Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland list human population growth and associated habitat loss as the major underlying threat to birds. The major factors include afforestation, loss of riverine and wetland/marsh habitat, agricultural and livestock modification, poisoning, persecution, long-lining (pelagic sea birds), disturbance, manmade structures, pet trade and oiling.

Regionally extinct birds include the Egyptian Vulture (*Neophron percnopterus*) and African Skimmer (*Rynchops flavirostris*).

Vulnerable species that occur in the area include Martial Eagle (*Polemaetus bellicosus*), African Marsh Harrier (*Circus ranivorus*), Lesser Kestrel (*Falco naumanni*), Blue Crane (*Anthropoides paradiseus*), Stanley's Bustard (*Neotis denhami*) and Knysna Warbler (*Bradypterus Warbler*). These species are deemed vulnerable as available scientific evidence indicates that they are facing a high risk of extinction in the wild.

Near threatened species, whose ranges occur in the study area include the Black Stork (*Ciconia nigra*), Secretary Bird (*Sagittarius serpentarius*), Crowned Eagle (*Stephanoaetus coronatus*), Black winged Plover (*Vanellus melanopterus*), Half collared Kingfisher (*Alcedo semitorquata*), Knysna Woodpecker (*Campethera notata*) and Melodious Lark (*Mirafra cheniana*). Near threatened species are species that are close to becoming vulnerable in the near future if the prevailing conditions remain unchanged.

4.1.8. Fish

According to Anton Bok, the Swartkops River is classed as a perennial fluvial system although the dynamics of the braided river system in the study area conforms more towards an ephemeral drainage model. Numerous isolated ponds and cut-off channels occur throughout the upper reaches of the Swartkops River, which are only connected during flood events when the floodplain and channel environments are underwater.

Fish species should occur within these isolated water bodies (in deep pools and during wet season) in the river channel and floodplain environments. Only about ten indigenous fresh-water fish occur in the Eastern Cape Province. Translocation and introduction of other South African and alien species, however, has resulted in a surprisingly diverse situation with at least 40 species recorded in the province.

Of the Red Data Book Species, only Fresh Water Mullet (*Myxus Capensis*) is listed in for the Swartkops River system. This species is considered rare and vulnerable. The species feeds and grows in fresh water but reproduces at sea.

The Swartkops is an important estuary system as it provides habitat for estuarine fish and micro-invertebrates. The estuary is also very important for catadromous fish species (Bok, 2008). Catadromous species refers to species which lay their eggs in salt water environments and the larvae and juveniles migrate into freshwater environments, finally after spending years in a freshwater environment they migrate downstream to repeat the cycle. This is particularly relevant to mining activities which may create a barrier to fish migrations upstream. Below is a list of catadromous species, found in the Swartkops estuary.

Table 4: List of catadromous species in the Swartkops estuary from Anton Bok

Species name	Common Name	Status
Myxus Capensis	Freshwater mullet	Species of concern in Eastern Cape, endemic to the region
Mugil cephalus	Flathead mullet	Common widespread
Mondactylus falciformis	Cape Moony	Common widespread
Anguilla mossambica	Longfin eel	Common in coastal rivers
Anguilla marmorata	African mottled eel	Common in coastal rivers
Anguilla bicolor bicilor	Shortfin eel	Common in coastal rivers
Glossobius callidus	Freshwater goby	Common in coastal rivers
Gilcgrestella estuaria	Estuarine round-herring	Wide spread in coastal rivers

According to Anton Bok, two other indigenous freshwater fish species, the Cape Kurper (*Sandelia capensis*), the threatened Eastern Cape Redfin (*Pseudobarbus afer*), are present in Swartkops River, but are largely confined to the undisturbed tributaries and are not found in the main channel within the lower reaches. Their absence is due to poor water quality and presence of fish predators introduced by man. These predatory fish include the alien largemouth bass *Micropterus salmoides* (from North America), as well as the non-endemic catfish or barbel (*Clarias gariepinnus*). The alien common carp, *Cyprinus carpio*, introduced from Europe, is also found in the lower Swartkops River.

Importance of Secondary Channels as Migration Corridor

According to Anton Bok,fish frequently undertake upstream migrations during high flow and flood conditions, and utilize the secondary channels with lower water velocities that become active under these conditions. If the flood is confined to a single deep channel with little in stream structure or hydraulic shelter, the high velocities currents could impede these upstream migrations. Strong currents are particularly problematic for small fish, such as the catadromous mullet and eels that would migrate from the estuary to freshwater zones in the Swartkops River. This is because small, juvenile fish which have relatively limited swimming ability compared to large fish. Studies have shown (Bok *et al.* 2007) that freshwater mullet (*Myxus capensis*) of < 40mm in length are unable to swim against currents of over about 1.2 to 1.4 m/s.

4.1.9. Soil Conditions

The soil type is determined by the underlying alluvial sediment. Towards the north this tends to be more clayey whereas to the south, closer to the Swartkops River the conditions are more sandy. The maximum soil thickness of about 40cm was encountered though soil thickness was almost non-existent at times. In all areas the soil was not significantly distinct from the sub-soil layers.

