APPENDIX: F

Impact Assessment

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Reg no. 2017/311178/07
VAT No. 4020225811

IMPACT ASSESSMENT:

TOWNSHIP DEVELOPMENT, BLOEMSPRUIT PLOT 146, BLOEMFONTEIN, FREE STATE

May 2018

Applicant:

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1. Assessment methodology

The environmental significance assessment methodology is based on the following determination: Environmental Significance = Overall Consequence x Overall Likelihood.

1.1 Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: Severity/Intensity, Duration and Extent/Spatial Scale. Each factor is assigned a rating of 1 to 5, as described in the tables below.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment Table 1).

Table 1: Rating of severity

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place (Table 2).

Table 2: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Determination of Extent/Spatial Scale

Extent refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders) (Table 3).

Table 3: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4 (Table 4).

Table 4: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	Example 10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	Example 3.3

Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described and in Tables 5 and 6.

Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken (Table 5).

Table 5: Rating of frequency

Rating	Description
1: Low	Once a year or once / more during operation / LOM
2: Low-Medium	Once / more in 6 Months
3: Medium	Once / more a Month
4: Medium-High	Once / more a Week
5: High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment (Table 6).

Table 6: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2 (Table 7).

Table 7: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	Example 6
TOTAL LIKELIHOOD (Subtotal divided by 2)	Example 3

Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below (Table 8).

Table 8: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact (Table 9).

Table 9: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

Impact Assessment:

1. **Geology and soil**

The study area is located in the Ca22 Land Type and is underlain by sandstone shale and mudstone of the Beaufort Group, with dolerite intrusions (ENPAT, 2001).

The area is characterised by undifferentiated, upland duplex and/or margalitic soils.

It is not expected that the proposed project will have an impact on the geology of the area as the only excavations will include trenches for foundations and roads. However, the following impacts may occur on soil as a result of the construction and operational phase of the activity:

- Loss of topsoil during construction,
- A change in soil characteristics as a result of the disturbance of the soil,
- Contamination of soil due to spillage, leakage of sewer pipes and pollution.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	4	5	3	4	4	4	4	16
MITIGATED	2	2	1	1.67	2	4	3	5
Alternative 1 (Plot 147)	4	5	3	4	4	4	4	16
MITIGATED	2	2	1	1.67	2	4	3	5
Alternative 2 (Plot 148)	4	5	3	4	4	4	4	16
MITIGATED	2	2	1	1.67	2	4	3	5
Technological alternatives								
Preferred Alternative (Full Sewage System, Preferred)	4	4	3	3.67	4	5	4.5	16.5
MITIGATED	2	1	1	1.33	2	4	3	4
Alternative 1 (Conventional Septic Tanks)	4	4	4	4	4	5	4.5	18
MITIGATED	2	2	2	2	2	5	3.5	7
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	2	1	3	2	3	2	2.5	5

MITIGATED	1	1	1	1	1	5	3	3
Alternative 2 (Solar Power)	2	1	3	2	3	2	2.5	5
MITIGATED	1	1	1	1	1	5	3	3
Water supply								
Preferred Alternative (Municipal water supply).	3	3	2	2.7	3	5	4	10.7
MITIGATED	1	1	2	1.33	2	5	3.5	4.7
Alternative 1 (Boreholes).	3	3	2	2.7	3	5	4	10.7
MITIGATED	1	1	2	1.33	2	5	3.5	4.7

Although there are 3 different location alternatives it is proposed that the impacts on soil and geology will be the same for all alternative sites as they have the same footprint. However, it should be noted that Alternative site 1 (Plot 147) is in the process of being developed. Therefore the impacts already occurred on this site. It was determined from the impact assessment that the impact without mitigation on all sites will be Moderate – High. This will result in a definite loss in topsoil. If mitigation measures are implemented and topsoil is stored correctly and not used during construction the impact will be Low – Moderate.

The significance of impacts occurring on soil for the technological alternatives will be the same as electrical cables and water pipes will be buried below ground for all alternatives. In the event that the use of groundwater is considered there will be an additional impact on the geology as boreholes will have to be drilled. The significance of the electrical alternatives will be Low – Moderate before mitigation and Low with mitigation. The significance of the impacts for water supply will be Moderate before mitigation and Low after mitigation.

The impact assessment indicates that the impacts on soil if the preferred alternative is decided on will be Moderate – High before mitigation and Low after mitigation. However, the significance of the impacts of a septic tank system will be higher due to the risks of pollution associated with a septic tank system.

As a result of the planned future developments in the area it is expected that there will be a cumulative impact on soil if it is not managed correctly.

