3. DESCRIPTION OF THE PRE-MINING ENVIRONMENT

Belfast Silica Mine is located on the Remaining Extent of Portion 1 of the farm Klipfontein 385 JS and is situated approximately 8 km north west of Belfast and Siyathuthuka (Figure 2.1). The mine has an approved mining right area of 19.19 ha as indicated in Figure 2.2a.

The mine however, plans to extend the mining right area by another 31.82 ha as indicated in Figure 2.2a.

3.1 Geology

The mine plans to extend the mining right area by another 31.82 ha (Figure 2.2a) in order to further exploit the quartzite present on the said property. The existing quarries (Quarry 1 and Quarry 2) will thus be extended as part of the extension of the mining operation (Figure 2.3).

According to Niesing and Lingenfelder (2003), the Steenkampsberg and Houtenbek Formations underlie the mining area (including the proposed extension area). A copy of the geological report by Niesing and Lingenfelder (2003) is provided in Appendix 4.

Figure 3.1 provides an indication of the underlying geology of the site.

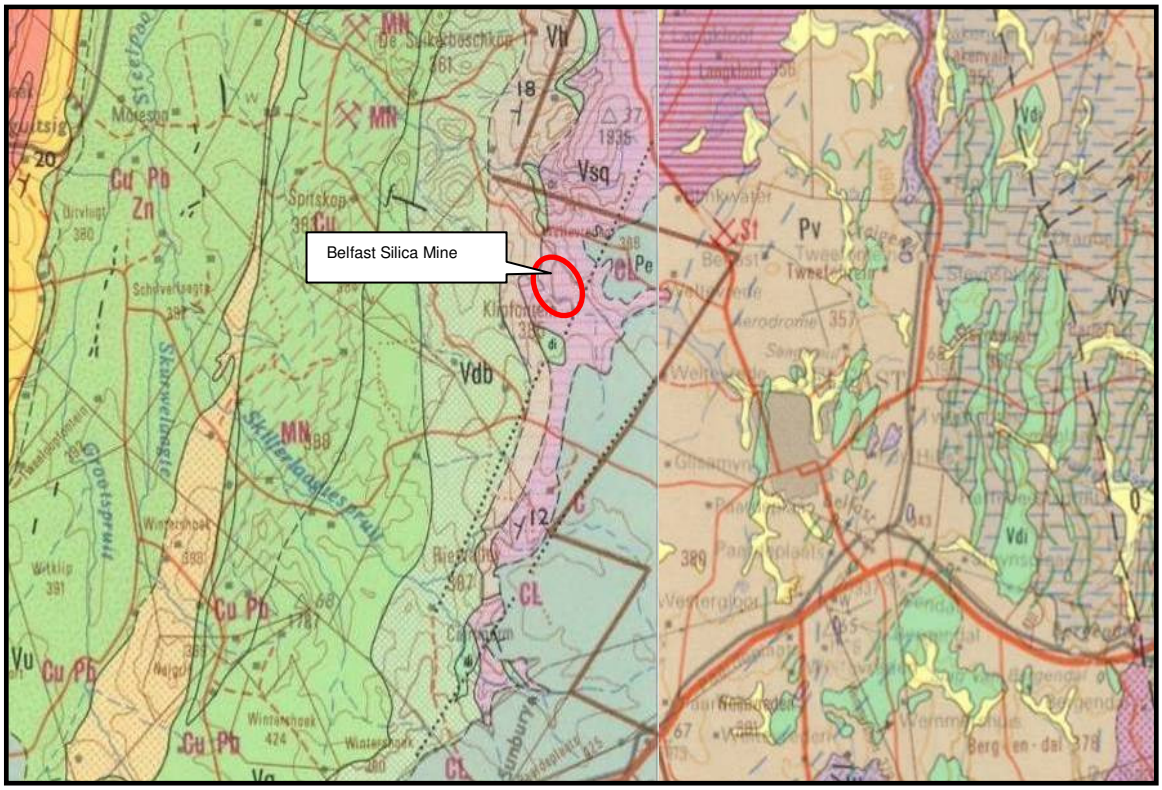


Figure 3.1: Underlying geology (taken from 2530 Barberton and 2529 Pretoria, 1: 250 000 Geological Series)

On the eastern part of the mining area, the Steenkampsberg quartzites outcrop on a dip-slope. The succession strikes at 10° and dips about 12° west. Due to the lack

of drilling information, the thickness witnessed in the quarries was assumed to be the proven thickness of the quartzites.

Three faults with unknown displacement are visible in the quarries (Figure 2 of Appendix 4). In Quarry no. 2, a shaly layer of 30 cm occurs, which is separated during the mining process. A possible geological fault was also noted within the proposed extension area (Figure 3.9) which daylights as a seepage area flowing into the Langspruit (Figure 3.9). Other geological faults could also be present within this area.

The quartzite is mostly fine-grained and white to light greyish in colour. However, light yellowish and fine to medium grained specimens were also evident. Along joint planes, some discolouration is visible.

On the western part of the mining area, the Steenkampsberg quartzites are overlain by Houtenberg hornfels and a thin layer of quartzite occurs on the top of the hill. A diabase sill has intruded the Houtenbek Formation and is clearly visible where it forms a ridge on the western slope (Figure 3.2). The calculated thickness of the Houtenberg Formation within the mining area ranges from 0 to 50m.

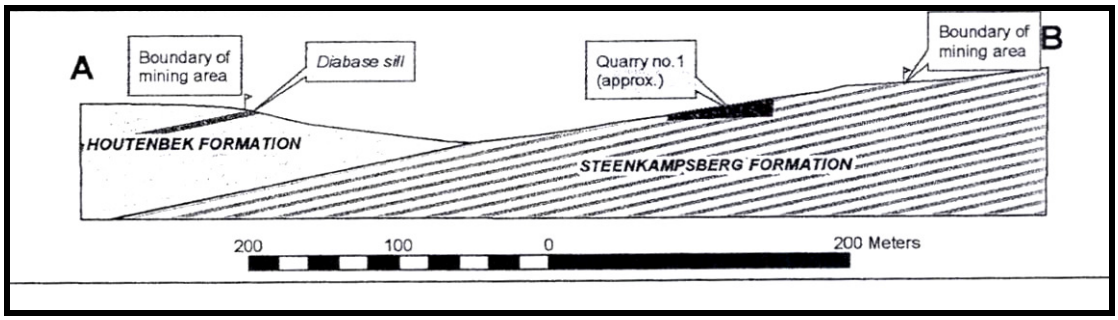


Figure 3.2: Cross Section (taken from Niesing and Lingenfelder, 2003)

3.2 Climate

3.2.1 Regional climate

The South African Weather Bureau has partitioned the country into 15 climatic regions. This division is based on:

- geographic considerations, more specifically the prominent mountain ranges (great escarpment) which constitute the main climatic divides, besides also other features such as rivers and political boundaries;
- the interior plateau - use has been made of the change from BW to BS and from BS to C climates according to the Köppen classification.

The site falls within Climatic Region H – The Highveld.

The climate is typical of the Highveld, with warm summers and cold winters with occasional severe frosts. Rainfall typically occurs as high-intensity short duration thunderstorms. The average frost period is 111 days per annum. The mean annual temperature is 22.5°C, with recorded extremes of -11°C and 34°C.

The site occurs in Mpumalanga and falls in the summer rainfall region, which is characterised by thunderstorm activity and relatively low average rainfall. The mean annual rainfall is 735mm compared to the mean annual potential evaporation of 1500mm. Pertinent climate data was obtained from the Middelburg (No.0515/826) and Belfast (No. 0517/0109) weather stations.

3.2.2 Mean monthly rainfall

The average number of days per month having rainfall depths in excess of 0.1mm, together with the average monthly depth of rainfall, are given in Table 3.1.

Table 3.1: Average monthly rainfall depths (mm) and days with rainfall of > 0.1mm.

Month	Average Depth	Average Days
January	132	13.8
February	103	11.2
March	88	9.5
April	42	6.5
May	19	2.9
June	7	1.5
July	9	1.7
August	8	0.9
September	22	3.7
October	63	8.3
November	124	13.0
December	118	13.1
Total	**735**	**86.1**

3.2.3 Mean annual rainfall

The maximum rainfall intensities recorded at the relevant weather stations are shown in Table 3.2.

Table 3.2: Maximum rainfall intensities.