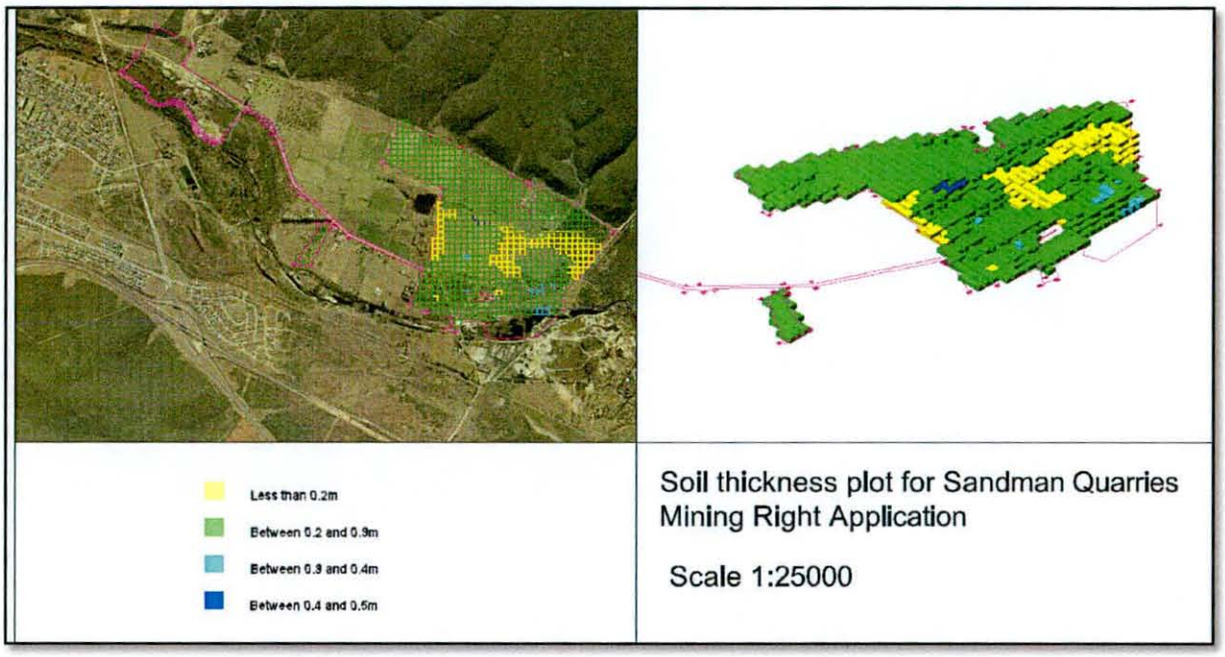

Figure 5: Plot over mining right application area of estimated top-soil depth.

5. GEOLOGICAL DESCRIPTION

The geomorphology is determined by the perennial Swartkops River System, which has significantly molded the terrain during cyclical fluvial events in the geological past.

The geological environment is dominated by weathered mudstone (residual clay) of the Cretaceous Uitenhage Group, to reveal soft malleable sub-soil conditions. The soft conditions have been eroded by palaeo flood events of the Swartkops River to reveal the very wide floodplain landscape in the area.

According to the 1:250 000 geological map (3324 Port Elizabeth) published by the Council for Geoscience the study area is underlain by undifferentiated fluvial terrace gravels with the Sundays River formation at depth throughout.

The fluvial terrace gravel has been deposited by the perennial Swartkops River and comprises clast-supported sub-rounded and well-rounded quartzitic sandstone boulders and gravel with a fine-grained sandy and clayey matrix. These clastic sediments are usually poorly sorted with clast types frequently determined by the availability of material from parent sources. These gravel deposits reflect changing sea-levels during quaternary and are occasionally cemented by lime, silica and iron oxide. Calcareous cover is also frequently associated with these deposits.

The overlying fluvial gravel and sand is the sought after material for the mining right application. The Sundays River formation underlying this formation will not be mined as the clays will reduce the quality of the final product.

5.1.1. Geology Revealed from Prospecting Undertaken

The prospecting was undertaken by excavation of 2.5m deep pits from which data was captured. This data revealed the following general geological data:

- The shallow material is formed from transported alluvial sediments
- The alluvial sediments are made up of fine grained sand, alluvial pebble beds and layers with higher clay percentage

The areas where higher clay percentages were found are on the Northern side of the prospecting area with the deposited material becoming finer grained and with lower clay fraction toward the south, which is closer to the Swartkops River.

The sandy areas are dominated by Sundays Doringveld vegetation cover. The fine sand tend vary from 2.2 to 2.5m thick, sometimes with inter-bedded pebble beds mostly consistent sand. In most areas pebble beds occur below circa 2.3m. The water table is found to the north at a depth of 2.2 to 2.4m and to the South it was not intersected at a depth of 2.5m.

6. SOCIO-ECONOMIC STATUS OF THE AREA

6.1.Demographic Data

The data from Census 2001 shows that the population for the ward in which the mining is proposed (ward 60 Nelson Mandela Bay Municipality) to be 12480 people. 37% of the population has some secondary education with 38% having completed matric. 14% of the population has a higher education.

7% Of households reported no income with 22% reporting an income of less than R19200 per annum (about R29 000 in 2008 value). 46% of the households had an income of greater than R76000 (about R120 000 in 2008 value). In South African terms this is upper middle class dominating ward.

7. MOTIVATION

Currently sand for the construction industry in the Nelson Mandela Bay Municipality is mainly sought from windblown sand reserves. These reserves tend to be formed from fine grain sand, less than 70µm. For larger construction projects and especially civil projects such as bridges, stadiums, road reinforcement, dams etc, where high strength of concrete is required (greater than 40MPa), a courser grain size for the sand is required. Currently this is sourced from the mines in the Perseverance, Dispatch and Uitenhage area, within the floodplain of the Swartkops River system. Despite the construction boom experienced prior to 2008 having subsided to a large extent, there are still large scale civil projects in the Nelson Mandela Bay Area, including Coega Industrial Development Zone and the soccer stadium.

Should the construction industry recover, driven by factors such as lower interest rates and lower inflationary pressures, then a shortage of quality building sand is expected. In addition, the Coega Industrial Development Zone is only in its infancy, and should the expected developments take place, then a source of quality sand close-by will be needed.
Some of the projects that will require higher strength concrete and thereby higher grade sand are:

1. Railroad infrastructure especially sidings.
2. Coega refinery
3. Breakwater infrastructure (ongoing)
4. Proposed metallurgical industry

Many of the projects will take some time to develop and as such strategically the allocation of resources required for such projects must be considered for the entire life of the development.

