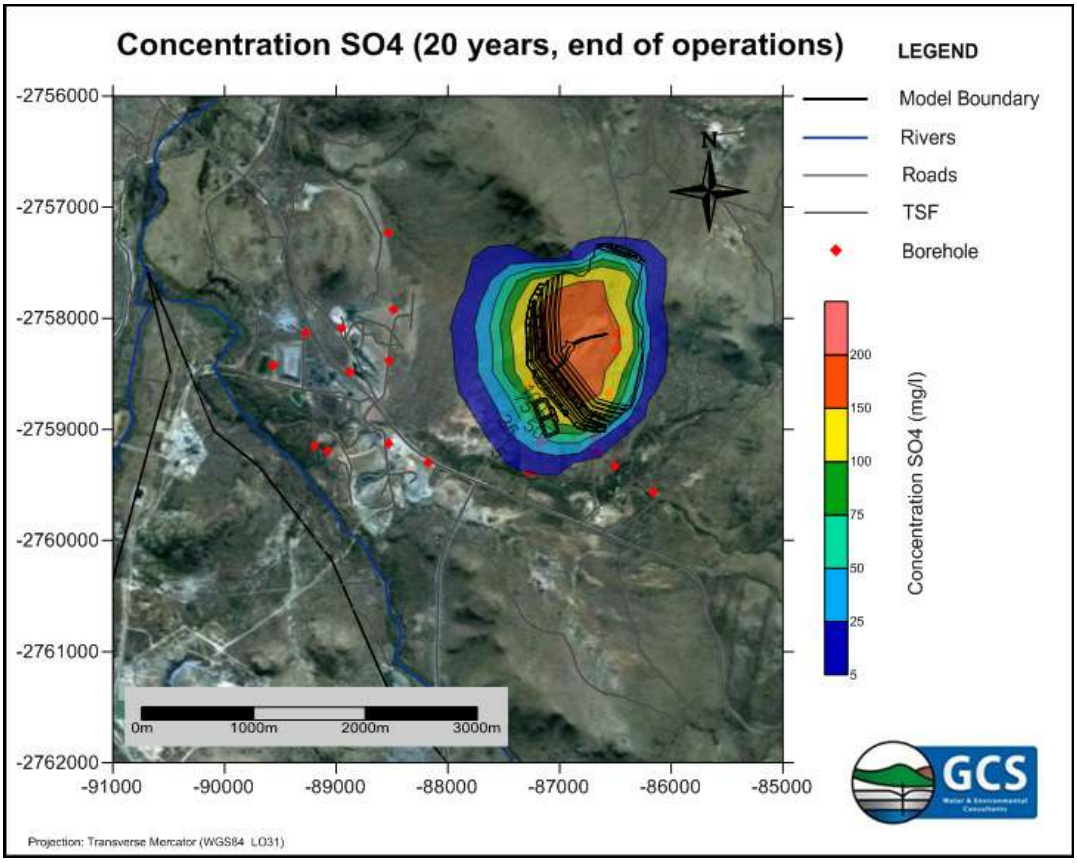
Calculations of 10 and 20 years indicate that groundwater with elevated salt concentrations and nitrate will likely not reach the Springkaanspruit and Groot Dwarsrivier. Seepage infiltrating into aquifers below the TSF will likely not migrate towards northeast direction into the B41H quaternary catchment.

Considering the RWD is located south of the proposed TSF, no contamination is expected from here. This RWD will be lined, so that seepage will likely be negligible.



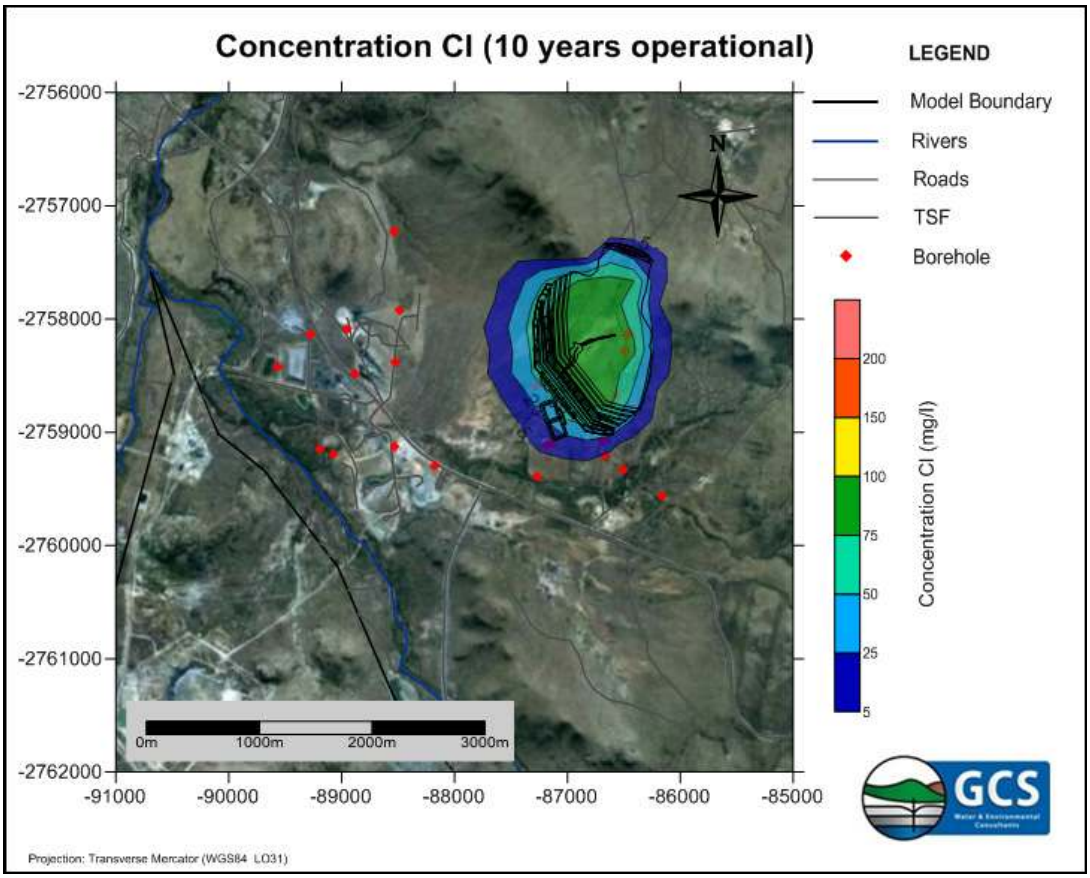
[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.2 The 10 year contaminant plume of sulphate during operational phase



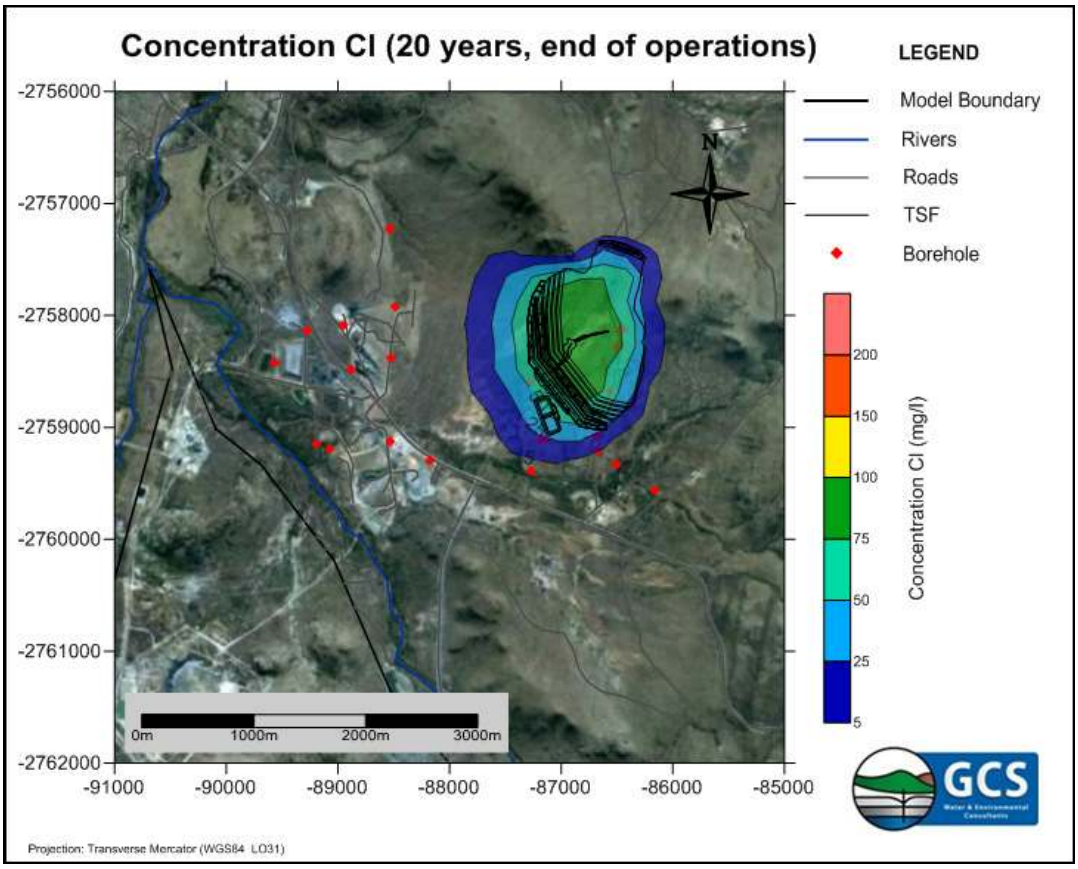
[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.3 The end of operations contaminant plume of sulphate



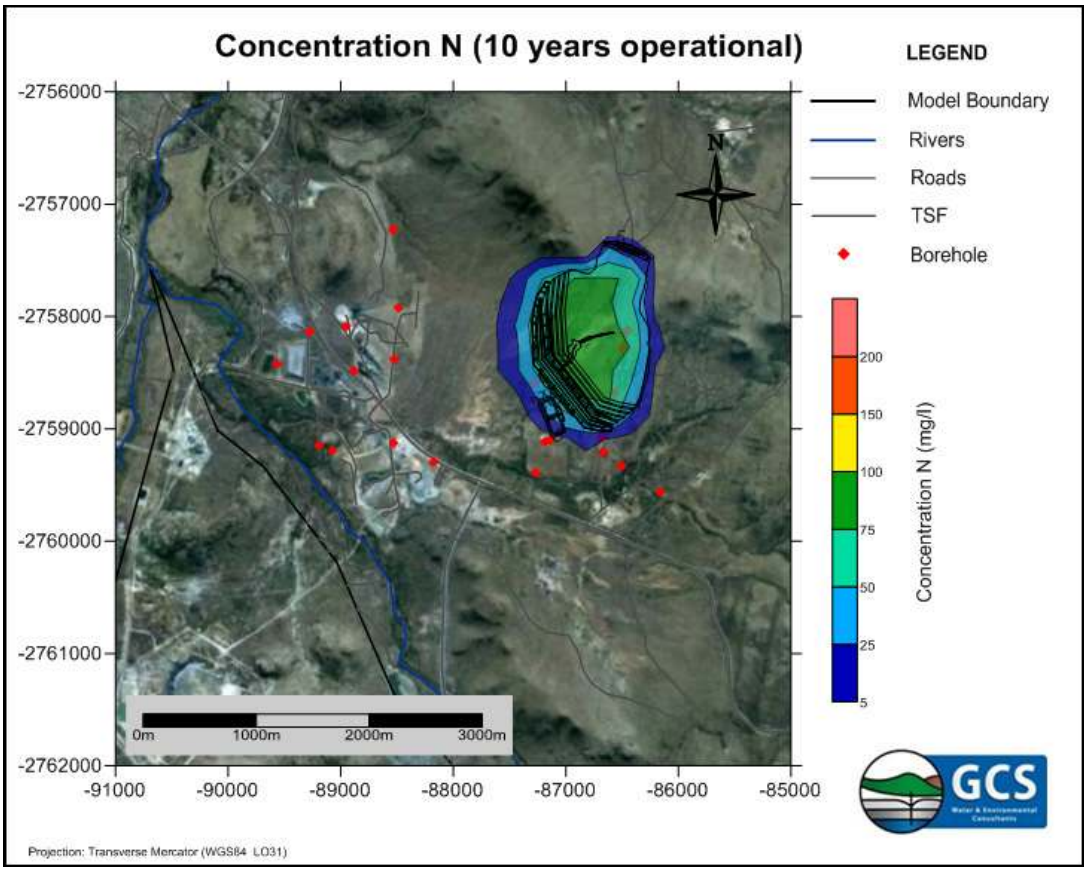
[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.4 The 10 year contaminant plume of chloride for TSF during operations