24 Hour Rainfall Depths (mm)			
Maximum recorded	**1:50 Yr. Storm**	**1:100 Yr. Storm**	**1:200 Yr. Storm**
117	104	118	134

3.2.4 Mean annual evaporation

The mean monthly evaporation figures recorded at the relevant weather stations are given in Table 3.3. The data in the table was obtained using an 'A' Pan.

Table 3.3: Mean monthly evaporation figures

Month	Evaporation (mm)	Rainfall (mm)	Monthly deficit (mm)
January	160	132	28
February	140	103	37
March	110	88	22
April	110	42	68
May	85	19	66
June	70	7	63
July	75	9	66
August	110	8	102
September	140	22	118
October	160	63	97
November	160	124	36
December	180	118	62
Total Average	**1500**	**735**	**765**

3.2.5 Mean monthly maximum and minimum temperatures

The average and actual maximum and minimum temperatures between the weather stations are given in Table 3.4.

Table 3.4: Mean monthly maximum and minimum temperatures (ºC)

Month	Daily Maximum	Daily Minimum	Highest Temperature	Lowest Temperature
January	27.2	13.7	32.0	9.1
February	26.8	13.4	30.8	9.0
March	26.8	11.4	30.2	6.4
April	23.9	7.4	27.9	1.4
May	21.3	2.2	26.1	-2.9
June	18.5	-1.8	22.4	-6.0
July	18.4	-1.7	23.0	-5.8
August	21.4	0.8	26.0	-4.1
September	24.0	5.3	29.2	-1.3
October	26.0	10.1	31.2	4.4
November	26.2	11.8	31.8	5.9
December	27.1	13.2	31.2	7.8
Yearly Average	**23.9**	**7.2**	**28.4**	**2.0**

3.2.6 Prevailing wind direction

No wind data is available for Belfast according to the South African Weather Bureau. The wind pattern data for the Middelburg station is shown in Table 3.5.

Table 3.5: Mean monthly wind speed and direction

Month	N		NE		E		SE		S		SW		W		NW	
	N	v	n	v	N	v	N	v	N	v	n	v	n	V	n	v
January	161	3.0	287	3.2	44	3.1	92	3.3	122	3.6	96	3.3	109	3.7	48	4.5
February	142	2.9	295	3.2	44	3.1	74	3.4	112	3.4	101	2.9	141	3.9	60	4.2
March	152	2.8	304	3.3	36	3.1	54	3.1	100	3.4	104	2.9	139	3.4	63	3.5
April	170	2.7	211	3.3	47	3.2	95	3.4	149	3.6	146	2.8	87	3.4	39	3.0
May	172	2.6	166	2.9	59	3.4	89	3.7	162	3.9	167	2.9	67	3.0	51	3.3
June	146	2.5	149	3.0	54	3.6	117	3.0	157	3.8	166	2.7	86	3.2	43	3.2
July	162	2.5	184	2.9	51	3.9	99	3.9	142	3.6	143	2.8	79	3.4	53	4.2
August	174	5.4	180	3.4	40	3.5	86	4.1	141	4.1	182	3.0	83	3.2	40	4.4
September	197	3.2	223	3.8	27	3.5	70	3.9	131	4.3	171	3.3	84	4.0	41	3.9
October	190	3.4	243	3.7	33	3.6	71	3.6	142	4.0	160	3.8	83	4.3	42	3.6
November	174	3.2	225	3.6	28	3.1	68	3.1	185	3.8	154	3.5	92	4.1	40	3.9
December	180	3.1	254	3.4	34	3.0	69	3.3	154	3.5	135	3.3	95	4.0	40	4.0
Average	**188**	**2.0**	**227**	**3.3**	**41**	**3.3**	**82**	**3.8**	**141**	**3.8**	**146**	**3.1**	**95**	**3.7**	**47**	**3.8**

n = average direction frequency per 1000 readings v = velocity (m/s)

3.2.7 The incidence of extreme weather conditions

Being located on the Highveld, the area is prone to extreme weather on a regular basis. These weather conditions include droughts, floods and strong gusty winds prior to and during thunderstorms. Frost also occurs on an average of 120 to 150 days between April and September.

3.3 Topography

Figure 2.1 provides an indication of the location of the site in relation to the surrounding area. It also provides an indication of the surrounding topography, which is rugged in nature.

According to the AGIS Comprehensive Map drafted by the Department of Agriculture, Forestry and Fisheries, average slopes in the area range between 9 – 20% as indicated in Figure 3.3.

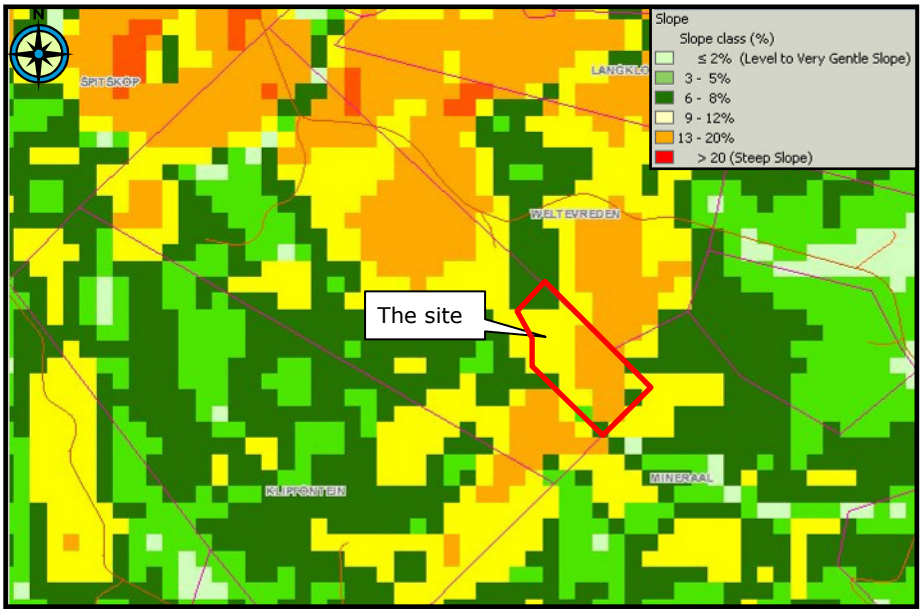


Figure 3.3: Slope of the site (taken from Department of Agriculture, Forestry and Fisheries)

The terrain type of the site is indicated as High Hills or Ridges with a small portion level plains with some relief (Figure 3.4).

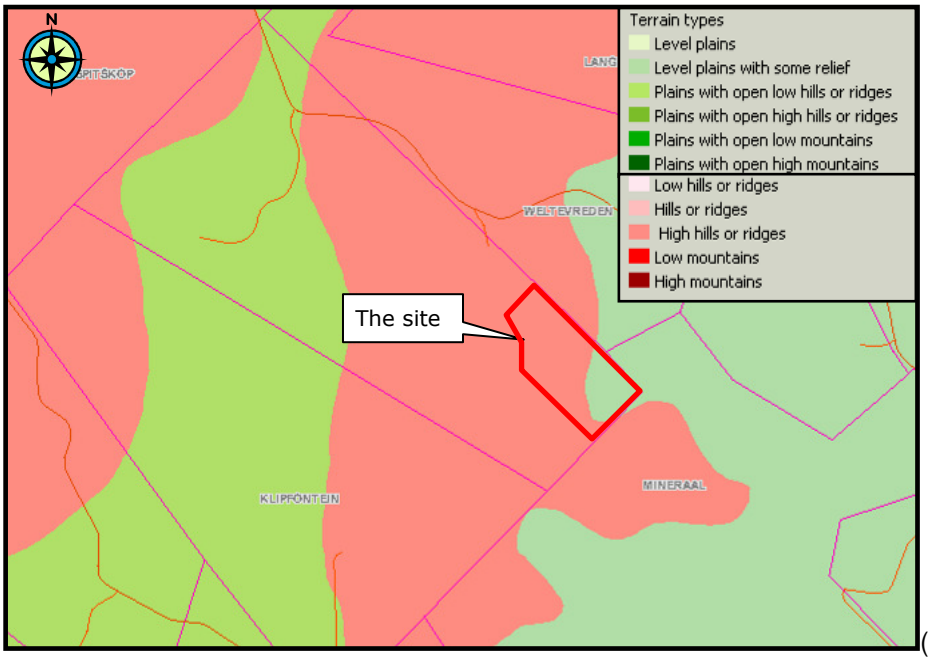


Figure 3.4: Terrain type of the site (taken from Department of Agriculture, Forestry and Fisheries)

Most of the quarrying activity and associated infrastructure, i.e. Quarry no. 1, Quarry no. 2, the workshop, the crushing and loading plants are located on the westerly/northwesterly facing slopes as indicated in Figure 3.9. These activities occur mostly between 1744 and 1788 m above mean sea level (amsl).