8. ASSESSMENT OF NATURE , DURATION , EXTENT , PROBABILITY AND SIGNIFICANCE OF THE IDENTIFIED ENVIRONMENTAL IMPACTS

8.1.Environmental Impact Assessment

8.1.1. Possible Direct Impact Categories

- Extraction of soil
- Removal of vegetation
- Change in height of landscape
- Loss of soil fertility
- Increase in soil erosion
- Reduction in agricultural potential (cultivation)
- Reduction in agricultural potential (grazing)
- Constraint of future land use options
- Loss of indigenous vegetation cover
- Loss of threatened species
- Increase in alien invasive species
- Loss of terrestrial habitat for fauna
- Loss of aquatic habitat for fauna (wetlands)
- Change of in stream flow conditions
- Pollution of water resources by hydrocarbons
- Pollution of surface water resources by poor sanitation or waste management
- Increase in turbidity of surface water features due to silt run-off
- Draw down of groundwater
- Airborne dust
- Creation of disturbing or excessive noise
- Loss of cultural heritage sites

- Loss of important paleontological sites

8.1.2. Possible Cumulative Impacts

- Impacts from multiple mining operations resulting in general degradation of floodplain of Swartkops River system
- Impacts on the migratory fish species in the Swartkops River system
- Increase in alien vegetation due to removal of indigenous vegetation and lack of management of invader species
- Increase in traffic on Eland Road

8.1.3. Positive Impacts

- Increased employment in the sector
- Sustainability of current operations
- Supply of raw materials to construction industry
- Revenue input into local economy

8.2. Risk Assessment Procedure

The risk assessment has been carried out in three manners; firstly the IAPS have been called upon to assessment the environmental and social risks of the project and to make comments. This allows for an observation of perceived risk to the IAPs as individuals as well as the environmental and community in general. Secondly a risk assessment process has been developed and carried out which addresses all impacts the quarry is expected to have from a professional assessment. This risk assessment uses a rating system and defines the most significant risks, in terms of extent, duration, severity and constancy. The process involves assessing primary risk without any mitigation and subsequently assessing the residual risk after mitigation measures have been implemented. This allows for identification of areas where

mitigation and management attention must be focussed. The third assessment means is to undertake specialist inputs where for sensitive environmental and social aspects.

8.3. Summary of Environmental & Social Risks

8.3.1. Risks highlighted through Own Risk Assessment

Soil Removal

Soil removal will be dealt with by pre-stripping of soil using a bulldozer and stockpiling of soil prior to mining of sand and gravels. Stockpiles must not be higher than 2m and soil should be used within 1 year of stripping.

Vegetation Removal (loss of cover)

Vegetation removal will be mitigated by seeding and planting of replaced soil. This will require the selection of species, which in this case should exclude *Cynodon Dactylon* grass to allow for other species to establish. Some species may require germination in seedling trays, in a nursery. Thus it is suggested that a nursery is established.

Lowering of Landscape

This is an unavoidable consequence of mining; however, it can be mitigated by filling with in situ material classes as unsuitable for processing. This will include all clay, which occurs predominantly close to the soil. In addition, slopes must be made gentle, by pushing in material from surrounding un-mined areas. This will lessen the visual impact and where clay is used to fill the excavation, this will form a good base for vegetation rehabilitation.

Loss of Indigenous and Threatened Species

Indigenous species loss can be mitigated by careful selection of mining areas, to exclude areas where significant accumulations of sensitive species occur. In addition, the nursery programme described previously should include indigenous species. Another important factor for ensuring survival of indigenous species is to ensure that alien species are eradicated and controlled.

Increase in Alien Vegetation

This can only be mitigated by an ongoing programme to eradicate the alien plant species. This should be done in combination with the mining rehabilitation schedules as mining of areas opens the opportunity to replant indigenous veld types once mining is competed and hence the alien vegetation stripped.

Nuisance Dust

Nuisance dust is expected to predominate from roadways used for haulage. This will be dealt with by using a water cart for areas close to residential areas.

Disturbing Noise

Noise will be managed by ensuring that production work within earshot of residential areas is limited to day time 7h00 to 18h00. Crushing and grinding operations will be kept at the current approved site to ensure that no changes occur.

Cumulative - Degradation of Flood Plain

Currently adjacent quarries exist, under other owners and managers which may result in cumulative impacts on the flood plain system. This impact can only be mitigated if each responsible person undertakes to play their part. Sandman Quarries in this case must ensure that the channel is maintained in the South

East corner, such that the river flow remains unaffected. River diversions may have to be undertaken at times to protect the river.

8.3.2. Risks Highlighted by Specialist Studies

The specialist study undertaken by Prof. Eileen Campbell highlighted the fact that the vegetation at Sandman Quarries largely consists of farm lands and secondary Acacia Thicket. The endemic vegetation on the site which is sensitive includes the Sundays Thicket, which occurs on the North Eastern corner of the mining right area. This area does not fall into any of the proposed mining blocks as it is associated with an area underlain by clay. This was made apparent during reconnaissance undertaken prior to the submission application for mining rights. The mining of clay does not form part of the mining right and as such the area is inherently protected from the impacts of the sand and gravel mining proposed.

The Department of Water Affairs & Forestry has undertaken a river flow dynamics assessment of the greater Swartkops River. In 2004 the Institute for Water Research has undertaken a similar study and a summation of the abovementioned studies can be seen in paragraph 18 : Specialist Studies on Swartkops River Flow Dynamics.

9. SUMMARY OF ENVIRONMENTAL IMPACTS

This process involves the assessment of nature, extent, duration, probability and significance of identified environmental, social and cultural impacts of the current mining operation. The methodology applied is to rate the probability, extent, duration, intensity and thereby significance of each impact, according to the table below:

Table 5: Risk assessment rating system

Category	Category	Rating	Description
Probability	Improbable	0	Less than 30% chance
Probability	Possible	1	30 to 50% chance
Probability	Probable	2	50 to 75% chance
Probability	Definite	3	Greater than 75% chance
Extent	Site only	1	Project site
Extent	Local	2	Effects surrounding suburbs
Extent	Municipal	3	Effects municipal area (NMMM)
Extent	Regional	4	Effects regional (Cacadu) area
Extent	National	5	Effects R.S.A.
Duration	Very short term	1	Less than 1 year
Duration	Short term	2	1 to 5 years
Duration	Medium term	3	5 to 20 years
Duration	Long term	4	Longer than 20 years
Duration	Permanent	5	Permanent
Intensity	Very low	1	No effect on natural, cultural or social conditions
Intensity	Low	2	Marginal effect on natural, cultural or social conditions
Severity	Medium	3	Modification of natural, cultural or social conditions
Severity	High	4	Temporary threat to existence of natural, cultural or social conditions
Severity	Very high	5	Permanent Threat to existence of natural, cultural or social conditions

This methodology has been applied to each aspect of the operation that may have an impact on the environment. Once the baseline risk has been determined an evaluation of the extent to which mitigation will reduce risk exposure is undertaken and the results shown.