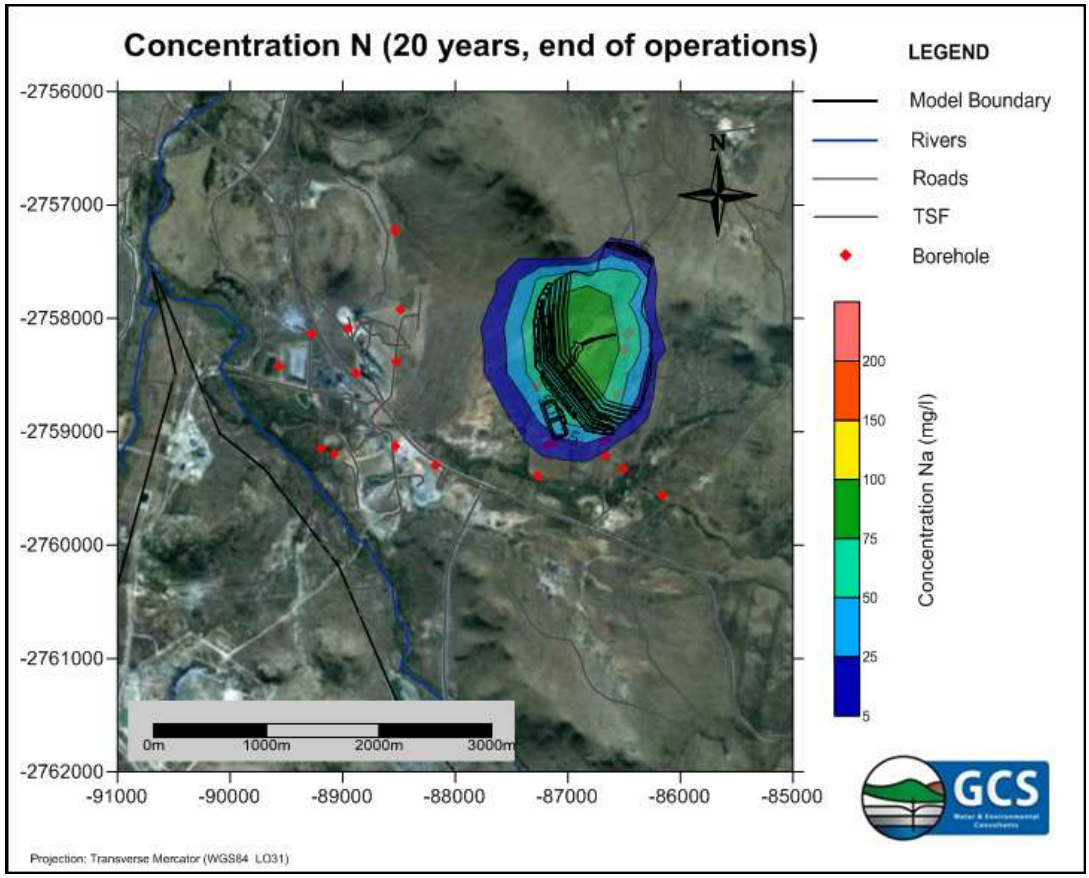
[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.5 The end of operations contaminant plume of chloride



[FIGURE NOT TO SCALE- REFER TO APPENDIX B1]

Figure 8.6 The 10 year contaminant plume of nitrate for TSF during operations



[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.7 The end of operations contaminant plume of nitrate

8.4.6.3 Groundwater model update

The hydrogeological conceptual model must be updated to improve the understanding of the processes that governs groundwater flow around the TSF. This will be important when overall TSF rehabilitation and closure options are evaluated. The water level, water quality and water balance data collected during the monitoring programme will be essential in the update of the conceptual model.

Actual tailings water must be tested when the TSF is operational. This data should be included in the numerical modeling to enable a more representative prediction of the influence of the release SO_4, Na, Cl and NO_3-load during operation and post-closure.

It is recommended that the flow and mass transport model be calibrated every two (2) years with updated monitoring data. A better understanding of the local aquifer conditions will be developed through the use of the data and more reliable long-term predictions can be made.

8.4.7 Air Quality

Dust will be created as the tailings dries. The lack of nearby communities, or sensitive receptors in close proximity to the proposed TSF site, makes this impact of medium significance, which can be reduced to low significance if proper concurrent rehabilitation is undertaken.

8.4.8 Noise

The lack of nearby communities, or sensitive receptors in close proximity to the proposed TSF site, makes this impact of low significance. Regular maintenance of equipment may help to reduce the noise created.

8.4.9 Visual

8.4.9.1 Viewshed

A viewshed analysis defines areas which contain all possible observation sites from which the proposed infrastructure would be visible. It considers the worst-case scenario, using line-of-sight i.e. ignoring trees and other structures and is based on topography alone.

The viewshed area and the areas which have direct visibility of the TSF site are depicted in Figure 8.8. The viewshed analysis methodology is described in section 5.1.1 of the VIA Report (Appendix B-3).

The viewshed indicates that the proposed TSF is visible for at least 2km in all directions, and partially visible in all directions for 10km. There is a degree of topographic screening in low-lying areas, where the mountainous terrain visually screens the proposed TSF. Areas with the most exposure include the eastern facing slopes of the Klein-Dwars River valley and the surrounding environment to the immediate south of the project area. Partial visibility occurs through large parts of the zone of influence.

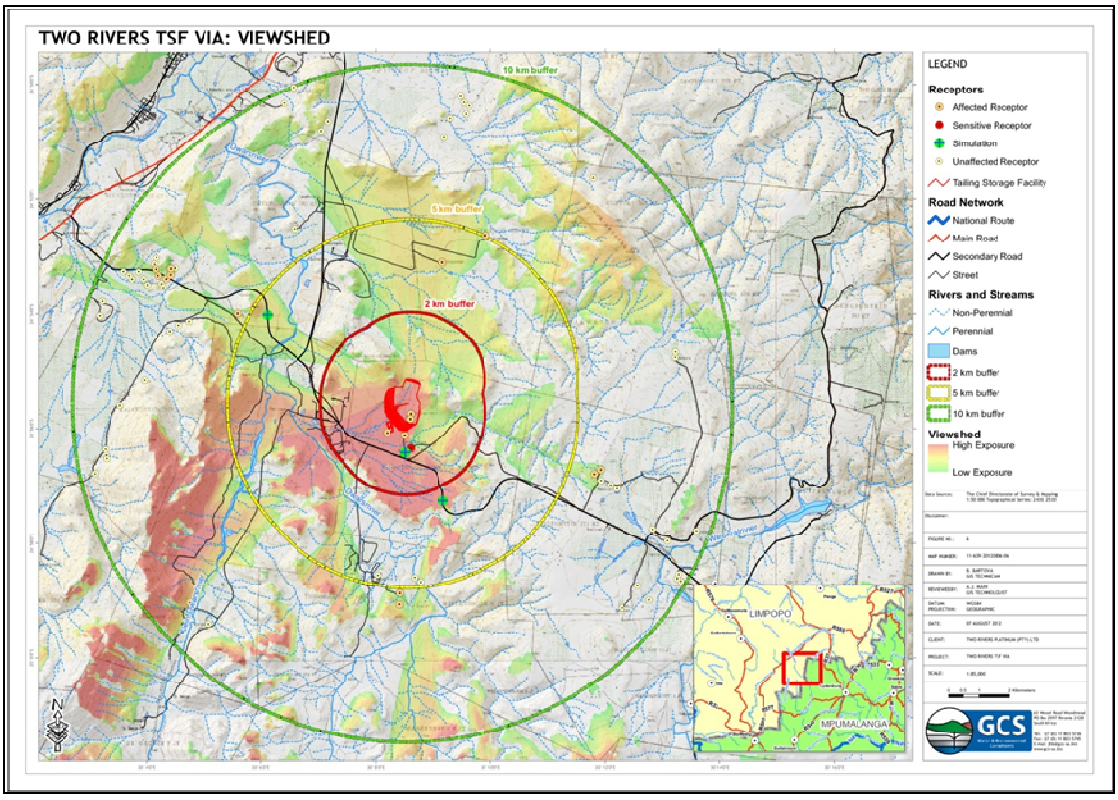
The viewshed also indicates that the footprint areas will be visible from residents and motorists within the potential zone of influence.

The visibility of the proposed TSF area from the surrounding areas during the construction and operational phases will be moderate (Refer to the evaluation criteria in Table 8.4).

Visibility during the closure phase will remain moderate to low (if mitigation measures are correctly implemented).

Table 8.4 Viewshed evaluation for the proposed TSF (moderate)

HIGH	MODERATE	LOW
If the project and its infrastructure is visible from over half the zone of potential influence, and/or views are mostly unobstructed.	*If the project and its infrastructure are visible from less than half the zone of potential influence, and/or views are partially obstructed.*	If the project and its infrastructure is visible from less than a quarter of the zone of potential influence, and/or views are mostly obstructed



(FIGURE NOT TO SCALE – PLEASE REFER TO APPENDIX B-3)

Figure 8.8 Viewshed for proposed TSF site

8.4.9.2 Viewing Distance

The visual impact of an object in the landscape diminishes at an exponential rate as the distance between the observer and the object increases (Hull and Bishop, 1988). Thus, the visual impact at 1000m would be approximately a quarter of the impact as viewed from 500m.

The 'zone of potential influence' (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was established at 10km. The visual impact of the TSF and associated infrastructure would be at its maximum at a distance of 2000m and would have diminished considerably at a distance 10km away. .

View distance is rated using four increments of severity, each with their respective qualification and contribution to visual impact (Refer to Table 8.5).

Table 8.5 View distance evaluation for the proposed TSF

	HIGH EXPOSURE (SIGNIFICANT CONTRIBUTION TO VISUAL IMPACT)	MODERATE EXPOSURE (MODERATE CONTRIBUTION TO VISUAL IMPACT)	LOW EXPOSURE (MINIMAL INFLUENCE ON VISUAL IMPACT)	INSIGNIFICANT EXPOSURE (NEGLIGIBLE INFLUENCE ON VISUAL IMPACT)
Residents	**0 – 2.0 km**	**2.0 – 5.0 km**	**5.0 - 5.0 km**	**Over 10.0 km**
Tourists	0 – 2.0 km	2.0 – 5.0 km	5.0 - 10.0 km	**Over 10.0 km**
Motorists	0 – 2.0 km	2.0 – 5.0 km	5.0 - 10.0 km	**Over 10.0 km**

8.4.9.3 Visual Absorption Capacity

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment such as:

- **Degree of Visual Screening**: A degree of visual screening is provided by landforms, vegetation cover and/or structures such as buildings. For example, a high degree of visual screening is present in an area that is mountainous and is covered with a forest compared to an undulating and mundane landscape covered in grass.
- **Terrain variability:** Terrain variability reflects the magnitude of topographic elevation and diversity in slope variation. A highly variable terrain will be recognised as one with great elevation differences and a diversity of slope variation creating talus slopes, cliffs and valleys. An undulating landscape with a monotonous and repetitive landform will be an example of low terrain variability.
- **Land Cover:** Land cover refers to the perceivable surface of the landscape and the diversity of patterns, colours and textures that are presented by the particular land cover (i.e. urbanised, cultivated, forested, etc).

Areas which have a high VAC are able to easily accept objects so that their visual impact is less noticeable.