The proposed extension will involve an extension of Quarry no.1 and Quarry no. 2 on the westerly/northwesterly facing slopes i.e. from 1760 amsl to 1840 amsl (i.e. the top boundary of the site).

This area slopes steeply in a westerly/northwesterly direction towards the existing quarries (Photo 3.1) and the unnamed tributary (Photo 3.2) extending through the centre of the Belfast Silica Mine area.

Photo 3.1: Westerly/northwesterly slope towards the existing quarries

Photo 3.2: Westerly/northwesterly slope towards the unnamed tributary

A portion of the site also slopes steeply in a southwesterly direction towards the Langspruit (Photo 3.3). Relatively flat areas are also present near the boundary of the site (Photo 3.4).

Photo 3.3: Southwesterly slope towards the Langspruit

Photo 3.4: Flatter area near boundary of the site

3.4 Soils/land type

According to the AGIS Comprehensive Atlas of the Department of Agriculture, Forestry and Fisheries, the Belfast Silica Mine area predominantly comprises rock with limited soils as indicated in Figure 3.5. Red and yellow soils with low to medium base status are indicated in the north eastern corner of the site.

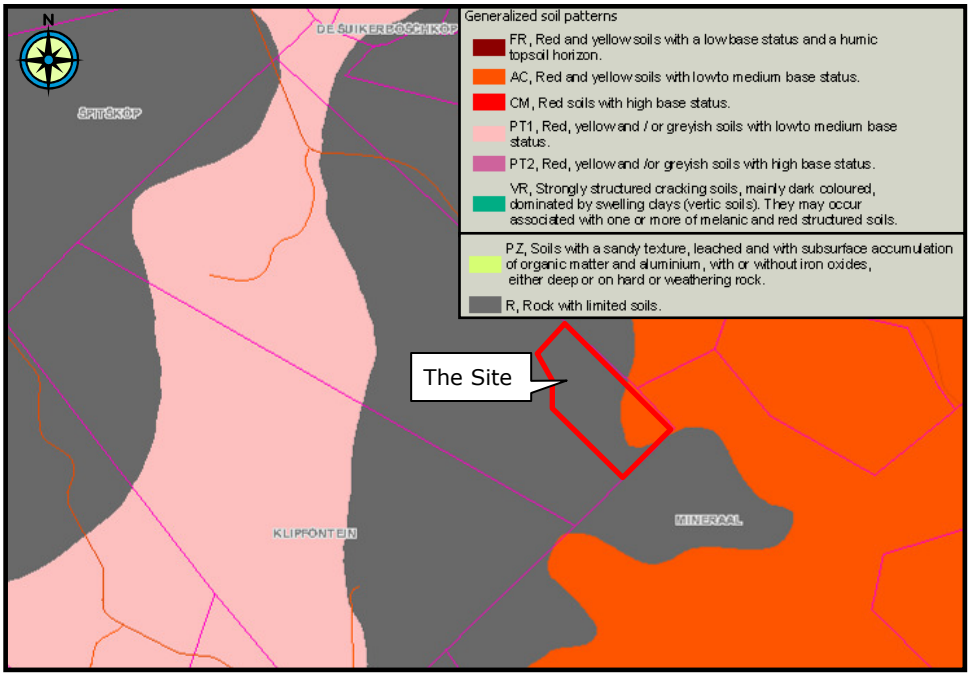


Figure 3.5: Generalized soil patterns (taken from Department of Agriculture, Forestry and Fisheries)

The Department of Agriculture, Forestry and Fisheries classified the land type of the Belfast Silica Mine site predominantly as Ib (Figure 3.6), which comprises of rocky areas (>60% exposed surface rock) with miscellaneous soils.

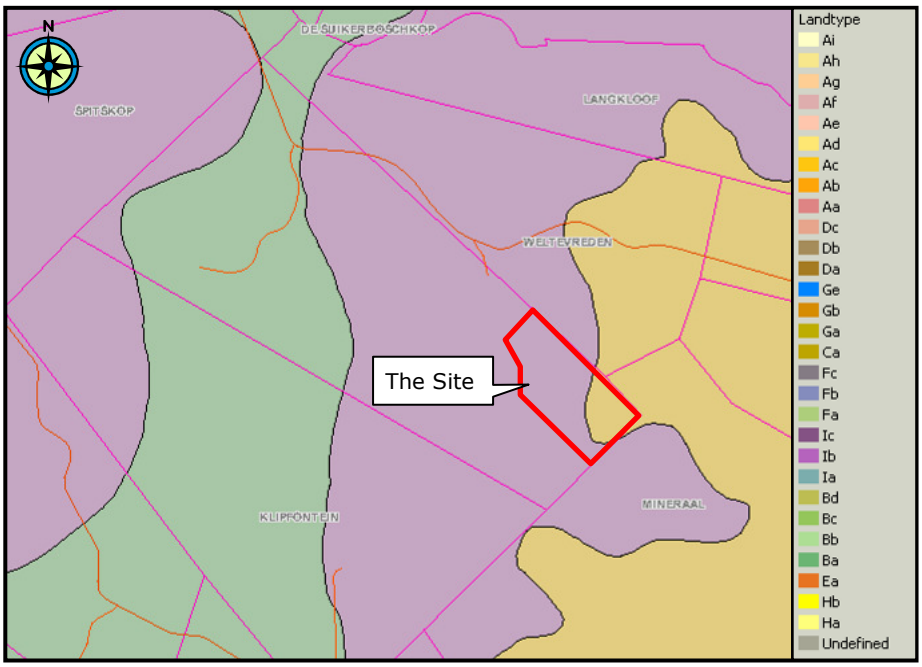


Figure 3.6: Land type of the site (taken from Department of Agriculture, Forestry and Fisheries)

Topsoil or overburden is virtually non-existent at the Belfast Silica Mine since the said site is very rocky (Photo 3.5). This is also the case for the proposed extension area.

Photo 3.5: Rocky nature of the site

3.5 Land capability/agricultural potential

In terms of land capability, the Belfast Silica Mine site is indicated as wilderness according to the Department of Agriculture, Fisheries and Forestry (Figure 3.7). A small portion is indicated as marginal potential arable land (Figure 3.7).

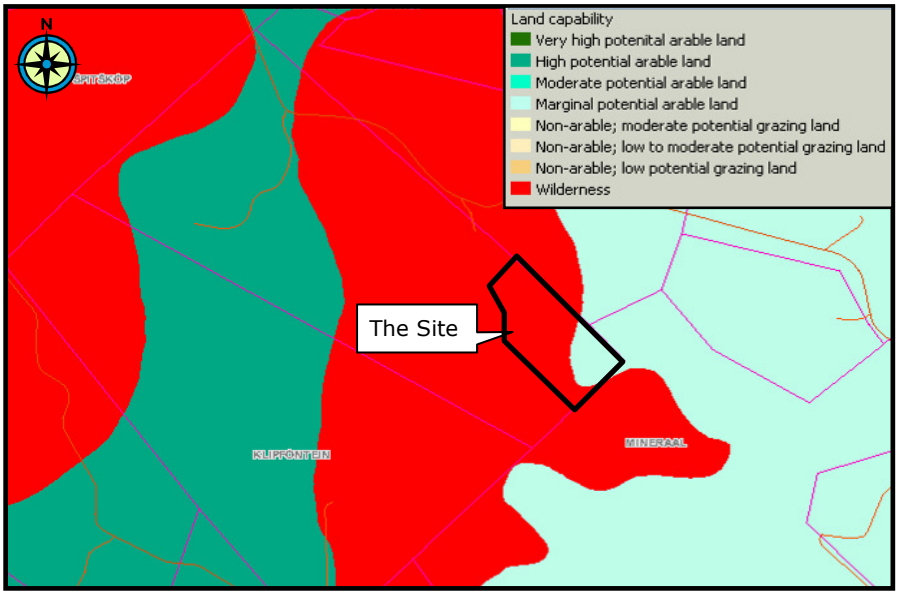


Figure 3.7: Land capability of the site (taken from Department of Agriculture, Forestry and Fisheries)

The Mpumalanga Biodiversity Conservation Plan indicates a score of 1 (very low) in terms of arable land and a score of 7 (high) for the Belfast Silica Mine site in terms of grazing. The Department of Agriculture, Forestry and Fisheries indicates that the site has a grazing capacity of 5-7 ha/large stock unit (Figure 3.8). The site and surrounding area are therefore mainly suitable for grazing and not cultivation.