9.1.Ecological Risk Assessment Process

9.1.1. Soils

It will be necessary to remove the soil to access the sand and gravel below for mining purposes. This can potentially leave areas barren with no soil, resulting in a general impact on the ecosystem. Other issues with soil relate to potential for loss of fertility and increased soil erosion potential.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Loss of soils	Definite 3	Site 1	Permanent 5	Very high 5	High 75	Temporary storage of topsoil for replacement after mining
Post mitigation	Definite 3	Site 1	Long term 4	Medium 2	Medium 24	

The mitigation measure involves the creation of top-soil stockpiles which will be used to temporarily store soil until mining is completed, after which these soils can be replaced. The effectiveness of this approach depends on the following factors:

1. The manner in which soil is stripped
    a. Mixing with sub-soils can result in fertility loss
    b. Stripping vegetation and soil together can preserve soil properties and reduce alien species post mining
2. The nature of the soil stockpiles
    a. Soil stockpiles must not be excessively high
3. The length of time the soil is stored
    a. Less time is better for preservation of soil fertility

Soil compaction is not a concern with regard to Sandman Quarries because of the low clay content due to the sandy nature of the soils.

9.1.2. Vegetation Impacts

The vegetation must be removed along with the soil prior to mining in order to access sand and gravel below soil. This can result in loss of indigenous flora, loss of threatened species and increase in alien invasive species.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Loss of vegetation	Definite 3	Site 1	Permanent 5	Moderate 3	Medium 45	Creation of pastures after mining
Post mitigation	Definite 3	Site 1	Medium term 2	Medium 2	Low 12	

All vegetation will be removed prior to mining, which will include removal of all alien vegetation. Vegetation will be pushed with soil, such that the stockpiling will result in death of alien species such as Jointed Cactus. After mining, areas which are not flooded will be soiled and vegetated with pasture grasses such that the farming operation can continue in those areas.

9.1.3. Surface Water Impacts

Surface water will be affected if run-off from the mining area is mixed with clean water off-site. This can impact on the clean water quality by hydrocarbon pollution, turbidity and silt load. These impacts could be as a result of poor control of hydrocarbons and erosion of exposed sub-soil.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Surface water quality	Definite 3	Local 2	Permanent 5	Medium 3	High 90	Contain all surface water within excavations to allow to seep into ground water
Post mitigation	Possible 1	Site 1	Very Short term 1	Medium 3	Low 6	

The mitigation measure for this impact involves separation of dirty and clean water systems. Dirty water from the mining area must be contained in pollution control facilities such as dams or containment berms and clean water must be directed away from mining area to avoid contamination with mine dirty water.

Oil, grease and fuel though not expected if machinery is maintained, must be controlled to prevent entry into any natural surface or ground water. Any accidental spills must be addressed through means of an emergency hydrocarbon spill plan.

9.1.4. Groundwater Impacts

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Ground water contamination	Probable 2	Local 2	Short term 2	Medium 3	Medium 24	Control of hazardous or polluting substances entering quarry area
Post mitigation	Possible 1	Site 1	Short term 2	Low 2	Low 4	

Ground water is unlikely to be severely affected by mining but prevention measures such as controlling fuels and oils on site and avoidance of any maintenance or use of chemicals on the mining site.

Drawdown is not seen as a significant mining impact because the shallow ground water is brackish and draw down of this ground water is not likely to result in a major environmental impact.

9.1.5. Aquatic Fauna

Aquatic fauna will be at risk if any significant changes are made to the stream channel of the Swartkops River. If primary channels and secondary channel flow rates change significantly this could affect the ability of migratory aquatic species to continue breeding and feeding in the river system.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Aquatic species	Possible 1	Regional 4	Medium term 3	Very high 5	High 60	Creation of berms against stream flow area
Post mitigation	Possible 1	Site 1	Medium term 3	Very high 5	Medium 15	

The impact on aquatic fauna will be mitigated by ensuring that no mining takes place with the bank full zone. This is the area in which the river runs during normal seasonal fluctuations. A berm will be placed to prevent mining affecting the bankfull zone and space for secondary channels for migratory fish species will be ensured.

9.2. Biodiversity Risk Assessment Process

Biodiversity will be adversely affected should any threatened indigenous species be removed in significant numbers. If one or more critical aspects or parts of an ecosystem cannot function, the biodiversity may be under threat, where only limited species can function.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Biodiversity	Possible 2	Local 2	Long term 4	Very high 5	High 80	Do not mine in areas with threatened species
Post mitigation	Unlikely 1	Site 1	Short term 2	Low 1	Low 2	

The mitigating factors here include the fact that all the areas underlain by sand and gravel deposits of significance are not over grown with vegetation types in which threatened species occur. Most areas with sandy soils are vegetated by either farm grazing land or by Sundays Doringveld, which is not threatened.

9.3.Airborne Dust Risk Assessment Process

Airborne dust is likely to be caused by the mining activities as well as vehicular traffic on the access roads. This may pose nuisance to local neighbours or may even pose health threat to persons living in close proximity to the mine.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Airborne dust	Definite 3	Local 2	Medium term 3	High 4	High 72	Wetting of roads and mining areas and monitoring
Post mitigation	Possible 2	Local 2	Medium term 3	Moderate 3	Medium 36	

Airborne dust can be minimised through road wetting and wetting the mining area during dusty conditions. It is likely that there will always be dust from this type of mining and as such mining will be done in such a way to disturb a minimum area and mining will be kept at a distance from any residential areas (>100m) to prevent long term exposure of residents to dust.