Viewpoints representative of views experienced by residents through the study area were used for the photographic simulation. The before and after simulations which were done show the proposed activity superimposed onto the existing landscape scene (Refer to Photo 4.5 and Photo 4.6). The simulation illustrates the visual absorption potential of the affected landscape when viewed from two possible sensitive receptor positions within the study area.

The VAC of the surrounding landscape is medium-high (Refer to Table 8.6) due to:

- The proposed TSF is situated on a relatively diverse landform type with hilly terrain surrounding the immediate side;

- The medium – high degree of visual screening (due to the mountainous surrounding topography and presence of moderate visual screening vegetation);
- The colour of the proposed operations is in contrast with the natural colours of the area;
- The terrestrial environment is already disturbed by activities associated with mining. Additional mining infrastructure would therefore be completely alien and invasive to the surrounding environments landuse.

Table 8.6 Visual absorption capacity evaluation for the proposed TSF

CRITERIA	HIGH	MEDIUM	LOW
Visual Absorption Capacity (VAC)	The ability of the landscape to easily accept visually a particular development because of its diverse landform, vegetation and texture.	The ability of the landscape to less easily visually accepts a particular development because of a less diverse landform, texture and vegetation.	The ability of the landscape not to visually accept a proposed development because of a uniform texture, flat slope and limited and limited vegetation cover.

Photo 8.1 A view looking towards the TSF area from a the secondary road 2km south east of the proposed TSF area (before)

Photo 8.2 Simulation: A view looking towards the TSF area from a the secondary road 2km south east of the proposed TSF area (after)

Photo 8.3 A view looking towards the TSF area from the Ecsal lodge residential dwelling and guest house 500m south east of the proposed TSF area (before)

Photo 8.4 Simulation: A view looking towards the TSF area from the Ecsal lodge residential dwelling and guest house 500m south east of the proposed TSF area (after)

8.4.9.4 Visual Impact

The magnitude evaluation of the visual impact of the TSF operational phase is presented in Table 8.7 and discussed thereafter.

Table 8.7 Magnitude evaluation for the proposed TSF (Operational Phase)

	QUALITY OF VISUAL RESOURCE	VIEWSHED	VISUAL DISTANCE	VAC	SENSITIVITY	VISUAL IMPACT (MAGNITUDE)
Construction Phase & Operational Phase Assuming mitigation is successful)		***Moderate***	***High***	***Medium-High (Medium-Low Impact)***	***Moderate***	***Moderate***

The results of the impact assessment show that the significance of visual impact associated with the proposed TSF, during the construction phase, will be **moderate - low**, and can be minimised to a low impact provided recommended mitigation measures are successful.

Significant impacts will result from the continuous expansion of the TSF as a result of its large vertical offset, particularly in the later stages when reaching its full capacity. Specific efforts should be made in the mitigation of the affects of these activities in order to limit the impact on the surrounding environment. International practise on large TSF's is concurrent re-vegetation so as to make the TSF more compatible and neutral with the surrounding environment.

Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances. Security flood lighting and operational lighting should only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas, i.e. the residential areas within falling within the viewshed and the roads in close proximity to the site . Wherever possible, lights should be directed downwards so as to avoid illuminating the sky and minimizing light spills.

8.4.10 Archaeology and Heritage

No impacts on the archaeology or heritage resources of the area are anticipated.

8.4.11 Riparian zones

The following impacts were identified:

- Discharge/diversion of clean surface water runoff and stormwater from the proposed TSF, as well as clean water diverted around the TSF, could lead to erosion at the point of discharge and the downstream watercourses. The soils of the area are considered to be highly erodible in places, as evidenced by the large erosion scars on site.
- Three potential avenues of water quality deterioration exist:
  - Spills and leaks of potentially polluting substances used and stored on site during the day to day operation of the TSF;
  - Seepage of polluted water out of the TSF; and
  - Failure of the water management infrastructure designed to intercept and contain dirty water from the TSF.
- Seepage of water out of the TSF which is not captured by water management infrastructure could result in increased water inputs to the downstream watercourses. This will likely result in changes to the vegetation structure and composition of the riparian habitats associated with the watercourses.

8.4.12 Socio-economic

The socio-economic impacts are discussed in section 7.2.13 of this report and in more detail in the SIA (Appendix B-9):

- Waged labour: An estimated 30 permanent opportunities will be created during the operational phase;
- Employment creation and decrease in unemployment;
- Conversion and diversification of land use;
- Impact equity;
- Gendered division of labour;
- Actual health and fertility;
- Physical health of the living environment (actual and perceived);
- Aesthetic quality of the living environment: The visual impact of the TSF will increase as the TSF height increases. The mitigation measures recommended in the VIA report should be implemented to reduce this impact on residents within the viewshed.
- Personal safety and hazard exposure: The impacts on natural resources which may impact on people reliant on these resources should be reduced through the implementation of the management measures recommended in this report).

Table 8.8 Operational Phase Impacts, Mitigation and Management (Action) Plan

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE TRP MINE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
OPERATIONAL PHASE ACTIVITIES: UNDERGROUND MINING, PRODUCT & WASTE STOCKPILING, ORE PROCESSING (PLANT), WATER MANAGEMENT, WASTE HANDLING (DOMESTIC, HAZARDOUS & SEWAGE), HYDROCARBON STORAGE, TAILINGS DEPOSITION																				
TRP MINING AREA: NEW TSF & PIPELINE																				
GEOLOGY																				
Alteration of geology	New TSF & Pipeline	**N/A**	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
TOPOGRAPHY																				
Alteration of topography	New TSF & Pipeline	**Tailings Deposition** - increasing size of TSF	8	5	1	5	70	-	H	Limit the steepness of slopes as far as possible and revegetate as soon as possible.	6	5	1	5	60	-	M	1. Maintain slopes less than 1:5 as far as possible. 2. Implement concurrent rehabilitation where possible	Operational Phase	Engineer
SOILS, LAND USE AND LAND CAPABILITY																				
Soil compaction	New TSF & Pipeline	**Product & Waste Stockpiling**	6	3	1	4	40	-	M	Minimise stockpile footprint areas	4	3	1	4	32	-	M	1. Adhere to mine design plans 2. Drive only on constructed roads	Operational Phase	Engineer
Soil Contamination	New TSF & Pipeline	**Water Management & Waste Handling** - waste and dirty water management	10	4	2	4	64	-	H	Ensure vehicles are in good condition, dirty water is contained	4	3	1	4	32	-	M	1. Adhere to TRP's recommended vehicle maintenance schedule and environmental policies 2. Provide spill kits and follow spill procedures on site for collection of contaminated soil 4. Ensure correct functioning of storm water management and PCD's 5. Ensure correct bunding of hydrocarbon and chemical storage areas	Operational Phase	Engineer
	New TSF & Pipeline	**Operation** - Spillage of tailings	8	4	2	4	56	-	M	Prevent spills, remediate if spillage occurs	4	4	1	2	18	-	L	1. Contain and pick up slime/ tailings spills where possible; 2. Dry the spilled tailings. 3. Dispose of the dry tailings on the back end of the tailings dam.	Operational Phase	Engineer
TERRESTRIAL BIODIVERSITY (FAUNA AND FLORA)																				
Indirect impacts on surrounding habitats	New TSF & Pipeline	**All operation activities**	6	4	2	3	36	-	M	Prevent the spread of impacts to adjacent habitat	6	4	2	2	24	-	L	1. Contain activities to the mine site only	Closure Phase	Engineer
Human-animal conflicts & interactions		**All operation activities**	6	4	1	3	33	-	M	Operational plans that allow for animal protection. Staff training and awareness.	6	4	1	2	22	-	L	1. Awareness programmes (environmental induction for new contractors) 2. Catch and release protocol	Closure Phase	Engineer in consultation with Environmental Officer

SURFACE WATER																			
Deterioration of surface water quality	New TSF & Pipeline	**Stockpiling, Water management -** contaminated runoff	4	4	2	3	30	-	M	Consider runoff from stockpiles and infrastructure as dirty water. Maintain all water control infrastructure.	4	2	2	2	16	-	L	1. Ensure ongoing maintenance of water dams. 2. Ensure maintenance and unblocking of storm water structures. 3. Contain and remediate hazardous spills immediately 4. Implement and maintain the water monitoring programme 5. Investigate poor water quality results and implement appropriate mitigation where possible 6. Implement correct maintenance of the sewage treatment plants as per manufacturer's instructions 7. Implement sewage outflow monitoring as per the water use and waste licences 9. Maintain bunded areas for hydrocarbon and chemical storage	Operational Phase	Engineer
	New TSF & Pipeline	**Waste Handling** - sewage overflow, waste spills , **Hydrocarbon storage**	6	4	2	4	48	-	M	Design pollution control structures to contain the 1:50 year flood event	4	4	2	3	30	-	M		Design Operational Phase	Engineer
	New TSF & Pipeline	**Tailings Deposition -** spills and leaks	8	4	2	4	56	-	M	Conduct regular inspection and maintenance on the tailings pipeline	6	4	2	4	48	-	M		Operational Phase	Engineer
Siltation of water resources	New TSF & Pipeline	**All operation activities** - exposure of soil surfaces and ineffective rehabilitation	8	4	3	4	60	-	M	Maintain storm water infrastructure, ensure effective rehabilitation	4	4	3	2	22	-	L	1. Maintain berms and cut-off trenches 2. Collection of eroded topsoil for use in rehabilitation 3. Monitor post-construction rehabilitation and implement further rehabilitative measures where it has not been effective	Operational Phase	Engineer in consultation with Environmental Officer
Pollution of water resources	New TSF & Pipeline	**Tailings Deposition -** risk of failure	8	4	2	3	42	-	M	Ensure regular inspection and maintenance of the New TSF and associated pipelines	6	4	2	2	24	-	L	1. Rate of rise not to exceed 4m/yr 2. Slopes should not exceed 1:3 (preferably 1:5) 3. Appointment of competent, experienced civil engineer to manage the technical aspects of the TSF 4. Regular monitoring of side slope stability 5. Water from the TSF will be pumped out via the penstock system 6. Seepage will be pumped out via the under drainage system	Operational Phase	Engineer
RIPARIAN ZONES on and off site, AND WETANDS DOWNSTREAM OF THE SITE																			
Erosion within watercourses	New TSF & Pipeline	**All operation activities**	6	4	2	4	48	-	M	Ensure maintenance of storm water structures	4	4	1	3	27	-	L	1. Maintain the clean and dirty water separation structures 2. Ensure drains and storm water structures are maintained and free from obstruction	Operational Phase	Engineer
Water quality deterioration	New TSF & Pipeline	**All operation activities**	6	4	2	5	60	-	M	Ensure correct waste handling	4	4	2	3	30	-	M	1. Refer to the action plan for surface water quality above	Operational Phase	Engineer
GROUNDWATER																			