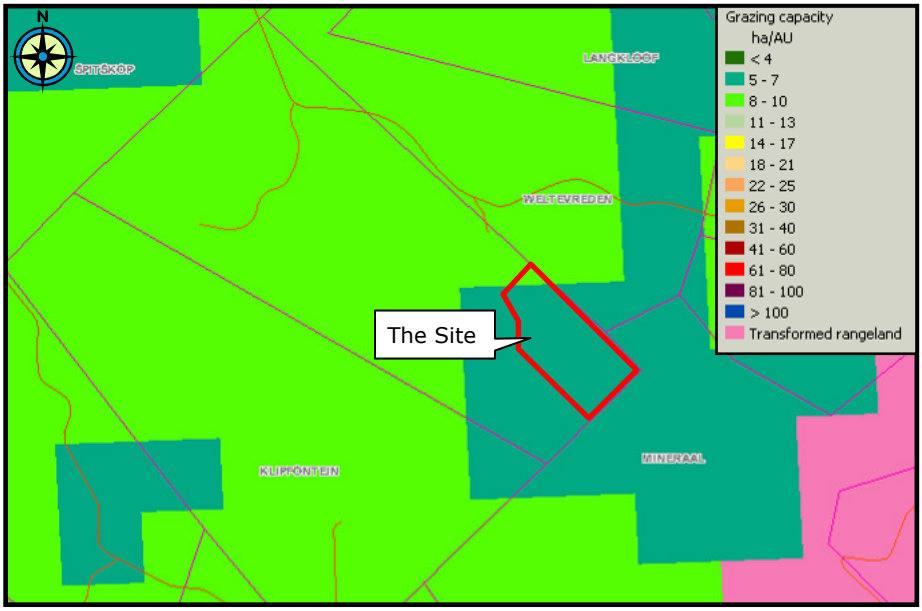


Figure 3.8: Grazing capacity of the site (taken from Department of Agriculture, Forestry and Fisheries)

The proposed extension area is also very rocky with very little or limited topsoil and is therefore also classified as wilderness. Presently, no agricultural activities (i.e. grazing or cultivation) are taking place within the proposed extension area.

3.6 Land use

3.6.1 Land use before mining activities

As previously indicated, the Belfast Silica Mine site is not suitable for cultivation purposes due to the rocky nature of the area.

The proposed extension area has not been used for agricultural purposes (cultivation or grazing) due to the rocky nature of the area.

3.6.2 Historical agricultural production

Not known.

3.6.3 Signs of misuse and/or soil erosion

No signs of misuse and/or soil erosion were noted within the proposed extension area.

3.6.4 Existing structures and distance from activities

Within the proposed extension area, no structures are present except for a boundary fence.

The following infrastructure is however present within the existing mining area (Figure 2.4 and Figure 3.9):

- Quarry no 1;
- Quarry no. 2;
- Crushing and screening plant;
- Loading plant (load out);
- Workshop (including washbay);
- Diesel tank and paraffin tank;
- Eskom transformer;
- Office
- Explosive Magazine;
- Guard house;
- Gravel access road;
- Product stockpiles;
- Sand drying plant.

In close proximity of the magazine, ruins of a homestead are present. The farmstead of Mr. T. Mahlangu and the graves of the Mahlangu family occur just outside of the mining area as indicated in Figure 3.9.

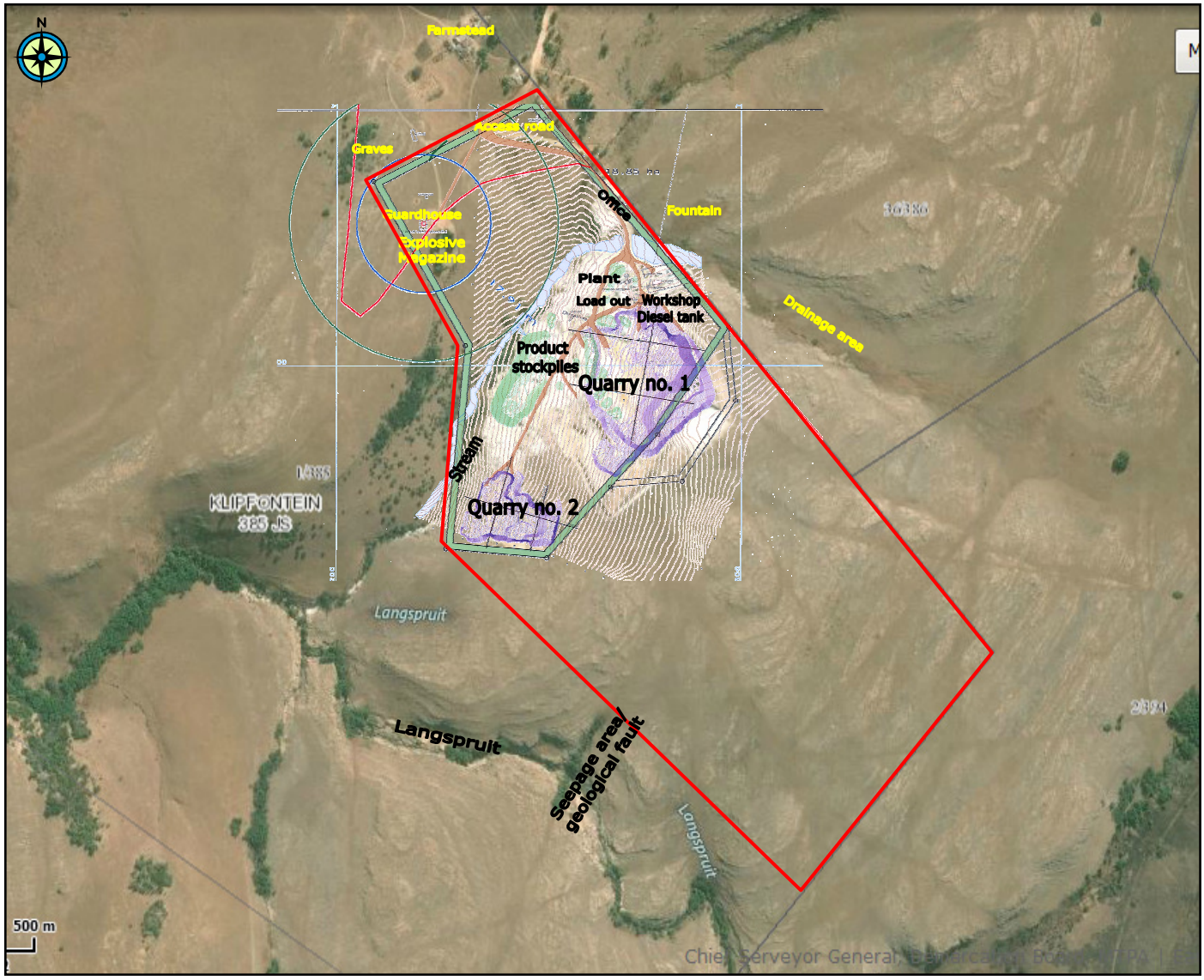


Figure 3.9: Existing structures present within mining area

3.7 Natural vegetation

3.7.1 General vegetation description

According to the 'The vegetation of South Africa, Lesotho and Swaziland', the Belfast Silica Mine site falls within the Mesic Highveld Grassland bioregion, specifically the Lydenburg Montane Grassland (veld type Gm18) (Mucina & Rutherford, 2006). The vegetation type was previously referred to by Low and Rebelo (1998) as North-eastern Mountain Grassland (43) and by Acocks (1953) as North-Eastern Sandy Highveld (57).

This grassland extends from Pilgrim's Rest in the north and south and westwards towards Lydenburg, Dullstroom, Belfast and Waterval Boven. It includes the Steenkampsberg and Mauchsberg. Figure 3.10 provides an indication of extent of the vegetation type and the location of the site.