<u>Proposed Mitigation:</u>

- Topsoil will be removed before construction and stockpiled appropriately and in such a manner to prevent any loss thereof. Topsoil will not be used for any construction purposes and will only be used during the levelling of the site, in gardens and for landscaping after construction.
- Topsoil will then be used during the rehabilitation and construction of a storm water system for the site.

- Gravel and dolerite to be used during construction will be acquired from a commercial source. In the event that the applicant will mine the material on site a mining permit will have to be obtained before mining.
- Sewage pipes will be sealed appropriately during construction to prevent leakages. The sewer lines will be monitored and maintained constantly to ensure that there are no leaks. If any leaks are detected they will be reported and repaired immediately and contaminated soil will be removed and disposed of as hazardous waste. Sewer lines and pipes will be equipped with all necessary access holes to prevent blockages in the lines which may lead to overflowing.
- Construction equipment will be maintained and drip trays will be used to prevent spillages of petrochemical products which may cause contamination of soil. Any hazardous substances on the site will be stored in a bunded area which consists of an impermeable floor with walls which will have the capacity to contain 110% of the volume of the substance stored therein.

2. Climate

The Bloemfontein climate is largely characterised by a summer-rainfall area, with a mean annual rainfall of approximately 550mm and a mean annual evaporation of approximately 2 200mm. The mean annual temperature varies between 14°C to 16°C which indicates a warm temperature climatic regime. During the winter, temperatures can drop drastically with frequent frost occurrences (Mucina & Rutherford, 2006).

It is not expected that the proposed establishment of the residential area will have any impact on the climate in the area.

3. Land use

The site is currently vacant with no existing infrastructure. The only structures on the site consist of an old dilapidated building which was demolished.

The area is characterized by smallholdings with small agricultural activities and people residing on the smallholdings. There are some small businesses in the area. Furthermore, Plot 147 to the north of the proposed site is already in the process of being developed with residential units. The proposed smallholding and surrounding areas have been earmarked for future residential as indicated in the municipal IDP. This area is not located within a critically endangered or conservation area and also not in the Mangaung Open Spaces System (**MOSS**).

Potential impacts on the land use of the site:

- The land use and characteristics of the land will change from smallholding with larger open space to residential use.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	3	5	2	3.3	3	5	4	10.7
MITIGATED	2	5	2	3	1	5	3	9

Alternative 1 (Plot 147)	3	5	2	3.3	3	5	4	10.7
MITIGATED	2	5	2	3	1	5	3	9
Alternative 2 (Plot 148)	3	5	2	3.3	3	5	4	10.7
MITIGATED	2	5	2	3	1	5	3	9
Technological alternatives								
Preferred Alternative (Full Sewage System, Preferred)	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8
Alternative 1 (Conventional Septic Tanks)	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8
Alternative 2 (Solar Power)	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8
Water supply								
Preferred Alternative (Municipal water supply).	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8
Alternative 1 (Boreholes).	2	5	2	3	3	5	4	12
MITIGATED	2	2	1	1.7	2	5	3.5	5.8

All 3 site alternatives will have the same impact on the land use as all 3 sites are located in close proximity to each other. There will be a definite impact on the land use of the sites as they will be transformed from smallholdings to residential areas. The significance of the impacts will be Moderate if no mitigation is implemented. With mitigation the significance of the impact can be Low-Moderate.

The technology alternatives are associated with the transformation of the land and all technology alternatives will therefore have the same risks for the impact to occur on the land use. The significance of the impact will be Moderate before mitigation and Low-Moderate with mitigation measures being implemented.

Proposed mitigation:

- The area should be kept clean of littering and other pollutants during construction and operation phase to minimise littering on the surrounding environment. Refuse should be removed from the site regularly.
- Buildings should be constructed in a manner in which it is in line with the surrounding environment and should not cause unnecessary obstruction. Buildings, and the site, should also be maintained during operation as to not have a negative aesthetic impact.

4. Plant and Animal life

The vegetation in the area consists of Bloemfontein Dry Grassland (Gh 5). The vegetation type is currently listed as a Vulnerable (VU) vegetation type under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004). Landscape features of this vegetation type are dominated by flat to slightly undulating terrain dominated by grassland.

The site is in a degraded condition and the vegetation has been largely transformed due to previous land use activities. The natural vegetation on the site has been transformed to a large degree and is no longer considered a representative example of this vegetation type. The site is not located near any watercourse or other water body.

The site does not contain any wetlands, drainage lines or any other water related systems. The nearest significant watercourse is the Bloemspruit which is located approximately 1.2 km north of the site. According to the National Freshwater Ecosystems Priority Areas (NFEPA) there are also no wetlands, rivers or other water bodies near the site.