Impact on groundwater quality	New TSF & Pipeline	**Water Management** - Seepage from containment dams	6	3	2	4	44	-	M	Prevent and contain seepage	4	3	2	4	36	-	M	1.Maintain the clean and dirty water separation systems, including containment dams and storm water structures	Operational Phase	Engineer
	New TSF & Pipeline	**Water Management** - Seepage from the TSF	8	3	2	4	52	-	M	Prevent and contain seepage	2	3	1	2	12	-	L	1.The TSF should be operated with a minimum pool size to limit the infiltration volumes. 2. Review and update of conceptual and numerical model 3. Continue with the groundwater monitoring programme	Operational Phase	Engineer
AIR QUALITY																				
Dust creation	New TSF	**Tailings Deposition** - drying of tailings	4	4	2	3	30	-	M	Reduce exposed surface area	2	4	2	2	16	-	L	1. Concurrent rehabilitation of the New TSF side slopes	Operational Phase	Engineer
VISUAL																				
Light pollution	New TSF & Pipeline	**All operational activities**	7	4	3	3	42	-	M	Reduce lighting to the minimum required	6	4	2	3	36	-	M	1. Do not install more lighting than is required for safe work in dark conditions.	Operational Phase	Engineer
Dust Pollution from TSF	New TSF & Pipeline	**Tailings deposition** - expansion of New TSF	6	4	2	3	36	-	M	Reduce exposed surface areas	4	4	1	2	18	-	L	1.Refer to action plan under Air Quality	Operational Phase	Engineer
Change in topography	New TSF & Pipeline	**Tailings deposition** - expansion of New TSF	7	4	3	4	56	-	M	Limit visual intrusion as far as possible	6	4	3	3	39	-	M	1.Concurrent revegetation of Tailings Facility to limit visual intrusion. 2.Limit dust creation as much as possible	Operational Phase	Engineer
ARCHAEOLOGY AND HERITAGE																				
No additional impacts after construction	New TSF & Pipeline	**All operational activities**	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
SOCIO-ECONOMICS																				
Actual health and fertility	New TSF & Pipeline	**All operational activities**	6	4	2	4	48	+	M	A health and safety management programme, and AIDS awareness.	4	4	2	3	30	+	M	1. Implement an AIDS awareness programme	Operational Phase	Engineer and Corporate and Social Affairs
Feelings in relation to the project and aspirations for the future	New TSF & Pipeline	**All operational activities**	6	3	2	2	22	+	L	Effective community liaison	6	2	2	2	20	+	L	1. Continuous consultation with the affected communities should take place to maintain an open and trusting relationship	Operational Phase	Engineer and Corporate and Social Affairs
Physical quality of the living environment (actual and perceived	New TSF & Pipeline	**All operational activities**	8	4	1	4	52	+	M	Minimise potential impacts as far as possible	6	4	1	3	33	+	M	1. Implement the operational phase environmental action plans. 2. Maintain community communication channels	Operational Phase	Engineer and Corporate and Social Affairs
Aesthetic quality of the living environment	New TSF & Pipeline	**All operational activities**	6	4	2	4	48	+	M	Minimise visual impacts	4	4	2	4	40	+	M	1. Implement the operational phase visual impact action plan.	Operational Phase	Engineer

Crime and violence	New TSF & Pipeline	**All operational activities**	4	3	2	2	18	+	L	Effective community liaison	4	2	1	2	14	+	L	1.Local, unemployed labour should be employed as far as possible	Operational Phase	Engineer and Corporate and Social Affairs
NOISE																				
Creation of noise	New TSF & Pipeline	**N/A**	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A

8.5 Decommissioning and Closure Phase

Refer to Table 8.10 at the end of this section which summarises the impacts, mitigation measures, and environmental management action plan.

8.5.1 Geology

No impacts on the geology of the area are anticipated.

8.5.2 Topography

The rehabilitation activities will aim to ensure that the disturbed areas are returned to as close to the natural topography of the area.

No significant impacts on the topography are expected during this phase. The closure and decommissioning phases will aim to return the area to a free-draining system and will therefore have an overall positive impact on the topography.

8.5.3 Soils, Land Use and Land Capability

Soil compaction may occur during this phase due to the movement of people and vehicles in the area. Spillages of hydrocarbons and chemicals may also occur during decommissioning activities.

This impact will be managed by the ripping of compacted areas after the removal of infrastructure. Furthermore, topsoil will be placed over the disturbed areas and these will be vegetated. The vegetation cover will protect the soils from erosion in the long term.

8.5.4 Flora and fauna

Indirect impacts to surrounding plant and animal communities are likely to occur, these can be mitigated by limiting activities to the footprint only, as well as conducting staff environmental awareness and induction, as well as limiting vehicle use to constructed roads only.

8.5.5 Surface Water

Rehabilitation activities create the risk of soil erosion and contaminated runoff. This can be mitigated by maintaining the stormwater management infrastructure until such a time that the rehabilitation is considered successful and the runoff from the area is no longer considered contaminated. Once this has been determined, the PCD, berms and channels may be rehabilitated to make the area free draining.

8.5.6 Groundwater

The potential impact of seepage from the TSF is rated as medium without mitigation, but can be reduced to low with the effective implementation of the recommended mitigation measures:

- The contaminant plume will continue to migrate in a westerly direction and will reduce in concentration and extend to 2k Refer to table 8.3 which details mitigation and action plans from the site (Figure 8.9). The contaminant load will be reduced substantially from the operational phase in the absence of tailings deposition and a pool area. Sloping, topsoiling and re-vegetation of the top and side slopes of the TSF during the decommissioning phase would minimise the ingress of rainwater and reduce the seepage volume;
- Containment of dirty water and seepage from the TSF will occur. Dirty water volumes should be minimized and spillage into the catchment prevented.

Continuation of the monitoring programme is required to establish decommissioning water quality trends. It is proposed that monitoring continue for two (2) years after decommissioning. This data would be used to verify the closure predictions. Further monitoring conditions will be specified based on these results.

8.5.7 Air Quality

Dust created during decommissioning activities and from the TSF can be managed through the use of dust suppression spraying (decommissioning activities), proper vegetating of the TSF, and rehabilitation of disturbed areas.

Post rehabilitation monitoring must be undertaken to determine if rehabilitation has been successful and if further rehabilitation efforts are required.

8.5.8 Noise

The noise impact is considered to be limited and can be mitigated through proper scheduling of activities and ensuring equipment and vehicles are well maintained.

8.5.9 Visual

The magnitude evaluation of the decommissioning phase of the TSF is presented in Table 8.9 and discussed thereafter.

Table 8.9 Magnitude evaluation for the proposed TSF (Decommissioning Phase)

	QUALITY OF VISUAL RESOURCE	VIEWSHED	VISUAL DISTANCE	VAC	SENSITIVITY	VISUAL IMPACT (MAGNITUDE)
Closure Phase (Assuming mitigation is successful)		***Moderate***	***Moderate***	***High (Low Impact)***	***Moderate***	***Moderate - Low***

According to the results tabulated in 8.9, the magnitude of visual impact associated with the proposed TSF area, during the construction phase, will be **moderate**, whilst during the closure phase the visual impact will be **moderate - low** assuming that mitigation measures are successful.

The significance of visual impact associated with the TSF during the closure phase, will be moderate – low for most of the activities, and can be minimised to a low impact provided recommended mitigation measures are successful. Where the TSF cannot be returned to the natural state, it is advised that a professional landscape architect / rehabilitation specialist is consulted in order to limit the long-term visual impacts of those disturbed areas.

The reworking and processing of the tailings can help to limit the overall footprint of the TSF, but it is unlikely that the entire TSF can be removed and rehabilitated to a state similar to that pre-construction. A registered landscape architect / botanist is crucial in determining the best way in which to deal with care and maintenance once the TSF is no longer in use.

8.5.10 Archaeology and Heritage

No impacts on the archaeology or heritage resources of the area are anticipated.

8.5.11 Riparian Zones

The following decommissioning phase and closure impacts were identified:

- Increased sediment transport into watercourses: Activities associated with the decommissioning and closure phase such as infrastructure removal and rehabilitation will again expose and disturb large areas of soil, leaving these areas exposed to erosion, with eroded sediments being washed into downslope watercourses and rivers. This will result in increased turbidity and changes to benthic habitats. Where sediments are deposited, changes in vegetation are also likely to occur.
- Specifically the steep side slopes of the TSF will be prone to erosion once topsoil is placed and prepared for re-vegetation.
- Altered runoff characteristics: Once the TSF has been capped and re-vegetated, surface runoff from the TSF will enter downslope water resources. The steep slopes of the TSF will likely result in increased volumes and velocities of surface runoff entering adjacent water courses, increasing the risk of erosion and changing aquatic habitats.
- Erosion with watercourses: Altered flows within the downslope watercourses will raise the possibility of erosion within these watercourses. Eroded sediments will be washed into the Dwars River.
- Water quality deterioration: Water quality deterioration during the decommissioning and closure phase can originate from two main avenues:
    - Disturbance of polluted sediments during the decommissioning and closure phase activities leading to mobilisation of pollutants; and
    - Seepage of contaminated water out of the TSF.

8.5.12 Socio-economic

The socio-economic impacts are discussed in section 7.2.13 of this report and in more detail in the SIA (Appendix B-9):

- Conversion and diversification of land use;
- Functioning of government agencies;
- Impact equity;
- Actual health and fertility;
- Physical quality of the living environment (actual and perceived); and
- Crime and violence.

Refer to Table 8.10 detailing mitigation measures and action plans.

Table 8.10 Decommissioning & Closure Phase Impacts, Mitigation and Management (Action) Plan

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE TRP MINE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
DECOMISSIONING and CLOSURE ACTIVITIES: REMOVAL OF INFRASTRUCTURE AND RUBBLE, REHABILITATION OF DISTURBED AREAS																				
TRP MINING AREA: NEW TSF & PIPELINE																				
GEOLOGY																				
Alteration of geology	New TSF & Pipeline	**N/A**	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
TOPOGRAPHY																				
Altered topography	New TSF & Pipeline	**Removal of infrastructure & rubble, rehabilitation**	6	5	1	3	36	+	M	None, the impact will be positive	6	5	1	3	36	+	M	1. Reshape and rehabilitate to free-draining, taking into cognisance the topography of the surrounding area.	Decommissioning	Engineer
	New TSF & Pipeline	**Rehabilitation -** final height	6	5	2	5	65	-	H	Rehabilitate the final dam to appear as natural as possible	4	5	2	5	55	-	M	1. Shape the slopes if required for stability and/or aesthetics. 2. Re-vegetate using species common to the area	Closure Phase	Engineer
SOILS, LAND USE AND LAND CAPABILITY																				
Soil compaction	New TSF & Pipeline	**Removal of infrastructure & rubble, rehabilitation** - vehicle movement	6	3	1	4	40	-	M	Minimise vehicle movement in undisturbed areas.	4	3	1	4	32	-	M	1. Adhere to mine design plans 2. Drive only on constructed roads 3. Use tracked rather than wheeled vehicles where possible	Decommissioning	Engineer
Soil Contamination by fuel and dirty water	New TSF & Pipeline	**Removal of infrastructure & rubble, rehabilitation** - vehicle movement	10	4	2	4	64	-	H	Ensure vehicles are in good condition, dirty water is contained	4	3	1	4	32	-	M	1. Adhere to TRP's vehicle maintenance schedule 2. Provide spill kits on site for collection of contaminated soil 3. Ensure correct functioning of storm water management and PCD's 4. Ensure correct bunding of hydrocarbon and chemical storage areas	Decommissioning	Engineer
Soil physical and chemical properties	New TSF & Pipeline	**Rehabilitation -** improvement of soil conditions	8	5	1	4	56	+	M	None, the impact will be positive	8	5	1	4	56	+	M	1. Topsoil stockpiles will be sampled and tested for fertiliser requirements. 2. Organic and chemical ameliorants will be added to the soil to improve conditions for plant growth, as per the fertilizer recommendations. 3. Areas of soil compaction will be ripped.	Closure Phase	Engineer
TERRESTRIAL BIODIVERSITY (FAUNA AND FLORA)																				