9.4.Visual Impacts Risk Assessment Process

Visual impacts will occur if the mining takes place within sight of neighbouring landowners or housing or suburban areas. In this case there will be a temporary visual impact during mining and a longer term impact of the excavation created after mining has ceased. A visual impact can result in reduced aesthetic appeal of an area, which impacts on the neighbouring communities' living standards or conditions.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Visual impact	Definite 3	Site 1	Permanent 5	Medium 3	Medium 45	Landscaping after mining has ceased
Post mitigation	Definite 3	Site 1	Short term 2	Medium 2	Low 12	

9.5.Noise Risk Assessment Process

Noise will be caused by the mining operation which may affect neighbouring land owners or communities. Excessive noise can disrupt sleep of inhabitants, faunal behaviour or purely create a nuisance disturbance to adjacent communities or landowners.

Activity and impact	Probability	Extent	Duration	Intensity	Significance	Mitigation measures
Nuisance noise	Probable 1	Local 2	Medium term 3	Low 1	Low 6	None
Post mitigation	Probable 1	Local 2	Medium term 3	Low 1	Low 6	

The effect of nuisance noise will be mitigated by the fact that no communities occur nearby the mining site.

10. COMPARATIVE ASSESSMENT OF DIFFERENT LAND USE OPTIONS

For the purpose of comparative assessment, mining of sands and gravel is compared to the current land use, which is grazing of cattle. This is because this is the most likely land-use if mining does not take place. For each assessment criteria mining and cattle farming are rated either best or worst, where 1 is best option and 2 is worst option. The option with the lowest rating is the most suitable option for the site.

Table 6: Comparison between mining and cattle farming

Assessment criteria	Mining	Cattle farming
Socio-economic impacts	1	2
Environmental impacts	2	1
Visual impact	2	1
Positive impacts for local community	1	2
Job creation potential	1	2
Support for other industry	1	2
Sustainability	2	1
Business risk	2	1
Market	1	2
Financial viability	1	2
Overall rating	**14**	**16**

Mining has the lowest rating according to the comparison table above, obviously both options have their advantages and disadvantages. The same owner will apply to both options, unless he decides to sell the land. If mining does not take place in the short term, the resource will always be in demand in times of construction, and thus interest will always be there for construction sand.

The competitors in the sand and gravel mining industry are listed below, with advantages and disadvantages for each business:

SANDMAN QUARRIES cc

1. Lafarge Mining SA
    a. Advantage - Close to city centre
    b. Advantage - Well established with access to capital
    c. Disadvantage - Plant at Perseverance quarry is in needs upgrading to suite local market for construction materials
2. Harbron Quarries
    a. Advantage - good quality sand
    b. Advantage – close to markets in Uitenhage
    c. Disadvantage – Far from Port Elizabeth and Coega markets
3. Glendore Sand
    a. Advantage – close to markets of Coega and Western suburbs of PE
    b. Disadvantage – Quality of sand not good enough for civil construction projects

11. APPROPRIATE MITIGATION MEASURES FOR EACH SIGNIFICANT ENVIRONMENTAL IMPACT

11.1.1. Soil Conservation Programme

Soil will be conserved through the following management interventions:

1. All topsoil to an expected depth of more than 250mm will be removed prior to mining by excavator
2. Stripped topsoil will be placed in berms of not more than 1.5m in height
3. The topsoil berms will be seeded with an easy growing indigenous grass seed such as *Cynodon Dactylon*, to prevent erosion and to preserve fertility of the soil.
4. Once mining is completed then soil will be excavated and placed on the sites
5. Placed soil must be immediately seeded, preferably with a mix of indigenous vegetation and using hydro-seeding techniques.

11.1.2. Surface Water

Surface water will be protected through the following management programme:

- A storm water berm must be created around the mining area to divert storm water away from the mining area.
- Water within the mining area must be channelled into a pollution control dam which in the case of this mining will take the form of the excavated pit of the mining area.
- Where water within the mining area needs to be released it must be released via a treatment facility which will take the form of a reed bed.

11.1.3. Indigenous Vegetation

Indigenous vegetation will be preserved by the following management programme:

- Vegetation which is stripped prior to mining will be placed with soil stockpiles such that seeds from this vegetation will be mixed with the soil
- A nursery for indigenous vegetation where necessary will be created to grow sensitive species
- Only indigenous species will be planted after mining
- Irrigation of rehabilitated areas will take place for a short period after seeding to ensure successful growth
- All alien invasive species will be removed and monitored during and after mining has ceased.

11.1.4. Airborne Dust

Airborne dust will be controlled through the following management programme:

- Water spraying will be done on a constant basis to ensure that roadways and mining areas do not produce excessive dust
- Work stoppage will take place on excessively windy days when neighbouring communities are at risk.

12. ENGAGEMENT OF INTERESTED & AFFECTED PARTIES

Below is the list of contacts for the scoping and environmental impact assessment process:

Contact list for public participation for Sandman Quarries :				
Mr. A. Greef	P.O. Box	61	Despatch	6219
Lafarge	P.O. Box	7123	Port Elizabeth	6055
New Era International	P.O. Box	427	Port Elizabeth	6000
Nelson Mandela Bay Municipality	P.O. Box	834	Port Elizabeth	6000
Mr. G.H.J. Olivier	P.O. Box	3090	Uitenhage	6230
Sharene Investments	P.O. Box	99	Swartkops	6210
Mr. L. Stander	P.O. Box	29	Despatch	6001
Mr. B. Turner	C/O	25 Amper Bo Street	Despatch	6219
Waagensdrift Property Trust	P.O. Box	313	Uitenhage	6230

The responses by the interested and affected parties are contained in **Error! Reference source not found.**.