The site does not form part of an Important Bird Area (IBA) or a Strategic Water Source Area (SWSA). There are also no National Protected Areas Expansion Strategy (NPAES) Focus Areas near the site. The area around the site does not contain any formal or informal protected areas (Van Rensburg, 2016).

Potential impacts on vegetation and animals:

- Transformation of the land,
- Loss of 4.2ha of indigenous vegetation of the Bloemfontein Dry Grassland,
- The growth and spreading of alien plant species,

- Fires made on the site by employees may result in the loss of vegetation of the surrounding environment,
- Destruction of habitat and loss of animal life.

Refer to the Ecological Impact Assessment attached in Appendix D.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Alternative 1 (Plot 147)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Alternative 2 (Plot 148)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Technological alternatives								
Preferred Alternative (Full Sewage System, Preferred)	3	5	3	3.7	3	5	4	14.7
MITIGATED	2	1	1	1.3	2	5	3.5	4.7
Alternative 1 (Conventional Septic Tanks)	4	5	3	4	4	5	4.5	18
MITIGATED	3	2	3	2.7	2	5	3.5	9.3
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Alternative 2 (Solar Power)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Water supply								
Preferred Alternative (Municipal water supply).	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7

Alternative 1 (Boreholes).	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7

Due to all 3 sites having the same environmental features and footprints the significance of the impacts on vegetation and animal life will be the same for all 3. However, Alternative site 1 (i.e. Plot 147) is already being developed and the impacts are already occurring on the site. There will be a definite impact on vegetation and animal life (if any) as the site will be transformed and indigenous vegetation of the Bloemfontein Dry Grassland will be removed during the construction phase. However, as indicated by Mr. Van Rensburg in the ecological report the vegetation on the site has been largely transformed as the area has been degraded. Taking into consideration that the vegetation on the site will be removed the significance of the impacts will be Moderate-High without mitigation and Low-Moderate with the implementation of mitigation measures. The site will be revegetated during construction in the form of gardens and some small open spaces.

The technology alternatives are associated with the development and these alternatives will not have less or more of an impact on the vegetation. However, as evident from the impact assessment above the use of a septic tank may cause contamination of soil and water which will have a negative impact on vegetation and animal life therefore, the significance of the impacts occurring with the implementation of this alternative will be higher.

Proposed mitigation:

- No animals will be harmed and/or killed on the site. If any animals are encountered they will be relocated from the site.
- No endangered or protected plant species (if any) will be harmed and/or removed on the site. If any such plants are encountered they will be transplanted from the site to areas which will not be disturbed.
- Vegetation will not be removed from areas where construction will not occur (if any).
- Alien plant species will be removed before seeding to prevent the spread of these plants to the surrounding environment. Alien vegetation should be controlled throughout the lifetime of the project.
- Open fires will not be permitted on the site.

5. Surface Water

There are no surface water features located near the proposed development. The nearest surface water feature to the site is the Bloemspruit which is located approximately 1.2km north of the site. It is therefore not anticipated that the proposed project will have a significant impact on surface water features is mitigation measures are implemented and maintained.

Potential impacts which might occur on surface water:

- Storm water may become contaminated because of spillages and mismanagement of petrochemical substances during construction and sewage leakages during the operational phase.
- The proposed development may affect the quantity of water draining to the surface water resources due to the buildings and structures acting as obstructions for the flow of water.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	3	3	3	3	4	5	4.5	13.5
MITIGATED	2	2	2	2	2	5	3.5	7
Alternative 1 (Plot 147**)**	3	3	3	3	4	5	4.5	13.5
MITIGATED	2	2	2	2	2	5	3.5	7
Alternative 2 (Plot 148**)**	3	3	3	3	4	5	4.5	13.5
MITIGATED	2	2	2	2	2	5	3.5	7
Technological alternatives								
Preferred Alternative (Full Sewage System, Preferred)	3	3	3	3	3	5	4	12
MITIGATED	2	2	1	1.7	1	5	3	5
Alternative 1 (Conventional Septic Tanks)	4	3	3	3.3	4	5	4.5	15
MITIGATED	2	2	2	2	2	5	3.5	7
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	3	3	3	3	4	5	4.5	13.5
MITIGATED	2	2	2	2	2	5	3.5	7
Alternative 2 (Solar Power)	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Water supply								
Preferred Alternative (Municipal water supply).	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7
Alternative 1 (Boreholes).	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7

Due to the similarities in all 3 site alternatives the significance of the impacts on all 3 sites will be the same. None of these sites has steep slopes and the topography on all 3 sites are flat.