This vegetation type is characterized by very low grasslands on the high-lying areas, with an increase of the grass sward on the lower slopes. The grassland is very rich in forb species.

Typical grass species include the Common Russetgrass (*Loudetia simplex*), Giant Speargrass (*Trachypogon spicatus*), and Threadleaf Bluestem (*Diheteropogon filifolius*). Typical forbs include *Senecio gerrardii* and *Helichrysum* spp. A number of small trees (e.g. *Protea roupelliae* subsp. *roupelliae*) and low shrubs (e.g. *Phymaspermum acerosum, Erica woodii)* can also be found.

Approximately 23% of the Lydenburg Montane Grassland has already been transformed, mostly by alien plantations (20%) and cultivated lands (2%). This vegetation type has been afforded the status of vulnerable with a conservation target of 24%.

The Lydenburg Montane Grassland is however, not listed in "The National List of Ecosystems that are Threatened and in need of protection" (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).

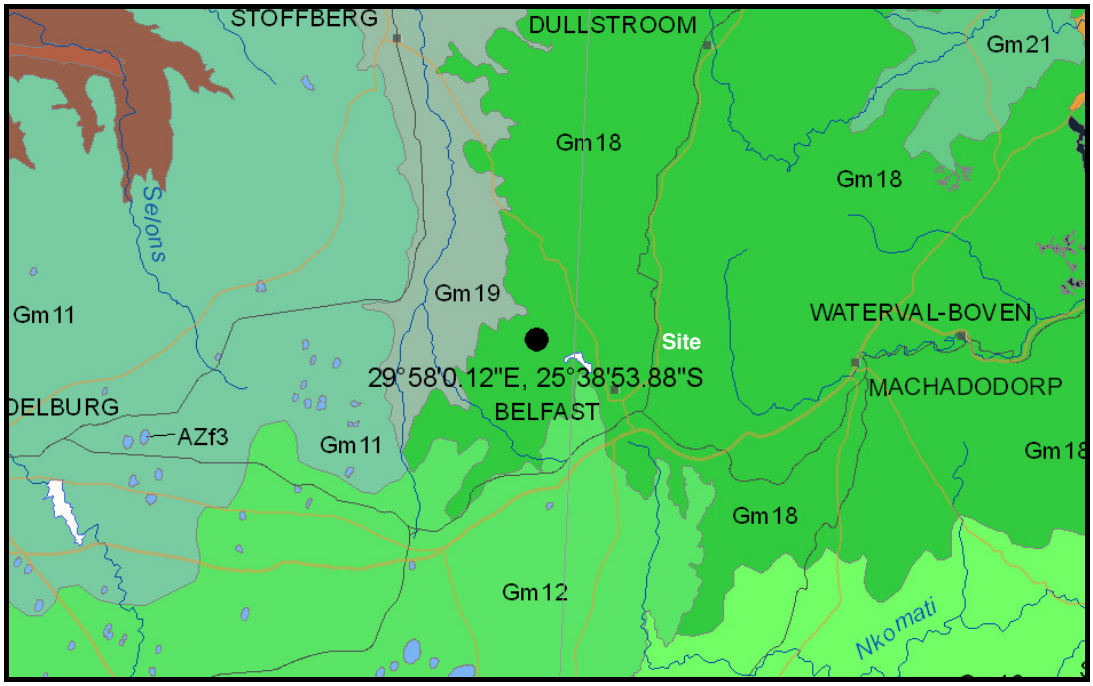


Figure 3.10: Vegetation type (taken from Mucina and Rutherford, 2006)

The Belfast Silica Mine site is demarcated as follows in terms of the terrestrial biodiversity assessment of the Mpumalanga Biodiversity Sector Plan (2013):

- ‘Heavily Modified’ (Figure 3.11) – i.e. the existing Belfast Silica quarries;
- ‘Other Natural Areas’ (Figure 3.11) – i.e. where mining has not taken place in the central portion of the site (corresponds with the stream extending through the site);
- 'Ecological Support Area - Local Corridor' (Figure 3.11) – i.e. where mining has not taken place in the south eastern portion of the site (corresponds with the proposed extension area).

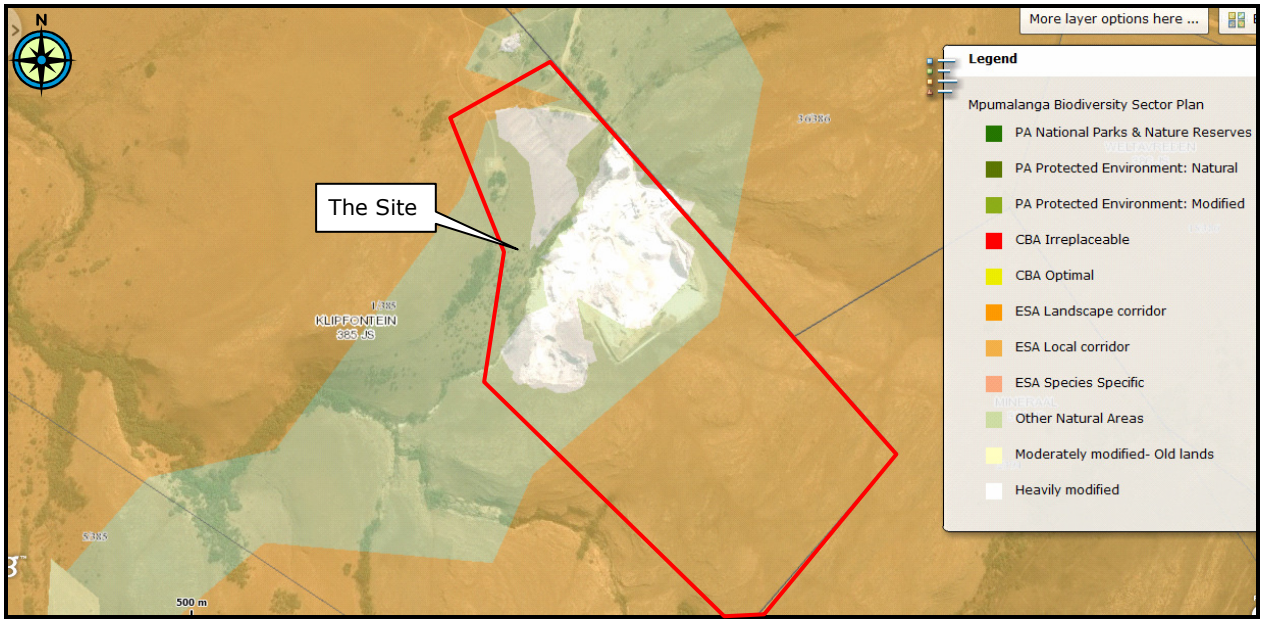


Figure 3.11: Terrestrial Biodiversity Assessment (taken from Mpumalanga Biodiversity Sector Plan, 2013)

3.7.2 Vegetation of the proposed extension area

As indicated above, the Belfast Silica Mine site is characterised by the presence of Lydenburg Montane Grassland.

The proposed extension area is also characterised by the presence of Lydenburg Montane Grassland, which is of low height (approximately 30 - 50cm in height) and rich in forb species. This vegetation has not been impacted by the existing mining operation and can be seen as almost pristine (Photo 3.6). No alien plant species (which indicate disturbance) were noted within the proposed extension area.

Boat grass (*Monocymbium ceresiiforme)* was noted to be dominant while in areas, the Monkeys tail (*Xerophyta retinervis*) was dominant. A lone protea shrub (*Protea* sp.) and the shrub, *Lopholaena coriifolia,* were noted near the boundary of the site.