The details of the comments are summarised below as well as the proposed mechanisms to deal with these concerns:

Table 7: Responses to concerns of interested and affected parties

Name of IAPS	Concerns raised	Response by Sandman Quarries
Mr. L Stander, Mr. Hattingh, Mr. Alberts	Disturbance relating to dust Chicken and pig farm sensitive to dust	Dust monitoring programme has been implemented adjacent to landowners property to assess dust currently as well as prevailing wind directions to enable risk assessment Note: That dust should not exceed levels currently produced by mine using current mitigation measures
Mr. L Stander, Mr. Hattingh, Mr. Alberts	Disturbance relating to noise Chicken and pig farm sensitive to dust	Perimeter noise monitoring has been undertaken to ambient levels of noise prior to commencement with mining Note: That noise should not exceed levels currently experienced as no more traffic will run on the road
Mr. L Stander, Mr. Hattingh, Mr. Alberts	Increase in traffic	No new traffic is planned to service the mining right in comparison with that currently undertaken with mining permit
Mr. L Stander, Mr. Hattingh, Mr. Alberts	Land value depreciation	No mining will take place in close proximity to houses for next 20 years. Should mining commence mining will stay 100m from the houses.
Mr. Meintjes	Temporary of landuse in accordance in LUPO	Agree to submit an application for temporary departure of land use with municipality NMBM in accordance with LUPO at time of submitting the EMP to the DME

13. KNOWLEDGE GAPS , ASSUMPTIONS & UNCERTAINTIES AND ADEQUACY OF PREDICTIVE METHODS FOR ENVIRONMENTAL IMPACT ASSESSMENT

The simplicity of the mining and the nature of the effected environment, means that little uncertainty is experienced in assessing environmental impacts. As far as possible an objective assessment has been done, with the interests of the client and the affected environmental and social conditions kept in mind.

14. ARRANGEMENTS FOR MONITORING AND MANAGEMENT OF ENVIRONMENTAL IMPACTS

No complex monitoring will be required for this mining operation to its simplicity however the following aspects should be checked on or monitored from time to time:

1. Effectiveness of storm water control measures which will involve checking that no "leaks" in the system occur, which could result in dirty water getting into the Swartkops River system.
2. Adequacy of stripping and stockpiling of topsoil, which will involve measuring the area stripped of topsoil against the volume of the stockpiles.
3. Undertaking dust measurements, which will involve a passive dust collection system placed at strategic points to ensure that dust does not affect nearby communities
4. Effectiveness of re-vegetation programme, which will involve checking that the variety of species which takes after mining is adequate in terms of species diversity
5. Elimination of alien invasive species, which will involve regular checking for growth of alien invasive species and then subsequent eradication.

Monitoring and performance assessment will be undertaken every two years by an independent consultant. This will include the following:

1. Mining progress against the mining plans submitted as part of the EMP
2. Progress on rehabilitation, which will involve the checking to see whether the planned rehabilitation for the mined out areas has been done according to the EMP
3. State of rehabilitation, which will involve checking that the rehabilitation programme is effective at achieving the objective of the EMP
4. Recommendations on improving rehabilitation techniques.

15. TECHNICAL AND SUPPORTING INFORMATION

See Annexures 17 + 18 for detailed Technical + Supporting Information

16. PLANS SHOWING MINING RIGHT AREA

17. SPECIALIST VEGETATION STUDIES

Department of Botany

Nelson Mandela Metropolitan University

for tomorrow

THE VEGETATION AND EXOTIC PROBLEM SPECIES OF THE SANDMAN QUARRY, DESPATCH.

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Report prepared for Algoa Consulting Mining Engineers

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Synopsis

- There are **three** vegetation units at the Sandman Quarry. Historically there was Albany Alluvial Vegetation and Sundays Thicket, but only 4 ha of **Sundays Thicket** remain. All the river banks are degraded and no intact **Albany Alluvial Vegetation** remains in the riparian zone.
- The Sandman Quarry has **13 exotic weeds** that are listed in the Conservation of Agricultural Resources Act 43 of 1983, amendment R280 of 2001:
    - **Nine category I weeds** were found that must be eradicated: *Acacia mearnsii* De Wild. (black wattle); *Cestrum laevigatum* Schlechtd. (inkberry); *Cirsium vulgare* (Savi) Ten.; *Datura ferox* L. (large thorn-apple); *Nicotiana glauca* Graham (wild tobacco); *Opuntia aurantiaca* Lindl. (jointed cactus); and *Opuntia ficus-indica* (L.) Mill. (prickly-pear) as well as *Eichhornia crassipes* (Mart.) Solms-Laub. (water hyacinth); and *Salvinia molesta* D.S. Mitchell in the river. Most individuals occur around the quarry fringes and along the roads, with the exception of *Opuntia aurantiaca* that is a serious invader over most of the property.
    - **Five category II invaders** must be controlled: *Acacia saligna* (Labill.) H.L.Wendl. (Port Jackson willow); *Agave sisalana* Perrine (sisal); *Eucalyptus camaldulensis* Dehnh. (red river gum); *Pinus pinaster* Ait. (cluster pine); and *Ricinus communis* L. (castor-oil plant).
- With the exception of the intact Sundays Thicket (4 ha), **indigenous plant diversity** is very low and no conservation-worthy plants were recorded. There is no realistic rehabilitation potential for any of the areas other than the river bed and banks. Rehabilitation efforts currently underway in the river bed should continue in accordance with the **The National Water Act 26 of 1998**.

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***This report should be referenced as**:*
Campbell, E.E. 2009. The vegetation and exotic problem species of the Sandman Quarry, Despatch. Report to Algoa Consulting Mining Engineers. Department of Botany, Nelson Mandela Metropolitan University, Port Elizabeth. 39 pp.

Terms of assessment

This report was commissioned with the aim of providing a list of exotic weed plant species as well as determining if there are any conservation-worthy plants found on the Sandman Quarry property north of Port Elizabeth (Fig. 1). Measures to be taken to remove, control or contain species as required by the Conservation of Agricultural Resources Act 43 of 1983 are also given. The entire Sandman Quarry property was assessed (Fig. 2) including the natural vegetation.