During the construction phase of the proposed project there might be some impacts on surface water as drainage of water might be blocked by trenches and/or berms. Furthermore, there will be machinery and vehicles on site which may result in leakages of petrochemical substances which may contaminate storm water. Sewage may also contribute to contamination of storm water. During the operational phase the infrastructure will be completed and will result in storm water being blocked and not being allowed to drain naturally into the surrounding environment. The significance of the impacts on surface water will be Moderate if no mitigation measures are implemented and Low-Moderate with the implementation of mitigation measures.

The connection of the sewer lines to the municipal services will have a lower risk for impacts occurring than a septic tank as septic tanks are prone to spillage if not managed correctly.

It is not expected that the significance of impacts because of municipal and solar electricity will differ. However, this is if solar panels are constructed on roofs and not on the ground where it will block storm water. This is also true for the water supply alternatives as all pipes will be placed underground.

There will be a cumulative impact on surface water because of more developments in the area.
Proposed mitigation:

- Sewer lines will be maintained throughout the lifetime of the project to prevent sewage from leaking.
- An adequate storm water management system will be implemented during construction to accommodate runoff during rain events as well as to divert the water around the development to the surrounding drainage basins. Storm water management systems will be maintained, repaired and cleaned regularly to ensure its functionality and to prevent impacts from occurring on downstream surface water resources.
- Once construction is completed, all open natural slopes must be re-vegetated to prevent soil erosion from occurring which might lead to siltation of surface water resources. It is very important to barricade areas which will remain private open spaces and not to disturb these areas during construction as the vegetation on these areas will lower the runoff velocity of surface water.
- Any hazardous substances permanently stored on site will be stored in a bunded area with a capacity to contain 110% of the volume of the substance. The bunded area will have a controlled outlet from which rain water collected therein can be drained and managed as hazardous waste.
- Spillages of hazardous substances will be cleaned by removing the spill and contaminated soil and disposing of it as hazardous waste.
- The site will be kept clean and tidy to prevent general waste and littering from occurring in the surrounding surface water resources.
- Any incidents on surface water resources during construction will be reported to the relevant authorities within 24 hours of the incident.

6. Groundwater

The MMM is not currently utilizing groundwater as a primary water supply resource for the supply of potable water to Bloemfontein. Groundwater is only used by individuals for irrigation of gardens and residential areas as well as small industries and micro irrigation for nurseries and garden centres. Groundwater is only used for agriculture towards the south-western areas (i.e. Bainsvlei & Kalkveld).

The Bloemfontein area is located in a minor aquifer region which is a moderately-yielding aquifer system of variable water quality (DWA, 2013). The proposed activity will connect to the existing water supply line of the municipality and will not use groundwater. The activity will therefore not have any impact on the quantity of groundwater. It is anticipated that if the development will have an impact on the environment, it will be low with the right mitigation measures.

It should be noted that the applicant will not use groundwater during construction or during the operational phase of the activity. In the event that groundwater will be used at any stage of the project a Water Use License should be applied for with DWS and the water use should be authorised by the authority before commencement thereof.

Potential impacts on groundwater:

- Contamination as a result of spillages of hazardous substances and leaking sewer pipes.
- Incorrect storage of waste products on the site may result in the contamination of the groundwater.
- Although it is not foreseen to occur there will be an impact on the groundwater quantity if groundwater is abstracted for the development.
- The development of the township will induce surface runoff and therefore reduce infiltration. Lower infiltration will lead to lower groundwater recharge.
- Deep excavation on the site may extend beyond the water table which will result in an impact on groundwater. However, it is not expected that this impact will occur as Bloemfontein is not known for very shallow aquifers.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	3	3	3	3	3	5	4	12
MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 1 (Plot 147)	3	3	3	3	3	5	4	12
MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 2 (Plot 148)	3	3	3	3	3	5	4	12
MITIGATED	2	1	1	1.3	1	5	3	4
Technological alternatives								
Preferred Alternative (Full Sewage System,	3	3	3	3	3	5	4	12

Preferred)								
MITIGATED	2	2	1	1.7	1	5	3	5
Alternative 1 (Conventional Septic Tanks)	4	3	3	3.3	4	5	4.5	15
MITIGATED	2	2	2	2	2	5	3.5	7
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	No Impact							
MITIGATED								
Alternative 2 (Solar Power)	No Impact							
MITIGATED								
Water supply								
Preferred Alternative (Municipal water supply).	2	3	2	2.3	2	5	3.5	8.2
MITIGATED	1	2	1	1.3	1	5	3.5	4
Alternative 1 (Boreholes).	3	5	2	3.3	4	5	4.5	15
MITIGATED	2	3	1	2	2	5	3.5	7

The impacts that might occur on all 3 site alternatives will occur as a result of contamination of groundwater from spillages and mismanagement of hydrocarbons and potentially hazardous substances. However, the impact will be the same on all 3 sites as all 3 sites have the same footprint and the activities which will occur on the sites are the same. Due to the volumes of potentially hazardous substances being used on the sites it is not expected that there is a risk of serious contamination of groundwater. The proposed project will impact infiltration of water and thus the recharge of groundwater as the concrete structures and infrastructure will result in a greater runoff velocity of surface water from the site and less time for water to seep. The significance of the impacts will be Moderate before mitigation and low with the implementation of mitigation measures.