Indirect impacts to surrounding plant and animal communities (fragmentation)	New TSF & Pipeline	**Removal of infrastructure & Rehabilitation**	8	5	2	3	45	-	M	Limit activities to the infrastructure footprint.	6	5	2	2	26	-	L	1. Conduct environmental induction for workers. 2. Limit vehicle movement to roads and infrastructure areas only	Decommissioning	Engineer
SURFACE WATER																			
Pollution of water resources	New TSF & Pipeline	**Removal of infrastructure -** improper waste handling and fuel/oil spills	4	5	2	3	33	-	M	Manage waste effectively to prevent pollution of water resources	4	5	2	1	11	-	L	1. Waste that is not removed from site should be spread, covered and suitably rehabilitated 2. Comply with the TRP vehicle maintenance schedule to prevent oil/fuel leaks 3. Provide spill kits on site to remediate oil spills	Decommissioning	Engineer
Runoff and drainage from stockpiles and TSFs continue to yield polluted water	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation**	6	5	3	4	56	-	M	Maintain dirty water separation systems until the site is rehabilitated and free draining	6	5	1	2	24	-	L	1. Stockpiles must be spread and surfaces rehabilitated 2. The surfaces of TSFs must be rehabilitated 3.Drains and return water dams must be maintained and water transferred to a pollution control dam until the site is free-draining	Decommissioning Closure	Engineer
Siltation of water courses	New TSF & Pipeline	**Removal of infrastructure** - including water and TSF pipelines	6	2	2	4	40	-	M	Rehabilitate as soon as possible, maintain erosion control for the duration of rehabilitation	4	2	2	3	24	-	L	1. Rehabilitate as soon after infrastructure removal as possible.	Decommissioning Closure	Engineer
RIPARIAN ZONES on and off site, AND WETLANDS DOWNSTREAM OF THE SITE																			
Increased sediment transport into down slope water resources	New TSF & Pipeline	**All Activities**	6	2	2	5	50	-	M	Ensure effective rehabilitation, and monitoring of rehabilitation until established	4	2	2	4	32	-	M	1. All disturbed areas should be landscaped to approximate the natural landscape profile 2. Where steep slopes are unavoidable, geotextiles should be used to stabilise slopes before & during re-vegetation. 3. Compacted soils should be ripped and scarified. 4. The rehabilitated areas should be re-vegetated as soon as possible following completion of the earthworks to minimise erosion. 5. Regular long-term follow up of rehabilitated areas will be required to ensure the successful establishment of vegetation and to survey for any erosion damage on site. 6. Erosion damage should be repaired immediately.	Closure	Engineer
Altered runoff characteristics of the landscape	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation**	4	5	2	5	55	-	M	Manage runoff and exposed surfaces to minimise runoff	2	5	2	5	45	-	M	1. Implement measures to avoid concentration of flows and high velocity flows. 2. Ensure revegetation of all disturbed areas.	Decommissioning Closure	Engineer
Erosion within watercourses	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation**	6	5	2	4	52	-	M	Monitor rehabilitated areas for erosion.	4	5	1	3	30	-	M	1. Implement an erosion monitoring plan during closure 2. All rehabilitated areas should be monitored twice annually (start and middle of wet season), with any observed erosion damage repaired immediately.	Decommissioning Closure	Engineer
Water quality deterioration	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation**	8	5	3	4	64	-	H	Prevent contamination of streams and rivers	4	5	2	3	33	-	M	1. As per the surface water action plans	Decommissioning Closure	Engineer

Increase in alien vegetation	New TSF & Pipeline	**Removal of infrastructure**	6	5	1	4	48	-	M	Prevent proliferation and remove alien species	2	2	1	3	15	-	L	1. As per the terrestrial biodiversity action plan	Closure	Engineer
GROUNDWATER																				
Impact on groundwater quality	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation** - Containment of dirty water and seepage	6	3	2	4	44	-	M	Maintain water control structures until rehabilitation is effective and the site is free-draining	2	3	1	2	12	-	L	1. Maintain storm water structures to keep clean water away from the Return Water Dam to minimise water volumes and risk of spilling from the site (until effective rehabilitation)	Decommissioning Closure	Engineer
AIR QUALITY																				
Creation of dust	New TSF & Pipeline	**Removal of infrastructure, Rehabilitation** - exposed areas	4	2	2	4	32	-	M	Control the creation of dust as far as possible	2	2	2	3	18	-	L	1. Implement dust suppression spraying where necessary 2. Rehabilitation must take place as soon after infrastructure removal as possible	Closure	Engineer
	New TSF & Pipeline	**Rehabilitation** - Ineffective rehabilitation of TSF slopes	4	4	2	4	40	-	M	Ensure effective rehabilitation of the TSF's	2	2	2	2	12	-	L	1. Monitor final rehabilitation of the TSF's for 5 years post closure, or according to legislative requirements at the time.	Closure	Engineer
VISUAL																				
Visual Impact of Tailings Storage Facilities	New TSF & Pipeline	**Removal of Infrastructure** - Decommissioning of TSF and RW dam	6	4	3	3	39	-	M	Ensure effective rehabilitation of the TSF's	5	5	3	3	39	-	M	1. Revegetate the TSF	Closure	Engineer
Improvement to aesthetics	New TSF & Pipeline	**Removal of Infrastructure**	6	2	2	3	30	-	M	Implement revegetation as soon as possible after infrastructure removal	4	2	2	3	24	-	L	1. Rehabilitation must take place as soon after infrastructure removal as possible	Closure	Engineer
ARCHAEOLOGY AND HERITAGE																				
No additional impacts	New TSF & Pipeline		0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
SOCIO-ECONOMICS																				
Physical quality of the living environment (actual and perceived)	New TSF & Pipeline	**All Activities**	8	4	1	4	52	-	M	Minimise potential impacts as far as possible	6	4	1	3	33	-	M	1. Implement the operational phase environmental action plans. 2. Maintain community communication channels	Operational Phase	Engineer and Corporate and Social Affairs
Personal safety and hazard exposure	New TSF & Pipeline	**All Activities**	4	4	1	4	36	-	M	Maintain essential mine facilities to ensure health and safety of personnel on site during closure and rehabilitation	4	3	1	3	24	-	L	1. Ensure the entire site remains fence for the duration of rehabilitation 2. Retain security access control to the site 3. Health and safety measures must be maintained	Decommissioning Closure	Engineer and Corporate and Social Affairs
NOISE																				

Creation of noise	New TSF & Pipeline	**Removal of Infrastructure**	4	2	2	3	24	-	L	Reduce noise levels as much as possible	2	2	2	2	12	-	L	1. Limit construction activities to the day time 2. Ensure that all equipment is regularly serviced	Decommissioning Closure	Engineer

8.6 Post-Closure Phase

Refer to Table 8.11 at the end of this section which summarises the impacts, mitigation measures, and environmental management action plan for the post-closure phase.

8.6.1 Geology

No impacts on the geology are foreseen.

8.6.2 Topography

No impacts on the topography are foreseen.

8.6.3 Soils, Land Use and Land Capability

Soil conditions will improve due to rehabilitation activities, the impact will be positive.

8.6.4 Flora and fauna

A positive impact is expected on fauna and flora, due to rehabilitation. The introduction of invader species is a potential negative impact, to be mitigated by monitoring and removal where possible.

8.6.5 Surface Water

No surface water impacts are foreseen as it is expected that the area will be fully rehabilitated before closure.

8.6.6 Groundwater

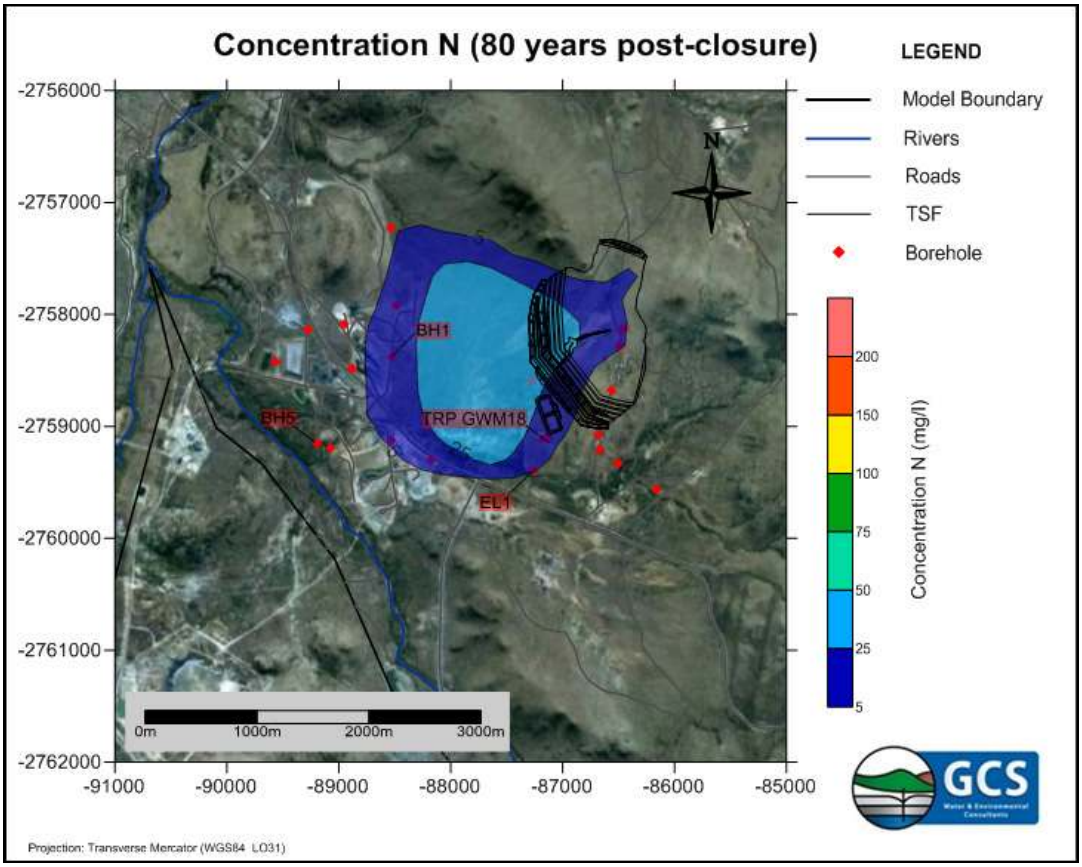
8.6.6.1 Groundwater contaminant transport from the New TSF post-closure

Nitrate was identified as the main contaminant for concern post-closure. The contamination plume and concentration breakthrough curves of nitrate for 80 years post - closure are shown in Figure 8.9. These are calculated for the operational phase and post-closure for three boreholes (TRP GWM18, EL1, BH5).

Also shown in Figure 8.10 to Figure 8.13 are the upper and lower limits of concentrations from the sensitivity analyses, changing the aquifer porosities (+/- 20 %). Total calculation time was 100 years.

The maximum potential contaminant plume will only reach Springkaanspruit after 60 years looking at borehole EL1 (Figure 8.9). The maximum nitrate groundwater concentration that can potentially reach the Springkaanspruit does not exceed the 15mg/l 80 years after closure. After, the contamination plume of nitrate will likely reach TRP plant area, but will probably not reach the Groot Dwarsrivier.

In general, the groundwater quality in the vicinity of the TSF will improve after closure, because of seepage reduction. Figure 8.12 (Borehole TRP GWM18) shows that groundwater quality will improve around 50 to 60 years due to the low permeability of the tailings and entrainment of water.



[FIGURE NOT TO SCALE- REFER TO APPENDIX B-1]

Figure 8.9 The 100 year contaminant plume of nitrate (80 years after closure)

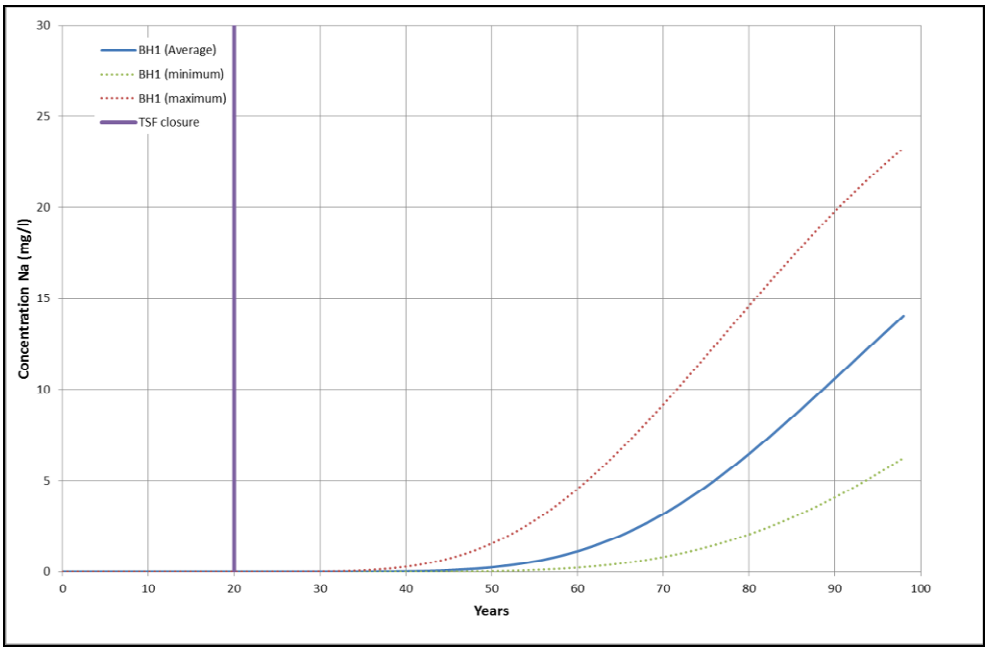


Figure 8.10 Breakdown curve of nitrate (Borehole BH1) during TSF operations (20 years) and post-closure (80 years)