Method

The vegetation and exotic species of the Sandman Quarry were assessed using data from surveys done in March 2009. The conservation value of the vegetation was evaluated by considering the species composition of the intact, natural vegetation. For transformed or invaded areas, value is assessed in the form of realistic rehabilitation potential. The species composition was assessed using four components:

- Species richness (diversity);

  Species richness (number of species) is considered to be the fundamental component of conservation value (Given, 1994) as it is a measure of diversity in the absence of abundance data.

- Presence of threatened species;

  The World Conservation Union (IUCN) has developed Red Data Book categories based on the need for conservation of species of special concern. The categories are described as follows (IUCN, 2000):

  - Threatened species are critically endangered, endangered or vulnerable.
  - Critically Endangered species are considered to be facing an extremely high risk of extinction in the wild.
  - Endangered species are considered to be facing a very high risk of extinction.

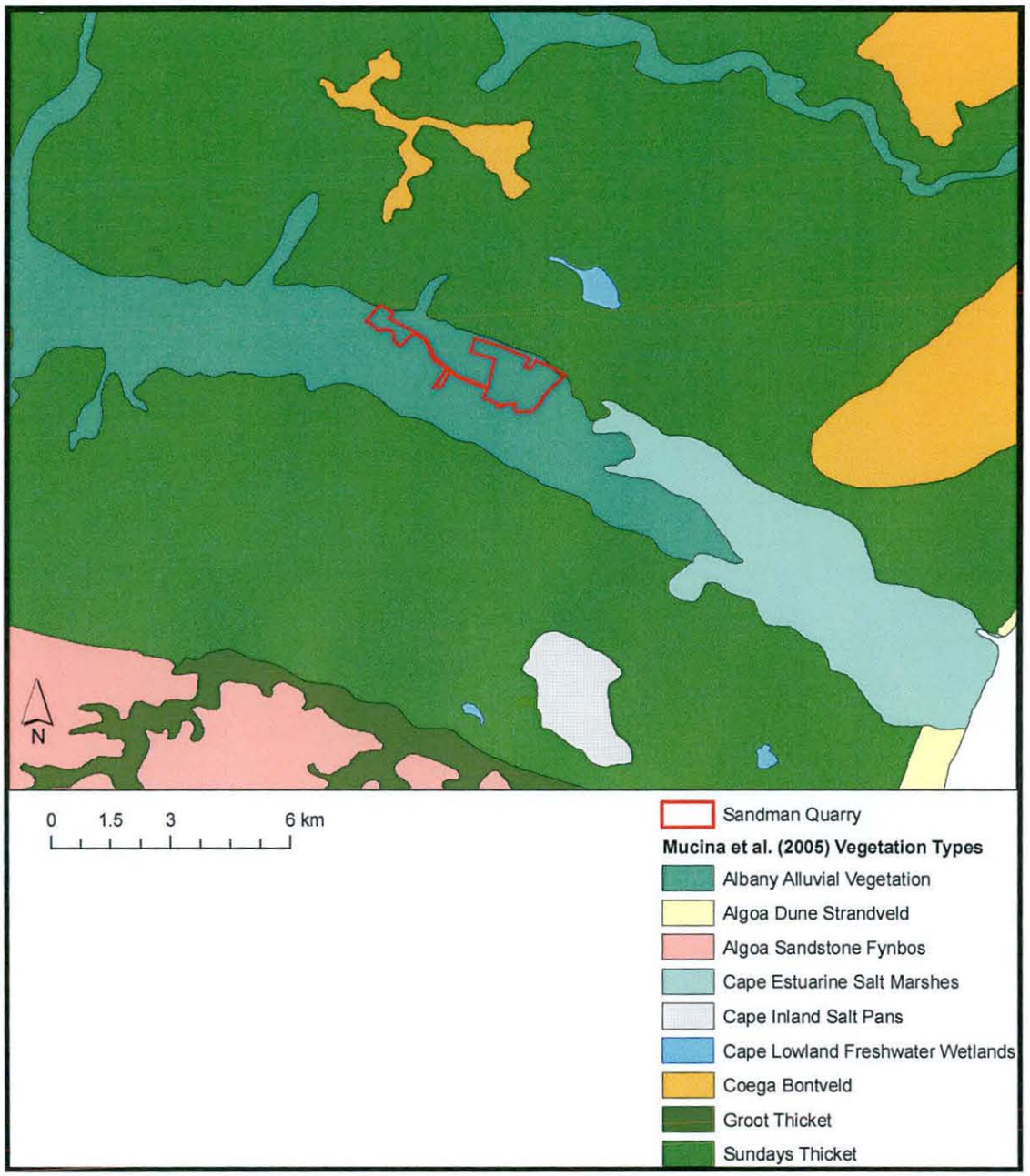

Figure 1. The locality of the Sandman Quarry north of Port Elizabeth overlain on a vegetation map of the area (Mucina *et al.*, 2005).