The only impacts that may occur with the technology alternatives will occur from the sewer system and the water supply. It was determined from the impact assessment that the risk of impacts occurring when using a septic tank system is much higher than connecting to municipal sewer system. However, there is a risk for contamination of groundwater for both alternatives as leaking sewer pipes will cause contamination. The abstraction of groundwater as main water supply to the development will have a greater impact on the groundwater quantity than connecting to the municipal line as the main water supply for Bloemfontein comes from surface water resources. However, it should be considered that the water supply to residents of Bloemfontein will remain the same if the population of the city does not increase.

The cumulative impact of this development will depend on the groundwater depth. There might be certain areas where the water table is shallower than other areas to allow the infiltration of pollution to the groundwater. Proposed mitigation:

- The impact will be low with proper engineering and maintenance and management of the sewage systems. Sewer systems should be inspected and cleaned regularly for any faults and leaks to prevent sewage contaminating the groundwater.
- Vegetation should be protected on areas to be used as private open space to allow for water to recharge the groundwater.
- Spillages of any potentially hazardous substances should be cleaned by removing the spill and the contaminated soil and disposing thereof as hazardous waste.
- Potentially hazardous substances will be stored on an impermeable surface inside a bunded area to prevent seepage of the substance and pollution of the groundwater.

7. Air quality and Noise

The Bloemfontein area, especially the northern suburbs are known for clean air because of a lack of major industrial facilities. Although the Bloemfontein industrial area is located close to the proposed site it is not regarded as an area with very high emissions. It should also be noted that there are no major contributors to atmospheric emissions in the Bloemfontein area as there are no power stations, etc.

The proposed site is in an open area where there are currently very little activities which has a negative impact on air quality apart from some areas where residential areas have been constructed. However, apart from additional emissions from vehicles, dust during construction and occasional fires there will not be any major contributors to atmospheric emissions because of the proposed development.

Activities associated with the Bloemspruit area is residential units, smallholdings, businesses and small industrial activities. An increase of housing and associated infrastructure in the area will increase traffic in the area which will elevate the noise levels.

Potential impacts on air quality and noise:

- During the construction phase there will be an impact on the air quality as a result of dust emissions from clearance of vegetation, construction activities and movement of machinery and vehicle movement on site. The construction activities will also have an impact on the ambient noise in the area.
- The burning of waste product, especially plastic will have an impact on the air quality.
- During the operational phase the impact on dust emissions should be very low. However, the noise levels will be elevated due to additional vehicles in the area.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	3	3	3	3	3	5	4	12
MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 1 (Plot 147)	3	3	3	3	3	5	4	12

MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 2 (Plot 148)	3	3	3	3	3	5	4	12
MITIGATED	2	1	1	1.3	1	5	3	4
Technological alternatives								
Preferred Alternative (Full Sewage System, Preferred)	No Impact							
MITIGATED								
Alternative 1 (Conventional Septic Tanks)	No Impact							
MITIGATED								
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	No Impact							
MITIGATED								
Alternative 2 (Solar Power)	No Impact							
MITIGATED								
Water supply								
Preferred Alternative (Municipal water supply).	No Impact							
MITIGATED								
Alternative 1 (Boreholes).	No Impact							
MITIGATED								

There will be a daily increase in emissions and dust to the atmosphere during construction on all 3 alternative sites. All the site alternatives will have an impact on the atmosphere and all sites will elevate noise levels during construction. There are no other developments or activities in the area responsible for elevated noise levels. The population in and around Bloemfontein is expanding and therefore it is necessary for the development as the town and residents may require such an expansion for residential living spaces. The overall impact of the location alternatives will be Moderate before mitigation. With the relevant mitigation the effect will be Low.

The technology alternatives are associated with the proposed project and will not have any additional impacts on noise and air quality.

The cumulative impacts will rise as more developments take place in the area as most surrounding areas are earmarked for future development.

Proposed mitigation:

- Dust suppression should be implemented on the site to reduce emissions of dust from the site, especially after the clearance of vegetation from the site.
- Construction activities, especially activities contributing to dust emissions should be avoided during windy conditions.
- Construction vehicles and machinery will be equipped with the necessary silencers to reduce noise levels during construction. Vehicles and equipment will also be serviced and maintained to reduce emissions to the atmosphere.
- Vehicles movement and speeds at which vehicles travel on the site will be kept to a minimum.
- Waste will not be burned on site and open fires during construction will not be permitted.
- Construction activities contributing to elevated noise levels will be restricted to normal working hours.