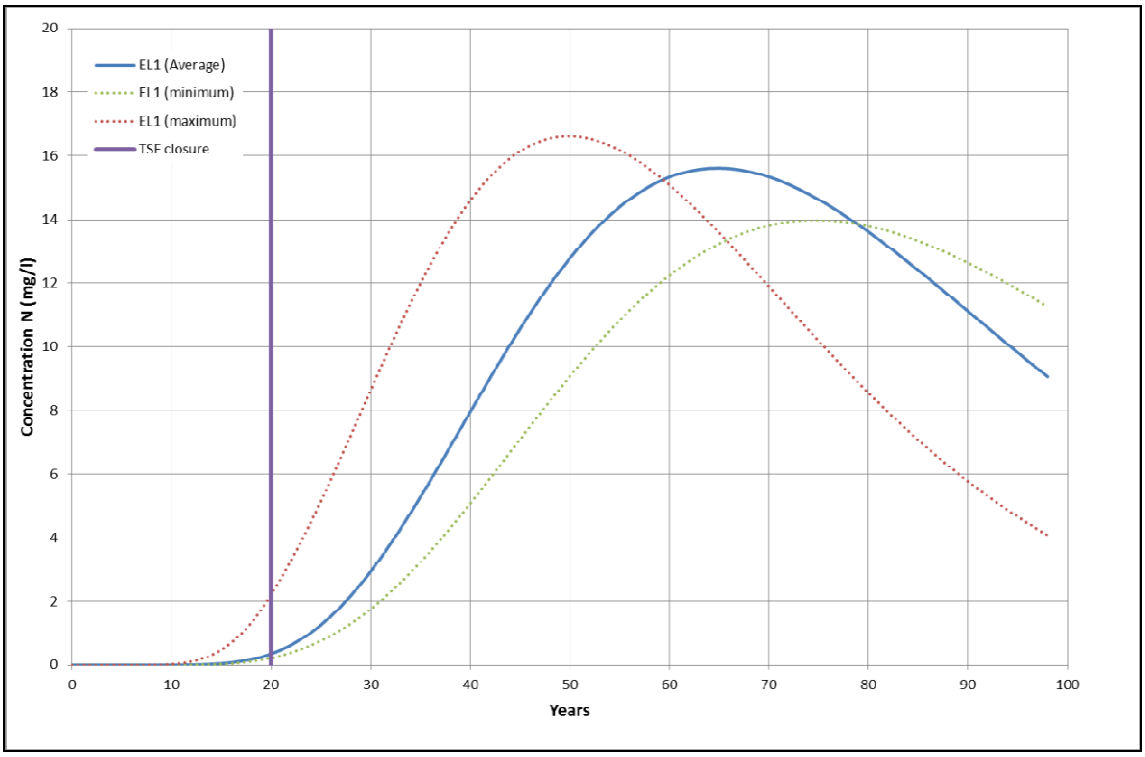


Figure 8.11 Breakdown curve of nitrate (Borehole EL1) during TSF operations (20 years) and post-closure (80 years).

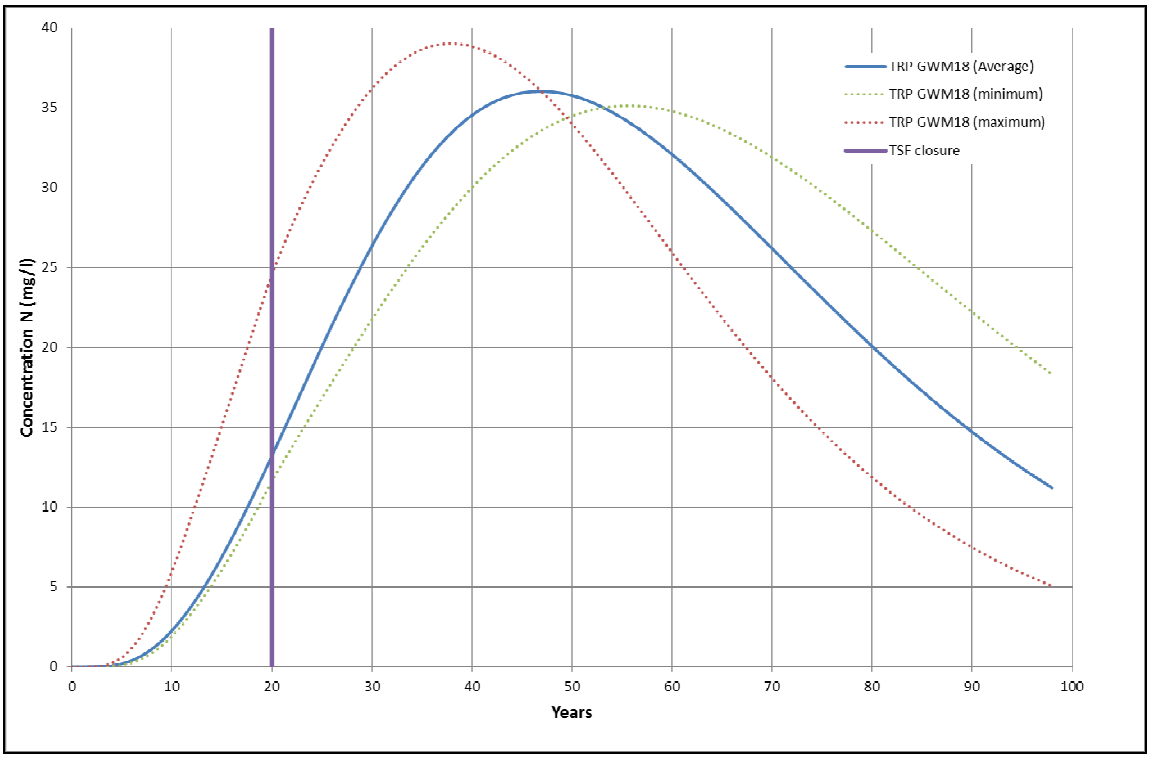


Figure 8.12 Breakdown curve of nitrate (Borehole TRP GWM18) during operations (20 years) and post-closure (80 years)

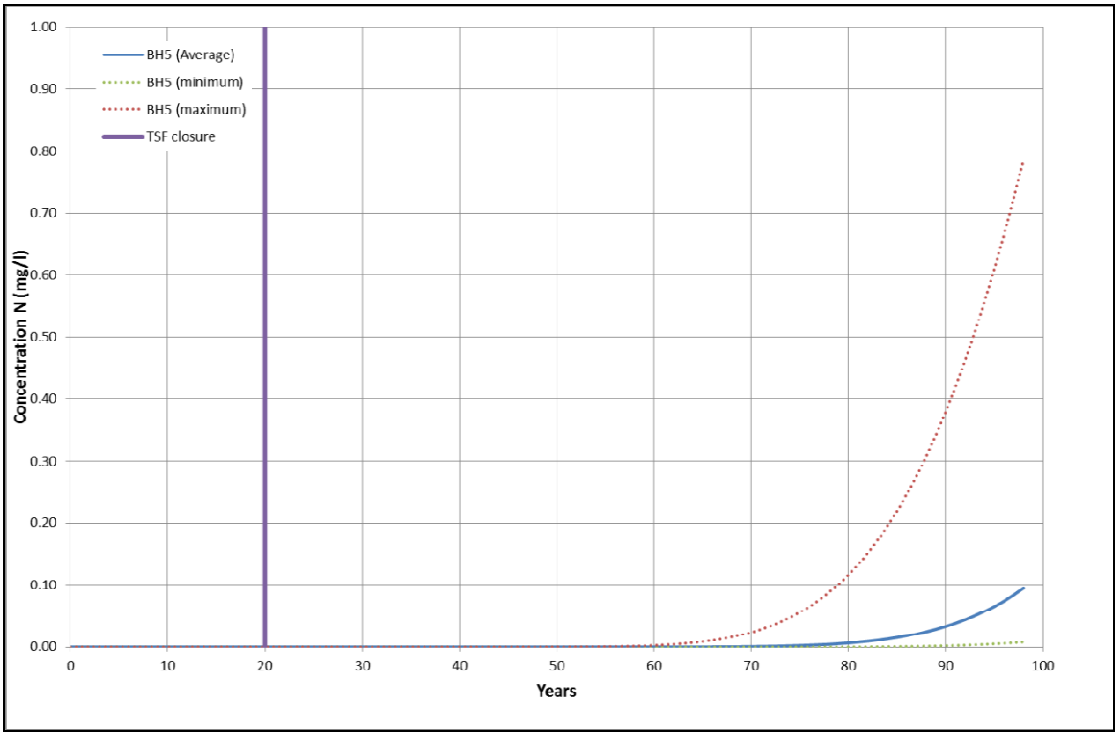


Figure 8.13 Breakdown curve of nitrate (Borehole BH5) during TSF operations (20 years) and post-closure (80 years)

8.6.7 Air Quality

Impacts to air quality will be positive since all mining activities would have ceased.

8.6.8 Noise

No noise impacts are foreseen.

8.6.9 Visual

Visual Impacts will improve, i.e. become positive, assuming successful rehabilitation.

8.6.10 Archaeology and heritage

No archaeology or heritage impacts are foreseen.

8.6.11 Riparian zones

Positive impacts are expected i.e. improvement in riparian zones due to the end of life of mining activities.

8.6.12 Socio-economic

Loss of employment in the area, re-deployment of mine workers to other operations, or a new mine, is potential mitigation.

Table 8.11 Post-Closure Phase Impacts, Mitigation and Management (Action) Plan

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE TRP MINE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
POST-CLOSURE ACTIVITIES: MONITORING AND MAINTENANCE																				
TRP MINING AREA: NEW TSF & PIPELINE																				
GEOLOGY																				
No additional impacts			0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
TOPOGRAPHY																				
No additional impacts			0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
SOILS, LAND USE AND LAND CAPABILITY																				
Soil physical and chemical properties - improvement in conditions	New TSF & Pipeline	**Monitoring & Maintenance -** improvement of soil conditions	8	5	1	4	56	+	M	None, the impact will be positive	8	5	1	4	56	+	M	1. Conduct soil testing and amelioration (fertilization) should vegetation establishment not be successful post rehabilitation.	Post-closure	Environmental Personnel
TERRESTRIAL BIODIVERSITY (FAUNA AND FLORA)																				
Increase in alien vegetation	New TSF & Pipeline	**Monitoring & Maintenance -** growth of new vegetation on rehabilitated areas	6	5	1	4	48	-	M	Remove and control the spread of alien invasive species	2	2	1	3	15	-	L	1. Alien invasive species should be removed from the site as far as practically possible. 2. Monitor surrounding properties and riparian zones for the spread of alien vegetation and remove where practically possible	Post-closure	Environmental Personnel
Improvement in vegetation	New TSF & Pipeline	**Monitoring & Maintenance -** growth of new vegetation on rehabilitated areas	6	5	3	4	56	+	M	Prevent proliferation of invasive species, promote restoration of indigenous vegetation	6	5	3	4	56	+	M	1. Conduct soil testing and amelioration (fertilization) should vegetation establishment not be successful post rehabilitation.	Post-closure	Environmental Personnel
SURFACE WATER																				
Reduction in pollution of water resources	New TSF & Pipeline	**Monitoring & Maintenance -** site will revert back to free-draining state	4	5	2	1	11	-	L	Continue water monitoring to determine possible impacts	6	5	2	4	52	+	M	1. Continue with the TRP water monitoring programme for 5 years or as per legislative requirements at the time	Post-closure	Environmental Personnel
RIPARIAN ZONES on and off site, AND WETLANDS DOWNSTREAM OF THE SITE																				
Improvement to riparian zones	New TSF & Pipeline	**Monitoring and Maintenance** - return to free-draining state	4	5	2	2	22	-	L	Return to natural vegetation, removal of alien species.	6	5	2	2	26	+	L	1. Continue with the TRP water monitoring programme for 5 years or as per legislative requirements at the time	Post-closure	Environmental Personnel
GROUNDWATER																				