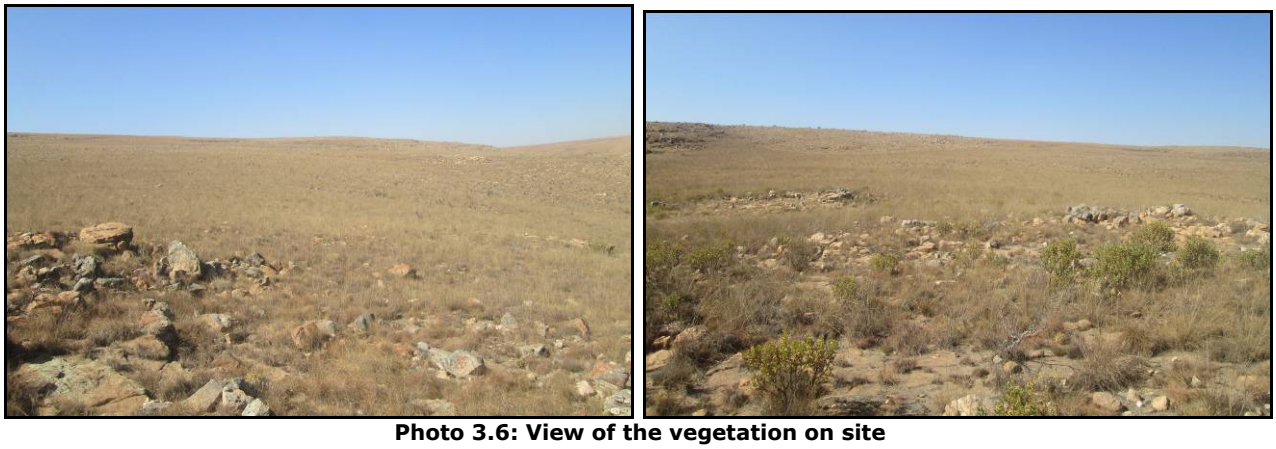


Photo 3.6: View of the vegetation on site

The following plant species were noted within the proposed extension area:

- *Lopholaena coriifolia* (succulent shrub);
- *Xerophyta retinervis* (Black-stick lily);
- *Eragrostis* sp.;
- *Monocymbium ceresiiforme* (Boat grass);
- *Aristida* sp. (Three awn species);

- ♣ *Elionurus muticus* (Wire grass);
- ♣ *Protea* sp.;
- ♣ *Gnidia* sp.;
- ♣ *Felicia* sp.
- ♣ *Stoebe vulgaris*.

A seepage area (possibly associated with a geological fault) which flows into the Langspruit was noted within the proposed extension area (Figure 3.9 and Photo 3.7). This seepage area is vegetated with wetland vegetation and a number of fern (including the Tree Fern, *Cyathea sp.*) and tree species making it a unique habitat within the grassland area.

Photo 3.7: The seepage area

Wetland vegetation would also be associated with the unnamed tributary extending through the centre of the Belfast Silica Mine site as well as the Langspruit. The Tree Fern (*Cyathea* sp.) was also noted within these systems. The presence of alien tree species (e.g. *Acacia dealbata, Acacia mearnsii*) indicates that these systems have been impacted upon.

Endangered or rare species

The Belfast Silica Mine site is located within the 2529DB quarter degree square. The following Red Data plant species are recorded on the PRECIS Database of the South African National Biodiversity Institute for the 2529DB quarter degree square and could therefore possibly occur on site:

- *Ilex mitis* – Declining;
- *Callilepis leptophylla* – Declining;
- *Streptocarpus denticulatus* - Vulnerable;
- *Eucomis montana* – Declining;
- *Khadia alticola* – Rare;
- *Khadia carolinensis* – Vulnerable;
- *Jamesbrittenia macrantha* – Near Threatened.

Ilex mitis is commonly known as the African Holly. It is a tall, fast growing tree usually found near streams and rivers.

Callilepis leptophylla is a bushy perennial herb with a tuberous rootstock and white flowers. It is widespread in grassland and often present on rocky ridges.

Eucomis montana grows to about 30 cm and has erect leaves, purple stems, and green to white flowers with purplish brown stamens and ovary.

Khadia alticolais is found along the Steenkampsberg and surrounding high-lying areas. It prefers high altitudes and rocky places. The flowers are pale pink or white and the capsules tend to gape open once wetted, never closing completely again. Although plentiful in habitat, its occurrence is not widespread.

Khadia carolinensisis is found on quartzitic rocks near Carolina and also grows further to the south and north. It forms large, flattened clumps that can grow up to 0.5 m in diameter. It has white to cream-coloured flowers and six-locular capsules that are woody and close fully again after they have opened.

Jamesbrittenia macrantha occurs on grassy slopes with other shrubs. It is however, restricted to Norite, which is not found on site.

Protected plant species
According to Provincial Ordinances, a number of plant species are protected in Mpumalanga Province, whether they are considered to be threatened or not. This includes, but is not limited to, the following common names: ferns, flame lilies, christmas bells, pineapple flowers, clivia, nerine, crinum, ground lily, fire lily, irises, all orchids.

Numerous specimens of the Tree Fern (*Cyathea sp.*) were found along the edges of the streams as well as the seepage area. According the Schedule 11 of the Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998), all species of the tree ferns are protected plants.

Invader or exotic species
The following declared weeds and alien invasive species listed in the Conservation of Agricultural Resources Act (Act 43 of 1983) and Schedule 13 of the Mpumalanga Nature Conservation Act, 1998 (Act 10 of 1998) were noted to be present within the Belfast Silica Mine site:

Latin name	Common name
Acacia dealbata	Silver Wattle
Acacia mearnsii	Black Wattle
Bidens pilosa	Blackjack
Cirsium vulgare	Scottish thistle
Cestrum laevigatum	Ink berry

3.8 Animal life

As indicated, the existing quarries and associated infrastructure has impacted on approximately 7 hectares of the natural vegetation present on the Belfast Silica Mine site. This would also have impacted on the animal habitats associated with this natural vegetation.

Almost pristine Lydenburg Montane Grassland occurs within the proposed extension area that could provide natural habitat for animal species. Although no animal species were noted during the brief site visit, the following animals are known to occur within the surrounding area:

- Grey Rhebok (*Pelea capreolus*);
- Common duiker (*Sylvicapra grimmia*);
- Baboon (*Papio ursinus*);
- Hare species (*Lepus* sp.);
- Steenbok (*Raphicerus campestris*).

Amphibian species are expected to be present within the unnamed tributary and associated wetland/drainage area, the identified seepage area (Figure 3.9) and the Langspruit (Figure 3.9). These areas would also provide habitat for bird species e.g. Hamerkop (*Scopus umbretta*) and Egyptian Goose (*Alopochen aegyptiaca*) which were noted during the brief site visit.

The Belfast Silica Mine site is demarcated as an Ecological Support Area (ESA): Important subcatchments (Figure 3.12) in terms of the freshwater assessment of the Mpumalanga Biodiversity Sector Plan (2013). The existing quarries and associated infrastructure area are indicated as 'Heavily Modified (Figure 3.12).

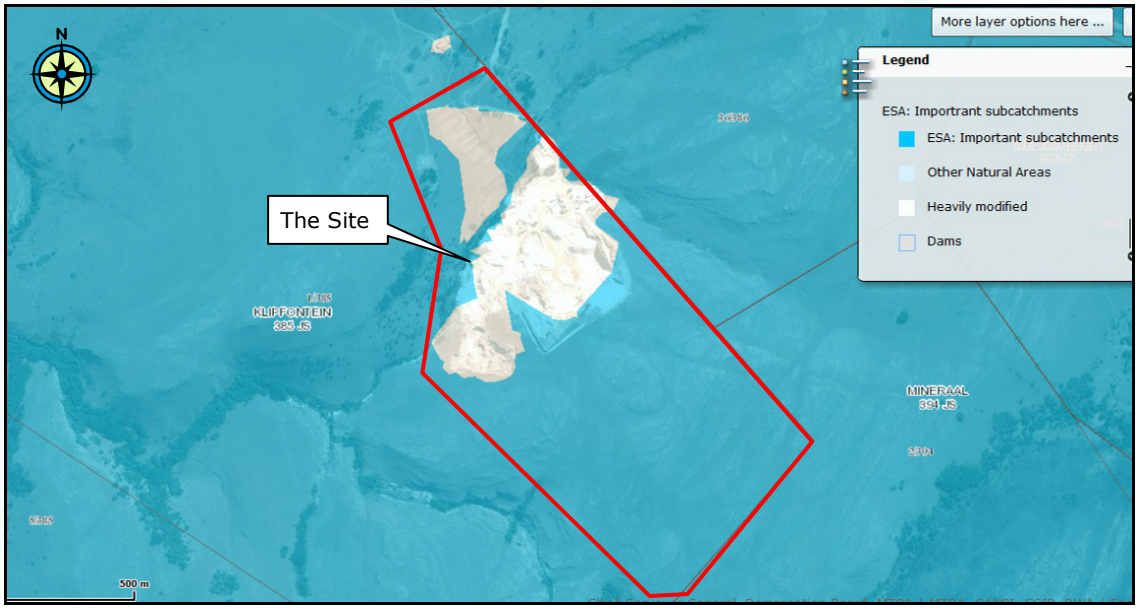


Figure 3.12: Freshwater Assessment (taken from the Mpumalanga Biodiversity Sector Plan, 2013)

Although no endangered or rare species were noted, it does not exclude the possibility that Red Data species may occur in the area.