8. Archaeological and Cultural Resources

Dr. Lloyd Rossouw indicated that the potential archaeological impact on the site is considered to be non-existent with regard to in-sito Stone Age remains, graves and graveyards or structures of historical significance. It was also indicated that the probability of palaeontological impact on superficial sediments at the proposed site is regarded as improbable as the palaeontologically significant rocks is buffered by a well-developed superficial overburden. However, Dr. Rossouw advised that any excavations into fresh bedrock exceeding more than 1m depths and 1000m^2 surface areas will require palaeontological monitoring for the duration of the activity.

Potential impacts on archaeological and paleontological resources:

- Unearthing and destruction of palaeontological significant artefacts/fossils.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	4	3	3	3.3	3	5	4	13.3
MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 1 (Plot 147)	4	3	3	3.3	3	5	4	13.3
MITIGATED	2	1	1	1.3	1	5	3	4
Alternative 2 (Plot 148)	3	5	3	3.7	4	5	4.5	16.5
MITIGATED	3	5	3	3.7	4	5	4.5	16.5
Technological alternatives								
Preferred	No additional Impact							

Alternative (Full Sewage System, Preferred)								
MITIGATED								
Alternative 1 (Conventional Septic Tanks)	No additional Impact							
MITIGATED								
Electrical facilities & services								
Preferred Alternative (Municipal Electricity, Preferred)	No additional Impact							
MITIGATED								
Alternative 2 (Solar Power)	No additional Impact							
MITIGATED								
Water supply								
Preferred Alternative (Municipal water supply).	No additional Impact							
MITIGATED								
Alternative 1 (Boreholes).	No additional Impact							
MITIGATED								

As all 3 alternative sites in terms of location is located on the same bedrock the significance of the impacts which may occur will be the same in terms of palaeontology being unearthed and destroyed. It should be mentioned that there are structures on Plot 148 which might be older than 60 years. Should this location be decided on the structures will have to be demolished for the proposed development to occur. This will require a permit from SAHRA. The significance of impacts occurring on the preferred location and alternative 1 will be Moderate without mitigation and Low with mitigation. However, as a result of the structures which will be demolished on location alternative 2 (i.e. Plot 148) the significance of the impacts will be Moderate-High with and without mitigation as the structures will be demolished and removed.

Proposed mitigation:

- If any items of archaeological significance be unearthed a heritage specialist will be contacted to investigate and the SAHRA will be notified.
- Any excavations into fresh bedrock exceeding more than 1m depths and 1000m2 surface areas will require palaeontological monitoring for the duration of the activity.

9. Visual exposure (Aesthetic impact)

The proposed development is planned in an area with smallholdings. The site is currently vacant. Although the proposed site is in an open area with smallholdings the use of the land is future development as indicated in the municipal IDP and some of the smallholdings have been transformed and/or in the process of being developed.

The proposed development will be visible by most of the surrounding residents and road users of the access roads.

Potential aesthetic impact:

- The land use of the site will change from vacant to residential and the natural area will be transformed to a residential development.
- The construction phase of the project will have a negative aesthetic impact on the surrounding land users as it will involve construction activities.
- The mismanagement of waste and the improper construction of infrastructure may lead to a negative visual impact on the surrounding land and road users.

Alternatives	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Site Alternative								
Preferred Alternative (Plot 146)	2	3	2	2.33	4	5	4.5	10.5
MITIGATED	1	2	1	1.33	2	3	2.5	3.33
Alternative 1 (Plot 147**)**	2	3	2	2.33	4	5	4.5	10.5
MITIGATED	1	2	1	1.33	2	3	2.5	3.33
Alternative 2 (Plot 148**)**	2	3	2	2.33	4	5	4.5	10.5
MITIGATED	1	2	1	1.33	2	3	2.5	3.33
Technological alternatives								
Alternative 2 (Full Sewage System, Preferred)	No Impact							
MITIGATED	No Impact							
Alternative 3 (Conventional Septic Tanks)	No Impact							
MITIGATED	No Impact							
Electrical facilities & services								
Alternative 4 (Municipal Electricity,	2	3	2	2.33	2	3	2.5	5.83

Preferred)								
MITIGATED	1	1	2	1.33	1	1	1	1.33
Alternative 5 (Solar Power)	2	3	3	2.67	3	4	3.5	9.33
MITIGATED	1	2	1	1.33	1	3	2	2.67
Water supply								
Preferred Alternative (Municipal water supply).	No Impact							
MITIGATED								
Alternative 1 (Boreholes).	No Impact							
MITIGATED								

All the site alternatives will have a negative aesthetic impact on the surrounding. Due to the attributes of all 3 alternatives being the same and the close proximity to one another the will not be any additional impacts associated with one site over another. The aesthetic impact at all the sites will be Moderate and can be reduced to a Low impact rating if the correct mitigation and management measures are implemented.