Groundwater Contamination	New TSF & Pipeline	**Monitoring and Maintenance** - Contaminant plume will continue to migrate	6	3	2	4	44	-	M	Ensure effective rehabilitation and ongoing groundwater monitoring	4	3	2	3	27	-	L	1. Continue with the TRP water monitoring programme for 5 years or as per legislative requirements at the time	Post-closure	Environmental Personnel
AIR QUALITY																				
Improvement in air quality	New TSF & Pipeline	**Monitoring and Maintenance** - All mining activities related to dust creation will have ceased	4	4	2	4	40	-	M	None required	6	5	2	2	26	+	L	None required	Post-closure	Environmental Personnel
VISUAL																				
Improvement of landscape appearance	New TSF & Pipeline	**Rehabilitation** - disturbed areas	4	5	2	2	22	+	L	Ensure effective re-vegetation	4	5	2	3	33	+	M	1. Monitor rehabilitated areas to ensure that rehabilitation has been effective 2. Implement further rehabilitation measures where rehabilitation has not been effective	Post-closure	Environmental Personnel
ARCHAEOLOGY AND HERITAGE																				
No additional impacts	New TSF & Pipeline		0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
SOCIO-ECONOMICS																				
Loss of Waged Labour	New TSF & Pipeline	**All Activities**	10	5	2	5	85	-	H	Mine closure will mean loss of employment	8	4	2	4	56	-	M	1. Possible re-deployment to similar mining operations or a new mine.	Post-closure	TRP Management
NOISE																				
Creation of noise	New TSF & Pipeline	**Monitoring & Maintenance**	4	2	2	3	24	-	L	None, mining activities will have ceased, reducing noise levels	2	2	2	1	6	+	L	1. Ensure vehicle maintenance to avoid excess noise during monitoring exercises.	Post-closure	Environmental Personnel

8.7 Cumulative Impacts

Refer to Table 8.12 at the end of this section which summarises the impacts, mitigation measures, and environmental management action plan for the post-closure phase.

8.7.1 Construction Phase

The following cumulative impacts may occur due to the construction of the TSF:

- Flora and fauna:
    - Cumulative impacts on conservation obligations and targets (including national and regional);
    - Cumulative increase in local and regional fragmentation/ isolation of habitat; and
    - Cumulative increase in environmental degradation, pollution.

- Surface water:
    - Cumulative impacts on surface water quality due to TSF construction in the vicinity of existing mines.
- Visual:
    - Cumulative impact on the visual character of the environment.
- Socio-economic:
    - Cumulative impacts on surrounding landowners and residents due to the creation of noise, dust, potential surface water contamination, etc.
    - Cumulative impact on employment due to the creation of jobs during the construction phase of the TSF and the UG2 and Merensky expansion.

8.7.2 Operational Phase

The following cumulative impacts may occur during the operational phase of the TSF:

- Surface water:
    - Without the efficient implementation of stormwater management (diversion of clean water and capturing dirty water, surface water runoff from the TSF will impact on the Dwars River.
- Groundwater:
    - The influence of the future underground mines in the areas surrounding the TSF has not been considered in the model predictions. This interaction can change the extent of influence of the proposed new TSF and should be considered in future updates of the predictions.

8.7.3 Decommissioning and Closure Phase

Impacts due to removal of infrastructure and rehabilitation will contribute to impacts in the surrounding areas, but for a short length of time. Therefore the impacts are considered low. Refer to Table 8.12 detailing mitigation measures and action plans.

8.7.4 Post-Closure Phase

Cumulative impacts in the post-closure phase are likely to be positive, since mining activities will have ceased, assuming that rehabilitation is successful. Refer to Table 8.12 detailing mitigation measures and action plans.

Table 8.122 Cumulative Impacts, Mitigation and Management (Action) Plan

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE TRP MINE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP			
CUMULATIVE IMPACTS: IMPACTS CONSIDERED ON A REGIONAL SCALE																				
TRP MINING AREA: NEW TSF & PIPELINE																				
GEOLOGY																				
No additional impacts	New TSF & Pipeline		0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A
TOPOGRAPHY																				
Change to topography	New TSF & Pipeline	**TRP as part of regional mining -** construction and operation	2	4	1	3	21	-	L	Mine design should utilise existing facilities as far as possible, to reduce further impact	2	4	1	2	14	-	L	1. Construct new infrastructure close to existing where practical. 2. Adhere to approved designs.	Prior to and during construction	Engineer
	New TSF & Pipeline	**TRP as part of regional mining -** new TSF in close proximity to other mine's TSF's	4	4	2	3	30	-	M	Implement Environmental Action plans at all phases to minimise cumulative impacts	4	2	2	3	24	-	L	1. As per construction and operational phases	Construction, Operation	Engineer, in consultation with Environmental Officer
SOILS, LAND USE AND LAND CAPABILITY																				
Soil erosion, compaction and contamination	New TSF & Pipeline	**TRP as part of regional mining -** disturbance of additional areas	2	4	1	4	28	-	L	Minimise construction footprints and adhere to the action plan above to minimise additional impacts	2	4	1	4	28	-	L	1.Implement soils action plan for all phases	All Phases	Engineer, in consultation with Environmental Officer
Loss of land capability	New TSF & Pipeline	**TRP as part of regional mining -** disturbance of additional areas	4	5	2	3	33	-	M	Keep as much original land cover as possible	4	5	2	3	33	-	M	1. Implement soils action plan for all phases	All Phases	Engineer, in consultation with Environmental Officer
TERRESTRIAL BIODIVERSITY (FAUNA AND FLORA)																				
Loss of fauna and flora of conservation importance	New TSF & Pipeline	**TRP as part of regional mining -** Vegetation removal	4	5	1	3	30	-	M	Ensure all species of importance are identified and relocated prior to clearing	2	5	1	3	24	-	L	1. Implement action plans for construction phase	Prior to vegetation clearing	Engineer, in consultation with Environmental Officer
Further fragmentation of vegetation communites and habitats	New TSF & Pipeline	**TRP as part of regional mining -** Development of pipelines	6	4	2	3	36	-	M	Very difficult to mitigate. Contain activities to the construction footprint only. Implement a biodiversity offset area.	4	4	2	2	20	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
Harm to animals and plants and introduction of invasive plant species	New TSF & Pipeline	**TRP as part of regional mining -** Development of new infrastructure'	4	5	1	3	30	-	M	Prevent the proliferation of invasive plant species and harm to animals over the entire mine	2	5	1	3	24	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
SURFACE WATER																				
Surface water quantity and quality	New TSF & Pipeline	**TRP as part of regional mining -** Development of new infrastructure'	4	4	2	3	30	-	M	Adhere to approved Water Use Licence and conditions	4	2	2	2	16	-	L	Implement action plans for all phases	During construction	Engineer, in consultation with Environmental Officer
	New TSF & Pipeline	**TRP as part of regional mining -** Inefficient storm water management	6	4	2	3	36	-	M	Maintain separation of sclean and dirty water	4	4	2	2	20	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer

RIPARIAN ZONES on and off site, AND WETLANDS DOWNSTREAM OF THE SITE																				
Increased sedimentation	New TSF & Pipeline	**TRP as part of regional mining -** Inefficient storm water management	6	4	2	3	36	-	M	Maintain separation of sclean and dirty water	4	4	2	2	20	-	L	1. Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
GROUNDWATER																				
Groundwater Quantity and Quality	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	6	4	2	3	36	-	M	Implement action plans and monitoring at all phases to minimise impacts.	4	4	2	2	20	-	L	1. Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
AIR QUALITY																				
Dust Creation	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	6	2	2	4	40	-	M	Minimise dust generation and maintain dust supression over the entire site	4	2	2	2	16	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
NOISE																				
Additional Noise	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	2	4	2	3	24	-	L	Limit construction activities to the day time; ensure that all equipment is regularly serviced	2	4	2	2	16	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
VISUAL																				
Addition to visual change to landscape	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	4	5	2	4	44	-	M	Design infrastructure to take cognisance of the environment where possible.	4	5	2	4	44	-	M	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
ARCHAEOLOGY AND HERITAGE																				
Loss of Heritage resources	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	4	5	2	2	22	-	L	Based on specialist studies, heritage resources are not at risk as part of the TRP expansion. Should any resources be uncovered at any stage, an Archaeologist is to be consulted.	4	5	2	2	22	-	L	1. Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
SOCIO-ECONOMICS																				
Aesthetic quality of the living environment	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	6	4	2	4	48	-	M	Implement the visual impact and dust/air quality action plans to minimise cumulative impacts.	4	4	2	4	40	-	M	1. Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
Loss of natural and cultural heritage	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	4	5	1	1	10	-	L	Based on specialist studies, heritage resources are not at risk as part of the TRP expansion. Should any resources be uncovered at any stage, an Archaeologist is to be consulted.	4	2	1	1	7	-	L	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer
Cumulative Impacts - waged labour and social dynamics of the area	New TSF & Pipeline	**TRP as part of regional mining -** Expansion of operations	6	3	3	3	36	+	M	Employ local labour, but avoid the construction of labour camps	6	3	3	3	36	+	M	1.Implement action plans for all phases	All Phases	Engineer, in consultation with Environmental Officer

9 MONITORING MANAGEMENT PROGRAMME

This chapter fulfils the report requirements set out in Regulation 33 of the NEMA Regulations.

Regulation 33	A draft environmental management programme must comply with section 24N of the Act and include-
	(e) Proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

Monitoring provides qualitative and quantitative information pertaining to the possible impacts of the development on the environment, and enables the measurement of the effectiveness of environmental management measures.

The implementation of a monitoring plan is necessary to ensure compliance with the NEMA, MPRDA and NWA environmental authorisations which must be obtained before any of the proposed activities may commence.

TRP currently undertakes monitoring at its operation which must be updated include the proposed activities. The current and proposed monitoring programme is described in detail in the Monitoring and Management Programme in Appendix D.

9.1 Groundwater Monitoring

The groundwater monitoring programme must begin prior to the construction of the TSF to establish the baseline conditions and must continue until after decommissioning of the facility until the groundwater quality trends are within the previously agreed Resource Quality Objectives (RQOs) and that sufficient information is available to calibrate and confirm the accuracy of the groundwater model.

An estimate of the time period that monitoring will be required after decommissioning will be available from the numerical groundwater model that was continuously updated during the operational phase. Monitoring will, however, continue 1here RQOs are not met, the implementation of (additional) mitigation measures, or changes in the cover design, will need to be considered.

Groundwater monitoring should be conducted to assess the following:

- The impact of TSF on the surrounding aquifers: This will be achieved through monitoring of groundwater levels in the monitoring boreholes. Private boreholes are identified within the zone of impact on groundwater levels, and should be included in the monitoring programme;
- Groundwater quality trends: This will be achieved through sampling of the groundwater in the boreholes at the prescribed frequency;
- Water balance data for the TSF:

A total of seven (7) existing boreholes (TRP GWM18, TRP GWM19, TRP GWM 20, DG5, DG6, EL1, EL3) as well as the two (2) proposed new monitoring boreholes (TRP GWM 24 and TRP GWM 25) around the TSF should be monitored for water quality and water level.

The groundwater monitoring programme is discussed in detail in section 2.1 of the Monitoring Programme Report (Appendix D).

9.2 Surface Water Monitoring

A comprehensive surface water monitoring programme at the TSF is recommended in terms of Best Practice Guidelines G3: Water Monitoring Systems (Department of Water Affairs, 2006). The monitoring programme will assist with overall water management at the site, including but not limited to:

- Prevent pollution and thereby protect the receiving water environment;
- Develop an understanding of the current pollution on the mine and monitor how it changes over time; and
- Assess performance of pollution prevention measures, i.e. compliance with license conditions and catchment objectives.