3.9 Surface water

Belfast Silica Mine is situated within the Olifants River Catchment, more specifically the B41A quaternary sub-catchment as indicated in Figure 3.13.

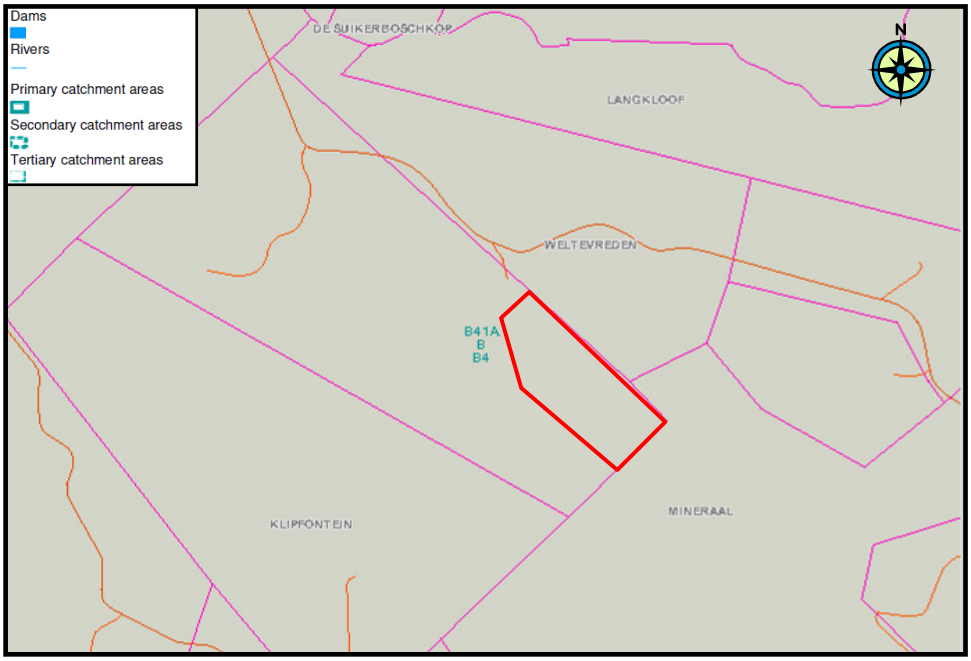


Figure 3.13: Tertiary Catchment (taken from Department of Agriculture, Forestry and Fisheries)

The Langspruit is located to the west of the Belfast Silica Mine site as indicated in Figure 3.14 and Photo 3.8. This river is characterised by a rocky base resulting in the presence of rapids, waterfalls and rock pools. From the site visit, it was evident that this river is polluted with sewage (Photo 3.9) and is heavily invaded by alien plant species (e.g. *Acacia* sp.) (Photo 3.10). Wetlands would also be associated with this system.

Photo 3.8: View of the Langspruit

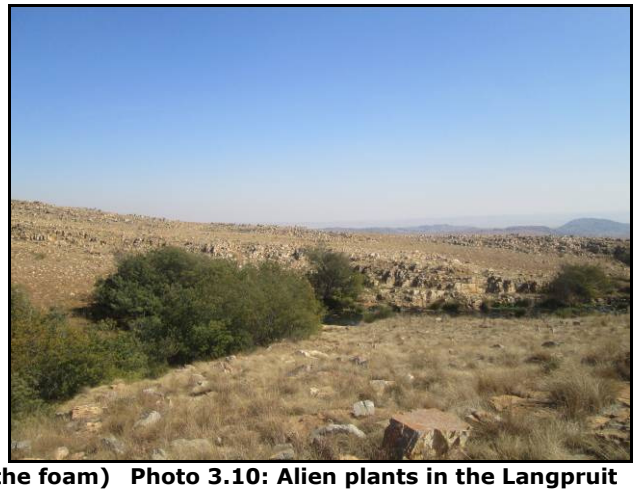


Photo 3.9: Sewage pollution in the Langspruit (note the foam) **Photo 3.10: Alien plants in the Langpruit**

A non-perennial, unnamed tributary of the Langspruit flows through approximately the centre of the site (Figure 3.14 and Photo 3.11). This tributary/stream is fed by a number of drainage areas and a fountain as indicated in Figure 3.14. Wetlands would be associated with this system.

Photo 3.11: The unnamed tributary of the Langspruit

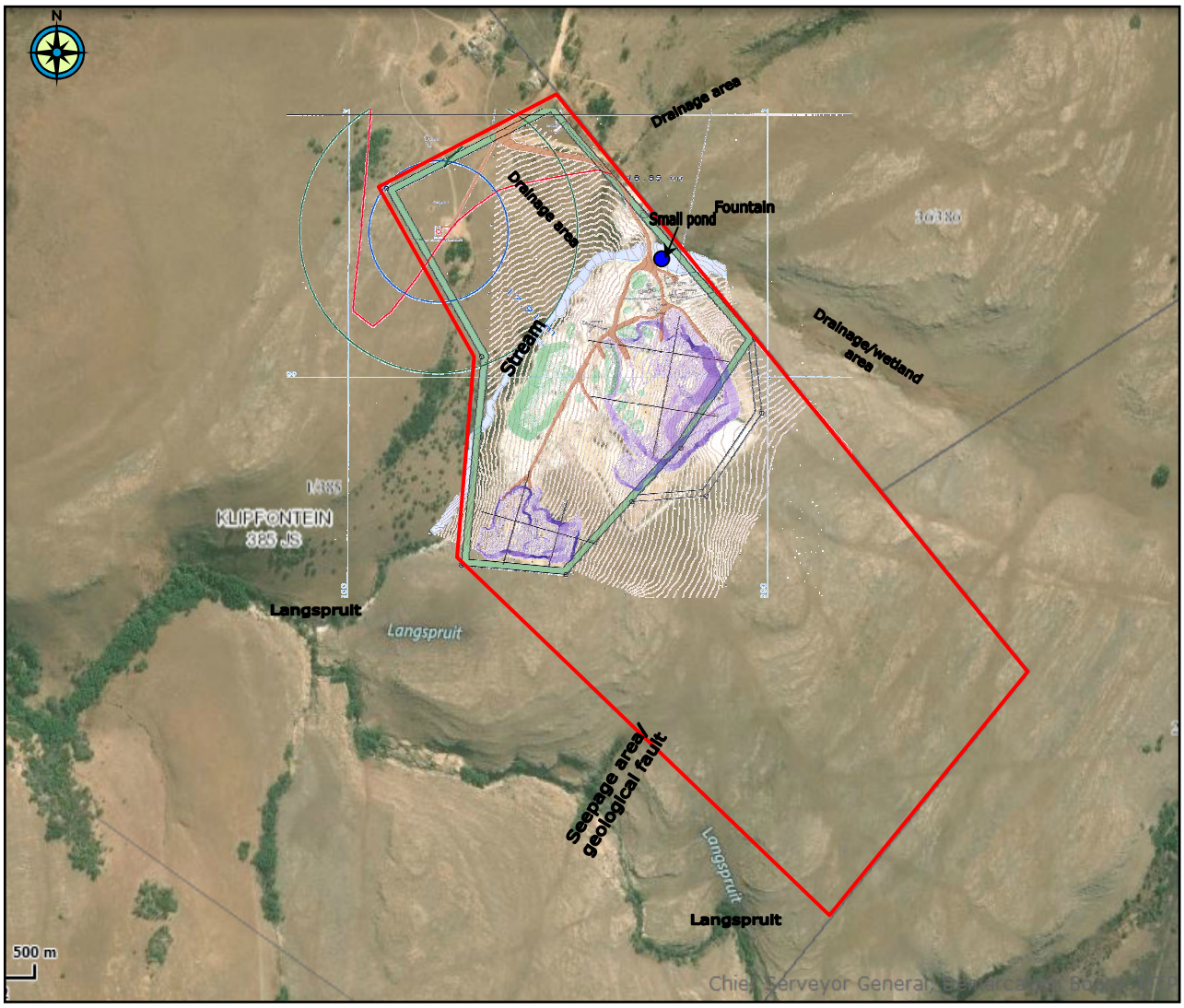


Figure 3.14: Aerial view of the surface water environments located on site

The following activities have impacted on the unnamed tributary and its associated wetlands:

- Construction of two roads (with drainage pipes) across the stream and drainage area/wetland.
- Excavation of a small dam (12m x 3m x 1m deep) within the drainage/wetland area (east of the site; Figure 3.14.
- Placement of product stockpiles on the banks of the stream resulting in sand and gravel being washed into the stream during heavy downpours (Photo 3.11).
- Presence of black wattle and silver wattle trees (Photo 3.11).