As the water and sewer lines will be buried in trenches they will not have any impact on the aesthetics in the area. Furthermore, the electrical cables will also be buried. However, although the aesthetic impact will be Low if solar panels are used it will still have a larger negative aesthetic impact as it will be visible from adjacent properties and roads. This will have a more industrial look in relation to "clean" roofs.

The project will have a cumulative impact on the visual aesthetic as the area is earmarked for future residential and more development will occur in the area.

Proposed mitigation:

- Buildings should be monitored throughout the project and maintenance (i.e. painting, fixing trimmings, gardens, etc.) should be done regularly to prevent the site from having a negative aesthetic impact.
- The site should be cleaned of any waste regularly to minimise the negative visual impact.
- Indigenous trees can be incorporated in the development to soften the visual impact of the site.

10. Demographics and Regional socio-economic structure

According to the reviewed integrated development plan 2016 – 17, about 50 000 people relocated from Botshabelo to Bloemfontein between 2007 to 2011. As a result of this, Bloemfontein now houses almost two thirds of the entire Mangaung Population. During the timeframe of 2001 to 2012, the unemployment rate of Mangaung grew from 69 536 to 73 877 which represents an increase of 6.2% in the unemployment range. During the same timeframe illiteracy and no schooling decreased from 10, 1% in 1996 to 4, 3% in 2011. People with matric have increased from 18, 7% to 30.1% in 2011 (MMM, 2016).

Design, construction, operation and recycling initiatives of the development may generate new job opportunities in most job sectors.

The development will have a positive impact on the socio-economics of the area. Direct and indirect jobs will be created during the construction phase. These jobs will include the building of the structures and infrastructure. Indirect jobs include the small businesses in the area which will provide building material to the applicant. Furthermore, more people in the area during the operational phase will result in more people to support local businesses in the immediate area. A comment was made that an increase of people to the area will increase property value and will improve safety

CONCLUSION AND MOTIVATION FOR PROPOSED ALTERNATIVES

The proposed township development on plot 146, Bloemspruit, Bloemspruit Agricultural plots, Bloemfontein

The development of 80 single residential erven and 1 open space on plot 146. The total size of the development will be 4.2ha. It will include all associated municipal services such as electricity, water and sewage, on the condition that approval is obtained from Mangaung Metro Municipality.
All possible alternatives were identified and assessed. The preferred site was decided on based on certain factors:

- All variables like current property owners, geology, surface and groundwater, air quality, plant & animal life, archaeological and cultural significance and visual exposure were taken into account during the assessment process.
- Lowest clearance of vegetation if possible.
- Proposed development will create job opportunities during the construction period with future jobs becoming available once the project is completed.
- Residential development will provide housing to more people in the area.
- Development will have a positive contribution towards the socio-economic and economic spheres of MMM.

Although the impact assessment revealed that the likelihood of the impacts on the site alternatives is also very low when compared to the preferred site, it should be understood that the preferred site (Plot 146) has certain attributes which make it the better alternative for development.

The preferred site is located on land owned by the applicant of the project. Alternative Site 1 (i.e. Plot 147) is also the property of the applicant. Environmental Authorisation was already issued for this property and construction of a residential development commenced on the property. However, the applicant identified the need for more housing in the area and therefore decided to develop on another property to increase the number of houses.

Site alternative 2 (Plot 148) is not the property of the applicant. In the event that this alternative is considered the property would have to be purchased by the applicant to develop. There are no guarantees that the current owner of the property will be willing to sell the property and if so the project might not be economically feasible for the applicant. Furthermore, as discussed in the impact assessment, there are structures on Plot 148 which will have to be demolished for the construction to commence. Apart from the additional demolition costs and the construction solid waste arising from this the structures might be older than 60 years and will require a permit from SAHRA to be demolished. Although the impact will not be significant as the structures are not considered to have a significant heritage value it would still contribute to the loss of heritage artefacts.

The ecological study done by Mr. Darius van Rensburg also indicated that the ecological value of the preferred site is low as the vegetation does not represent that of the Bloemfontein Dry Grassland and is very degraded.

Based on the above findings the preferred site (Plot 146) should be considered for development.