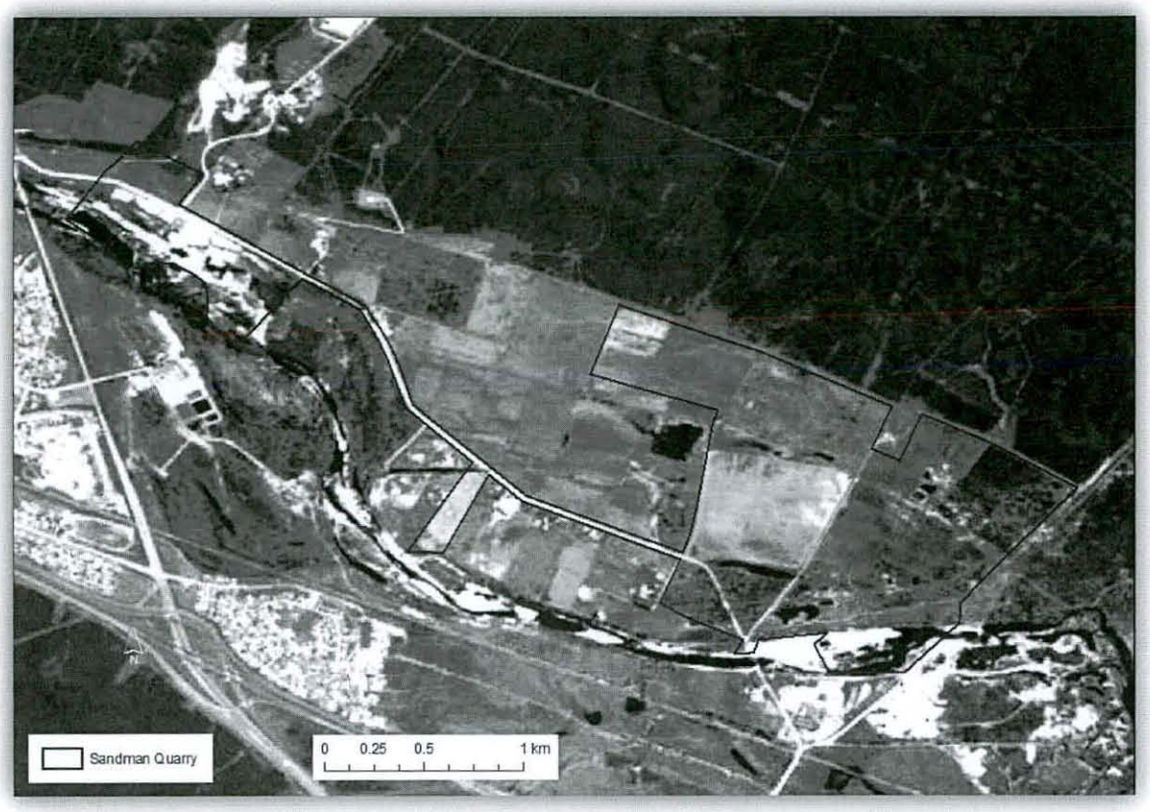

Figure 2. The Sandman Quarry study site north of Port Elizabeth.

- Vulnerable species are considered to be facing a high risk of extinction in the wild.
- Indeterminate species are known to be threatened but information needed to decide which of the four categories applies, is lacking.
- Near Threatened species have been evaluated against the criteria for Critically Endangered, Endangered or Vulnerable and found not to qualify at present, but are likely to qualify for a threatened category in the near future.
- Insufficiently known (uncertain) species possibly fall in one of the above categories, but this is uncertain because of lack of information.

The most recent Red Data list of southern African plants (SANBI, 2007) was used to asses the number of threatened species.

- Presence of rare species;

Rare species have small world populations, but are not at present Endangered or Vulnerable. They are at risk because some unexpected threat could easily cause a critical decline. The Red Data list of southern African plants (SANBI, 2007) contains an assessment of rarity.

- Presence of protected species.

  Protected species are species recognised by law as worthy of conservation. These include the Red Data list species, but also species considered to be worthy of protection because of economic, aesthetic or historical value. These species also contribute to the conservation value of the vegetation. The National Forests Act 84 of 1998, Schedule A and Eastern Cape Nature Conservation Act 13 of 2003 were used to assess protection status of species other than Red Data Book ones.

- The rehabilitation potential was assessed using three components:
- The degree of invasion by alien species;

  The presence of exotic species *per se* does little to decrease conservation value. However if these species are invasive, or are declared weeds, this strongly detracts from the conservation value of the vegetation. Declared weeds are taken from the Conservation of Agricultural Resources Act 43 of 1983 and amendments R280 of 2001.

- the diversity of indigenous floristic elements remaining; and
- the degree of modification of the physical environment.

  Dense stands of certain exotic invasive species alter the properties of the physical environment, predominantly the soil. This renders the area transformed to the extent that rehabilitation to a natural condition could only occur at unrealistically great expense. It is generally considered that moderately degraded Thicket does not rehabilitate at all.

1. Natural Vegetation

The vegetation of the Sandman Quarry historically consisted of Albany Alluvial Vegetation (Fig. 1). However, elsewhere this vegetation type appears to be an addition

of riparian species on the dominant vegetation of the area, which in this case, is Sundays Thicket.

1.1 Albany Alluvial Vegetation

Albany Alluvial Vegetation occurs on flood plains of the Eastern Cape (Mucina and Rutherford, 2006). The vegetation is generally surrounded by Albany Thicket, in this case Sundays Thicket. The climate matches the Vegetation Type in which it is embedded.

Albany Alluvial Vegetation consists of riverine thicket along narrow floodplain zones and becomes thornveld where the floodplains are wider (Mucina and Rutherford, 2006). Small trees form thickets on the deeper alluvial soils.

This Vegetation Type is considered **Endangered** (Rouget *et al.*, 2004) because it is **Poorly Protected** with only 6% formally protected while the target level of protection for the Vegetation Type is 31%. Little of this vegetation type is still available for achieving this target. Albany Alluvial Vegetation has a total area of 58 399 ha of which only 30 006 ha (or 51%) remains natural.

More than half of the area has been converted to cultivated lands, destroyed by urban expansion and plantations (Mucina and Rutherford, 2006). Alien invaders include *Acacia saligna* (Labill.) H.L.Wendl.; *Nerium oleander* L.; and *Eucalyptus* spp.

The National Water Act 26 of 1998 with General Authorisations published on 26 March 2004 prohibits damaging areas within 500 m of any wetland or water course and prohibits altering the bed or banks of such a water course. This Vegetation Type therefore receives the highest level of protection by law.

Endemic, dominant and important taxa of the Albany Alluvial Vegetation are listed in Appendix A.

1.2 Sundays Thicket

Sundays Thicket vegetation extends across the undulating plains and low mountains from Port Elizabeth northwards to the base of the Suurberg; Groot Winterhoek; and Klein Winterhoek Mountains at altitudes between 0 and 800 m a.s.l. Sundays Thicket receives non-seasonal rainfall ranging from 190 to 480 mm y^{-1}. The mean maximum