According to the mine, the surface water quality of the unnamed tributary is of good quality. Water for domestic purposes is obtained from the fountain located on the adjacent property (Figure 3.14). Water is also abstracted from the small dam located in the drainage area for dust suppression purposes (Photo 3.12).

Photo 3.12: Small dam in drainage area

No surface water environments (rivers/streams) are present within the proposed extension area. A seepage area that flows into the Langspruit (Figure 3.14 and Photo 3.13) was however noted to the west of the proposed extension area. This seepage area appears to correspond with a geological fault that extends within the proposed extension area (Photo 3.13). The seepage area is well vegetated and has not been impacted by mining activities to date.

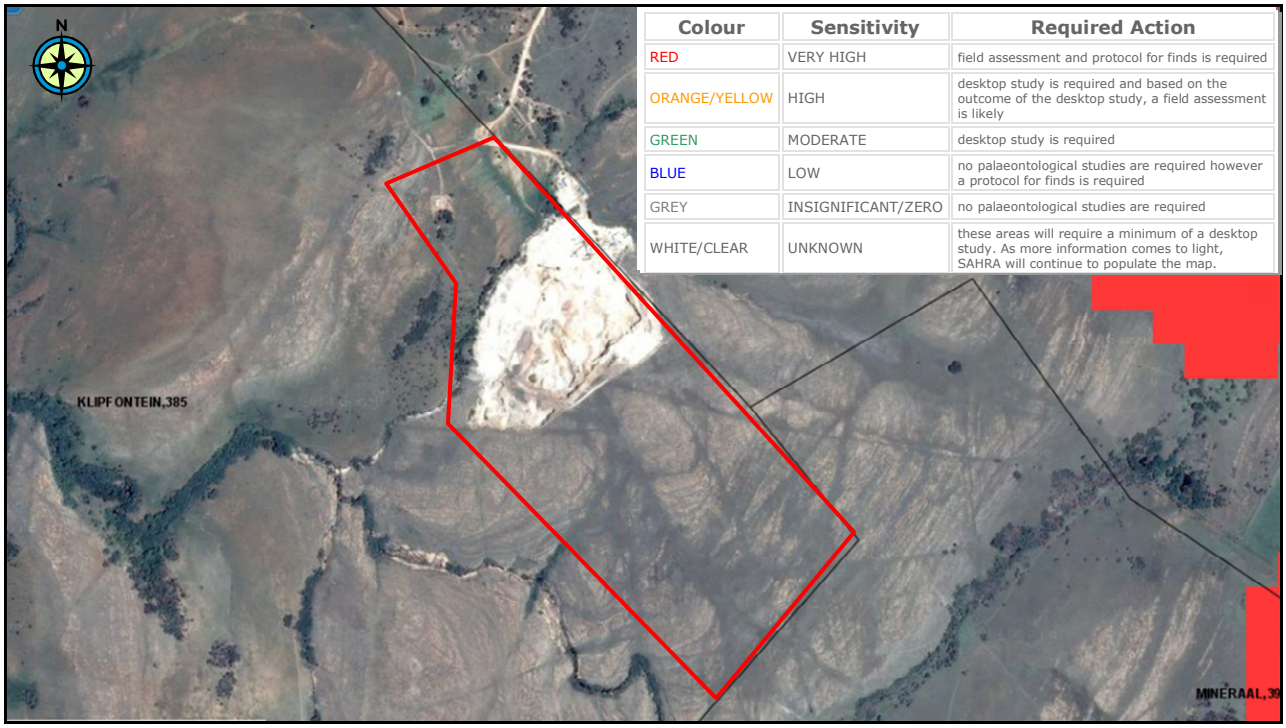
Photo 3.13: Seepage area (associated with geological fault) flowing into the Langspruit

3.10 Archaeological, historical and cultural aspects

No sites of archaeological and/or cultural interest are known to exist within the boundaries of the Belfast Silica Mine property (including the proposed extension area). Approximately 7 hectares (ha) have been developed and no artefacts or remains have been unearthed by the mining activities.

Eight (8) graves (belonging to the Mahlangu family) were identified in close proximity of the Mahlangu residence (Figure 3.9).

According to the palaeontological map supplied by the South African Heritage Resources Agency (SAHRA, 2014), the palaeontological sensitivity of the site is unknown. As a result, a minimum of a desktop study would be required (Figure 3.15).



Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 3.15: Palaeontological map (taken from SAHRIS, 2014)

3.11 Groundwater

No boreholes are located on site or the immediate surrounding area. Water for domestic purposes is obtained from a fountain, located on the adjacent property (belonging to Mr. J. van der Westhuizen).

Groundwater would be associated with the unnamed tributary and its associated wetlands as well as the Langspruit. Groundwater seepage does take place within the existing quarries. The groundwater is trenched and piped out of the quarry towards the unnamed tributary.

Groundwater would be associated with the seepage area that flows into the Langspruit (Figure 3.14) to the west of the proposed extension area. This seepage area appears to correspond with a geological fault that extends within the proposed extension area.

3.12 Air quality

The Belfast Silica Mine site (including the proposed extension area) is located within a rural agricultural area. The background air quality is therefore assumed to be of good quality since the site is not situated in close proximity of any industrial activities. The nearby gravel road is a source of dust at certain times.

The quarrying operation is a contributor of dust within this rural agricultural area. Dust would be as a result of:

- the blasting associated with the quarrying activity;
- the crushing and screening operation;
- the loading of the products into the trucks for transport;
- vehicles using the gravel roads to transport the products.

Dust from the mine contains free crystalline silica, which can cause silicosis following excessive exposure to dust in the respirable range. Gravel from the mine is also used to repair the access road, meaning the dust from the gravel road will also contain free crystalline silica.

No residential areas or farmsteads are located near the Belfast Silica Mine site (including the proposed extension area). The closest residence that could be impacted by dust from the mining activities is the homestead of Mr. T. Mahlangu. Dust suppression does take place within the mine.

Two farmsteads (that of Ms. W. Ackhurst and the Mlangeni Family Trust) are located near the gravel access road used by the mine. Dust as a result of the heavy vehicles using this road could impact on the residents of these homesteads. Dust suppression does take place along the gravel road.

3.13 Noise

The Belfast Silica Mine site (including the proposed extension area) is located within a rural agricultural area. The background noise level is very low. The nearby gravel road is a source of noise at certain times due to traffic utilizing this road.

The quarrying operation is the major contributor of noise within this rural agricultural area. Noise would be as a result of:

- drilling and blasting associated with the quarrying activity;
- the crushing and screening operation;
- the loading of the products into the trucks for transport;
- vehicles using the roads to transport the products.

No residential areas or farmsteads are located near the mine. The closest residence that could be impacted by noise from the mining activities is the homestead of Mr. T. Mahlangu.

Two farmsteads (that of Ms. W. Ackhurst and the Mlangeni Family Trust) are located near the gravel access road used by the mine. Noise as a result of the heavy vehicles using this road could impact on the residents of these homesteads.

3.14 Visual aspects

Figure 2.1 provides an indication of the location of the site in relation to the various roads and farmsteads in the surrounding areas. The visibility of the site is restricted due to the rugged nature of the area, which screens the quarrying operation.

The quarrying operation (including the proposed extension area) is not visible from any residential areas or farmsteads in the surrounding area. The quarrying operation and the proposed extension area are however, visible from the homestead of Mr. Thomas Mahlangu. The quarry (including the proposed extension area) is also visible from a certain point along the main gravel access road.

3.15 Traffic

Belfast Silica Mine (including the proposed extension area) is accessed via a gravel road (D1334 provincial road), which connects with the R33 provincial road to

Stoffberg near Belfast (Figure 2.1). A gravel road provides access to the mine and will also provide access to the proposed extension area. No roads are currently present within the proposed extension area.