Technological alternatives

It was determined that the preferred technological alternatives should be implemented based on the following:

Electricity

Although solar power has a lower carbon footprint as coal is not burned to generate the electricity the capital cost of installing such an energy supply is very expensive on a site of this size. Solar electricity also requires high maintenance which will also be costly. The applicant intends to develop in this area in order to provide housing for lower income groups. The implementation of solar power and the maintenance costs associated with it will result in the cost of the housing being elevated which could potentially make it unfeasible.

The proposed residential units will be sold individually and the owners of each unit would therefore have to be responsible for the upkeep and maintenance of the solar units and infrastructure on their property. Solar panels can also potentially contribute to a higher aesthetic impact on adjacent landowners and road users as it has a more industrial look.

Sewerage

An alternative to connecting the sewer system to that of the municipality was to construct a septic tank system. Due to the size of the development and the number of residents to reside in it the risk of the impacts associated with it occurring is however very high. A very large septic tank will have to be installed to manage the sewage from the units.

No construction will be allowed on top of the septic tank as this poses a safety risk and the septic tank will have to be accessible. Septic tanks require constant care and maintenance and are prone to producing foul smelling odours. A leak in the septic tank will result in the contamination of ground and surface water.

Water supply

An alternative to connecting to the municipal water supply is to drill boreholes and abstract and use groundwater. However, the drilling of boreholes and the abstraction of enough water to provide for all the needs of the residents of the development will result in high volumes of electricity being used which is very costly. Furthermore, it cannot be guaranteed that the groundwater aquifer can produce the volume of water needed to provide all the residents with water in a sustainable manner. Groundwater is mainly used as back-up water in the Bloemfontein area and for the watering of gardens and small agricultural activities. The area is not known for intense irrigation with groundwater.

Based on the above findings it is proposed that the preferred alternatives be implemented for the project.

Impacts associated with the proposed project as indicated in the Impact Assessment:

The likelihood of the expected impacts actually occurring will be small and limited if all the recommended mitigation measures are implemented throughout all the phases of the project.

Impacts associated with the Construction Phase will be temporary of nature and local if all mitigation measures are implemented. If the area is properly levelled, storm water is diverted around the site and all potentially hazardous substances are managed appropriately, the likelihood of the potential impacts actually occurring will be low.

In conclusion, if all the recommended measures are implemented, the significance of the impacts expected to be associated with the proposed buildings will be low.

Discussion on the 'no-go' alternatives:

No environmental impact will occur if the no-go alternative is decided on. The opportunity to provide good housing in the area will be lost. In addition, temporary employment opportunities that will be associated with the construction phase will be lost.

After consideration of the Impact Assessment the following conclusions are drawn:

Proposed site:
The vegetation on the site is in a degraded condition and has been largely transformed due to previous activities on the property. Should all the mitigation factors be implemented the environmental impact will be low. A municipal connection to sewage and water would be more economic advantages to the development then septic tanks but the municipality must approve the connection.

The following assessments were done for this proposed development and will be attached in Appendix J:

1. A Water and Sewer Infrastructure Capacity Analysis Request from Mangaung Metro Municipality
2. Exemption of a Phase 1 Archaeological Impact Assessment
3. Floristic and Ecological assessment
4. Electricity supply and network services report
5. Geotechnical report
6. Phase 1 Palaeontological Impact Assessment
7. Civil Services report
8. Traffic Impact Statement

These assessments provided the means to reaching the following conclusions pertaining to infrastructure for the proposed development on Plot 146, Bloemspruit, Bloemfontein, Free State:

Sanitation – a 150mm pipeline will connect with a sewer main in Nassau Street and will have enough capacity as stated above.
Water – A 110mm water connection be installed from the existing 350mm municipal water main in Voorspoed Street which has enough pressure.
Roads – The development will generate approximately 66 trips in the morning and afternoon peak times. This additional traffic would not unacceptably raise the traffic congestion at the inspected intersections.
Storm water – The runoff generated from the proposed development will drain into and along

Voorspoed Street and then into and along Nassau Street via a proposed open storm water channel next to the streets and lastly drain into the Bloemspruit stream via an existing natural channel north of the Bloemspruit area.
Electricity - The development will require a 500kVA 11kV/400V miniature substation within the registered servitude and a 185 Al 11kV PLTC underground cable from the North Eastern corner of Plot 146 to the miniature substation and another 185 Al 11kV PLTC underground cable from the miniature substation to the South Western corner of Plot 146. Upon completion of installing the miniature substation and underground cables; CENTLEC shall conduct an inspection and the installed services shall be taken over by CENTLEC.

The following mitigation measures should be taken into account:

- That the site must be levelled and all vegetation and topsoil removed from the site.
- Receptacles should be placed on site for the collection of general waste during construction and operation. These receptacles should be emptied on a regular basis and waste be disposed of at an authorised landfill site in Bloemfontein.

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