One monitoring point (TR SW1) was identified downstream (south) of the TSF. It is recommended that this point is sampled on a monthly basis and samples are analysed for:

- Total Dissolved Solids
- Sulphate, SO_4;
- Chloride, Cl;
- Sodium, Na;
- Magnesium, Mg;
- Potassium, K;
- Calcium, Ca;
- Nitrate, NO_3; and
- Chrome Hexavalent, (Cr6+).

9.3 Riparian Zones and Vegetation

A number of aspects relating to the watercourses or riparian areas on site should be monitored to ensure effectiveness of mitigation and management measures and to inform improvements where required:

- Vegetation re-establishment: monthly for the first six (6) months after rehabilitation, then annual until the appointed independent specialist is satisfied that a sustainable vegetation cover has been established;
- Erosion: All re-vegetated riparian areas should be monitored for erosion. Areas such as stormwater discharge points; clean water diversion discharge points; and road and pipeline crossings should also be monitored; and
- Alien vegetation: An alien vegetation removal programme should be ongoing through all project phases until closure.

9.4 Aquatic ecology (Biomonitoring)

The following assessment should be undertaken at a suitable monitoring point within the vicinity of the TSF monitoring point (TR SW1) and the following analysed:

- Macro-invertebrates in terms of the latest South African Scoring System (SASS5) method.
- Habitat integrity indices in terms of the Invertebrate Habitat Assessment System (IHAS, version 2).
- Toxicity in terms of Whole Effluent Toxicity (WET) tests on at least two trophic levels, namely fish and invertebrates.

It is recommended that biomonitoring is bi-annually (twice per year).

9.5 Soil monitoring

Soil monitoring will involve the inspection of soil which has been disturbed, compacted, contaminated or eroded. Soil monitoring will assist in determining where soils have not been sufficiently rehabilitated.

Where soils have contaminated by the spillage of hydrocarbon, monitoring must take place on a weekly basis for at least four (4) weeks or until the soil is considered sufficiently rehabilitated. Soils samples should be taken and submitted to a laboratory to test for contaminant content if it is considered necessary.

Soil monitoring should be undertaken during the following periods:

- Areas which have rehabilitated following construction;

- After remediation soils which have been contaminated by spillages during the operational phase; and
- After the closure and decommissioning phase.

9.6 Air Quality

The construction, operation and decommissioning of the TSF has the potential to create dust.

The prevailing wind direction is southeast, therefore single dust buckets are recommended at the south-eastern and north-western corners of the TSF site.

Dust deposition measurements should be carried out by method ASTM 1739- 98 recommended in SANS 1929-2004. This involves exposure of a standard bucket for a month, with weighing (and chemical analysis, if necessary) of the dust collected. The changing of dust buckets should be undertaken by trained TRP personnel on a monthly basis and the weighing can be carried out at a suitable off-site or on-site laboratory.

9.7 Reporting

It is recommended that monitoring reports (for surface water, groundwater, biomonitoring and air quality) is produced at the end of the construction period. Thereafter, monthly monitoring data collected should be consolidated into an annual report for submission to the relevant authorities (DWA, LDEDET and DMR).

It is important for each annual report to build on the results of the previous report in order to clearly present water quality trends.

9.8 Data Management

Monitoring results must be stored on the existing TRP monitoring database. This database is used to update the groundwater model and water balance and to determine the groundwater and surface water quality trends over time.

Trend analysis assists in determining if additional management measures are required.

It is important that the database is kept updated and that access to the database is properly controlled to maintain the integrity of the data.

9.9 Auditing

It is recommended that TRP conducts an annual internal audit at the mine and TSF site.

Furthermore annual audits of the approved Environmental Management Programme (EMP), environmental authorization and WUL must continue to determine if TRP is compliant with their authorization requirements/commitments.

10 ENVIRONMENTAL AWARENESS PLAN AND ENVIRONMENTAL EMERGENCY RESPONSE PLAN

This chapter fulfils the report requirements set out in Regulation 31 of the NEMA Regulations.

Regulation 33	A draft environmental management programme must comply with section 24N of the Act and include-
	(j) An environmental awareness plan describing the manner in which- (i) The applicant intend to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution of the degradation of the environment.

The TRP environmental awareness and emergency response plan which will be applicable to the proposed new TSF as well as the proposed expansion areas is attached as Appendix E of this report.

The environmental emergency plan should not be confused with the TRP emergency preparedness plan (TRP Doc TRP-COP-MAN-013), and should be used in conjunction with this plan.

Environmental Emergency situations at the TRP mining operations may include the following:

- Pollution Control Dam Overflow;
- Pollution Control Dam Breach;
- Tailings Dam Storage Facility Breach;
- Berm Breach/Drain Overflow;
- Hydrocarbon Spill (diesel, oil, grease, etc); and
- Veld Fires.

The necessary actions required, as well as the responsible person for ensuring that the actions are followed through and the reporting requirements are adhered to, to ensure effective and efficient response to each of the environmental emergency situations listed above are set out in this procedure (Refer to Appendix E).

11 GAP ANALYSIS

This chapter fulfils the report requirements set out in Regulation 31(2)(d) of the NEMA Regulations.

Regulation 33	A draft environmental management programme must comply with section 24N of the Act and include-
	(m) A description of any assumptions, uncertainties and gaps in knowledge.

11.1 Groundwater

The knowledge gaps identified during the hydrogeological assessment are discussed in this section.

The influence of the future underground mines in the areas surrounding the TSF has not been considered in the groundwater model predictions. This interaction can change the extent of influence of the proposed new TSF and should be considered in future updates of the predictions.

Data used in the modeling of the influence of the proposed new TSF is based on the hydrocensus and drilling results. This data represents a snapshot in time, while predictions are made well into the future. Uncertainty in rainfall and recharge rates, together with heterogeneous aquifer properties causes some uncertainty in the modeled predictions.

The monitoring of water balance data, water levels and water quality data over time after the TSF is commissioned, would provide useful data to update the conceptual model and improve confidence in the predicted impacts.

No monitoring boreholes in the simulated direction of the plume movement are currently available. Monitoring of the plume breakthrough will be important in providing data for future model calibrations and predicting the influence of remediation and closure scenarios.

11.2 Riparian zone delineation

The knowledge gaps identified during the wetland and riparian zone assessment is presented in this section.

Due to the scale of the remote imagery used (1:10 000 orthophotos and Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineate wetlands in the field, the delineated wetland boundaries cannot be guaranteed beyond an accuracy of about 20m on the ground. Should greater mapping accuracy be required, the wetlands would need to be pegged in the field and surveyed using conventional survey techniques.

Furthermore, the specialist soils and terrestrial ecology reports were not yet available at the time of compiling the Wetland and Riparian Assessment report.

12 UNDERTAKING BY APPLICANT

UNDERTAKING

I, _____. , the undersigned and duly authorised thereto by Two Rivers Platinum (Pty) Ltd, have studied and understand the contents of this Environmental Impact Assessment/Environmental Management Programme (EIA/EMP) and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to.

Signed at._____, on this ._____, day of

_____ 2013.

._____.
Signature of Applicant

I, ._____, the undersigned and duly authorised thereto by the LIMPOPO DEPARTMEN OF ECONOMIC DEVELOPMENT, ENVIRONMENT AND TOURISM, have studied and approved the contents of this Environmental Impact Assessment/Environmental Management Programme (EIA/EMP).

Signed at ._____, on this ._____, day of

_____ 2013.

._____.
Signature of Director

13 CONCLUSION

This chapter fulfils the report requirements set out in Regulation 31 of the NEMA Regulations.

Regulation 31(2)	*An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35, and must include -*
	(n) A reasoned opinion as to whether the activity should or should not be authorized, and if it should be authorized any conditions that should made in respect of that authorisation;
	(o) An environmental impact statement which contains: (i) A summary of the key finding of the Environmental Impact Assessment; and (ii) A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.

This report has been compiled in terms of the NEMA regulations (2010) and relates only to the proposed New TSF and associated pipeline. This project, however, is being undertaken in parallel with other environmental applications for TRP.

The environmental process for the proposed new TSF is being undertaken in three (3) parallel processes, i.e. in terms of NEMA, MPRDA and the NWA.

The proposed TSF will cover an area of 90ha and will include the TSF (and related structures such as paddocks, toe wall, est.), a RWD and a slurry delivery pipeline.

None of the specialist studies undertaken have identified any fatal flaws in respect of the proposed New TSF site.

The issues raised during the PPP are addressed in full within this report. The neighbouring landowner's objections and queries have been addressed in detail, refer to Appendix C-8. The proposed New TSF footprint and pipeline route fall within an established mining area where the topography is a major limiting factor when sourcing a site suitable for a platinum tailings storage facility.

Based on the site selection process, stakeholder consultation process, and the fact that no fatal flaws were identified during the various specialist environmental studies undertaken, it is recommended that the project is authorised in terms of the NEMA.

It is recommended that a biodiversity offset area be implemented to mitigate the unavoidable loss of biodiversity within, and immediately surrounding, the proposed TSF site and pipeline route.

Furthermore, it is recommended that an independent environmental control officer (ECO) is appointed to supervise compliance with RoD conditions, as well as those stipulated in the approved MPRDA EMP and WUL (should any additional conditions apply).

14 REFERENCES

Randell, B. Ilanda Water Services. September 2012. Report on Two Rivers Tailings Storage Facility and Return Water Dam, Water Balance and Channel Sizing. Report No : 0063-Rep-001 Rev1.

De Swardt, G. GeoTail. November 2012. Two Rivers Platinum Project Feasibility Study for the New Tailings Storage Facility. Report no. GT-11/2012-Rev 1.

Sekhukune District Municipality. Integrated Development Plan (IDP) 2012/2013 IDP/Budget.

Department of Water Affairs Best Practice Guideline (BPG) for Mine Residue Deposits (Guideline A2)

APPENDIX A – SITE SELECTION REPORT

APPENDIX B – SPECIALIST STUDY REPORTS

APPENDIX B-1 HYDROGEOLOGICAL STUDY REPORT

APPENDIX B-2 SOIL AND LAND USE STUDY REPORT

APPENDIX B-3 VISUAL IMPACT ASSESSMENT REPORT

APPENDIX B-4 BIODIVERSITY STUDY REPORT

APPENDIX B-5 HYDROLOGY STUDY REPORT

APPENDIX B-6 HERITAGE STUDY REPORT

APPENDIX B-7 WETLAND STUDY REPORT

APPENDIX B-8 SOCIAL IMPACT ASSESSMENT REPORT

APPENDIX B-9 DESKTOP PALAENTOLOGICAL ASSESSMENT

APPENDIX C – STAKEHOLDER CONSULTATION

APPENDIX C-1 INTERESTED & AFFECTED PARTIES DATABASE

APPENDIX C-2 SITE NOTICE

APPENDIX C-3 NEWSPAPER ADVERTISEMENT

APPENDIX C-4 BACKGROUND INFORMATION DOCUMENT

APPENDIX C-5 MINUTES OF THE SCOPING PUBLIC MEETING

APPENDIX C-6 LETTER OF ACCEPTANCE AND COMMENTS ON FINAL SCOPING REPORT – LDEDET

APPENDIX C-7 LETTER OF COMMENT FROM SAHRA

APPENDIX C-8 CONSOLIDATED OBJECTIONS RESPONSE: BOKOMOSO

APPENDIX C-9 SCOPING PHASE AUTHORITY MEETING MINUTES

APPENDIX C-10 EIA PHASE OPEN DAY MEETING MINUTES

APPENDIX C-11 EIA PHASE FOCUS GROUP MEETING MINUTES

APPENDIX C-12 LDEDET COMMENTS DRAFT EIA

APPENDIX D –MONITORING PROGRAMME

APPENDIX E –ENVIRONMENTAL AWARENESS AND EMERGENCY RESPONSE PLAN

APPENDIX F –AMENDED EIA APPLICATION FORM WITH CORRECT FARM PORTIONS

APPENDIX G – NEW TSF DESIGN REPORT

APPENDIX H – NEW TSF GEOTECHNICAL STUDY REPORT