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Draft Scoping Report
Unitas Park – Extension 16

Version - Draft for Authority and Public Comment

January 2021

Phumaf Engineering Solutions

GCS Project Number: 19.0921

Client Reference: 034RFP/7001/2019

GDARD Reference: 002/20-21/E0042

GCS (Pty) Ltd. **Reg No:** 2004/000765/07 Est. 1987
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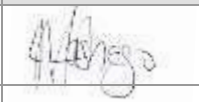
Author	Lehlogonolo Mashego		November 2020
Co-Author	Janice Callaghan		November 2020
Unit Manager	Gerda Bothma		January 2021

EXECUTIVE SUMMARY

Background

The Department of Human Settlements (DHS) aims at fast tracking the release of serviced stands from State owned land to qualifying beneficiaries through the Gauteng Rapid Land Release Programme (GRLRP). Phumaf Holdings (Pty) Ltd (Phumaf) was appointed as the responsible Engineers to undertake all preliminary planning, planning, design and construction management to enable the release of the identified stands. As part of the GRLRP, the Unitas Park Extension 16 Development has been identified for implementation.

GCS Water and Environmental Consultants (Pty) Ltd (GCS) has been appointed by Phumaf to undertake the environmental authorisation and associated Public Participation Processes (PPP) required for the individual projects in order for compliance to the National Environmental Management Act (NEMA) (Act 107 of 1998, as amended) and/or Supporting Environmental Management Acts (SEMA's).

Project Description

The site was originally planned to have a township layout, with 2680 residential erven, two primary and one high school, three social/commercial facility erven and three open space erven. This layout was approved; however, not proclaimed or registered as this "standard layout" did not accommodate different residential densities and it did not comply with the latest environmental and geotechnical requirements. The new strategy for this site is a proposed 7 250 units comprising of mixed high density and to achieve the proposed yield, the existing layout will have to be withdrawn and a new application submitted.

The area is currently zoned as agriculture on a dolomitic zone in terms of Geophysics. The site is approximately 149 hectares in extent and is owned by the Gauteng Provincial Government. The proposed site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of watercourses on the site, as well as to the south east of the site. A drainage line appears to run from the site towards Houtkop Road to the south west, where the surface water drains under the road and continues to flow into a National Freshwater Ecosystem Protection Area (NFEPA). The buffer of the NFEPA includes a portion of the south west of the site.

The proposed project entails the phased establishment of a mixed use residential development inclusive of the following land uses: low, medium and high density residential; student village; mixed use; innovation hub; social/educational; public open space and sports facility.

Due to capacity constraints identified during the preliminary investigations, the applicant is proposing to include an on-site above ground biological wastewater treatment facility (WWTF) as part of the proposed development. it is envisaged that the proposed WWTF will

be designed and constructed in a phased manner, directly aligned with the capacity demand of the implementation of the phased development. The final design of the proposed steel tank aboveground biological WWTF is estimated to treat to general discharge standards with a combined peak capacity of 20Ml/day (with these being phased in two stages of 10Ml/day respectively).

Scoping and Environmental Impact Assessment Process

A S&EIR process has two distinct phases: The Scoping Phase and the Environmental Impact Reporting Phase. This report, the Draft Scoping Report (DSR) identifies potential biophysical, social and health aspects and impacts of the proposed development on the receiving environment and invites comments from stakeholders in the identification of key issues and areas of concern, in order to inform the S&EIR process. The main objectives of the Scoping Phase are as follows:

- Provide a description of the proposed project, including the legislative context and project motivation;
- Identify and describe applicable alternatives to the proposed project;
- Identify and describe the anticipated environmental, social, economic and cultural impacts, including cumulative impacts, associated with the proposed development and outline key issues and Specialist Studies, included within the S&EIR process to assess these issues in further detail;
- Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored;
- Describe the methodology applied to conduct the scoping phase;
- Describe the process of engagement with identified stakeholders, including their views and concerns; and
- Describe the Plan of Study for the Environmental Impact Reporting (EIR) Process (second phase of the S&EIR process), which describes the nature and extent of further investigations required in the EIR phase.

The Scoping Phase concludes with the compilation and submission of a Scoping Report to the Competent Authority for acceptance. If accepted, the Competent Authority will instruct GCS to commence the EIR Phase. This report represents the draft version of the Scoping Report that will be made available for public comment.

As per the requirements of the NEMA EIA Regulations (2017) GNR 326, this DSR has been issued for public participation in terms of GNR 326, Regulation 41(b)).

All interested & affected parties are required to register as a Stakeholder in order to enable them to comment during this Public Participation Process (PPP). This PPP provides an opportunity to comment and raise any concerns or suggestions in respect of the Project.

All comments received during the PPP will be recorded and addressed within the Scoping Comments and Responses Report as well as the EIR Phase of the project.

This DSR will be available for comment for 30 calendar days from 15 January 2021 until 15 February 2021, as stipulated by the NEMA EIA Regulations (2017).

Summary of what the Draft Scoping Report entails and details:

- Details of the Environmental Assessment Practitioner (EAP);
- Location of the proposed development;
- Plan which locates the proposed activity or activities applied for at an appropriate scale;
- Description of the scope of the proposed activity;
- Description of the policy and legislative context applicable to the proposed development;
- Description of the need and desirability for the proposed development;
- Description of the potential environmental issues and impacts which have been identified to date;
- Full description of the process followed to reach the proposed preferred activity, site and location within the site;
- A Plan of Study (POS) detailing the tasks and specialist studies that will be undertaken during the Impact Assessment Phase; and
- Undertakings under oath or affirmation by the Environmental Assessment Practitioner (EAP).

Your comment on the Draft Scoping Report

This Draft Scoping Report will be made available to all registered I&APs for public review and comment from **15 January 2021** (comment period ending **15 February 2021**). I&AP's will be notified of the availability and will be sent an electronic copy on request. Copies will also be available for download from the GCS website: www.gcs-sa.biz.

Any comments on the Draft Scoping Report must be submitted in writing or email (including any additional supporting material) on or before **15 February 2021** directly to Lehlogonolo Mashego, Environmental Assessment Practitioner, by means of the following:

Tel: 011 803 5726
Fax: 011 803 5232
E-mail: lehlo@gcs-sa.biz

PO Box 2597
Rivonia
Johannesburg
2128

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CONTENTS OF THE SCOPING REPORT	RELEVANT SECTION IN THE REPORT
Details of – i. The EAP who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae	Section 1.3 and Appendix B
The location of the activity, including – i. The 21 digit Surveyor General code for each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 1.4
A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On land where the property has not been defined, the coordinates within which the activity is to be undertaken	Section 1.4
A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	Section 1.6
A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process	Section 1.5
A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location	Section 1.8**Error! Reference source not found.**
A full description of the process followed to reach the proposed preferred activity, site and location within the site, including – i. Details of all alternatives to be considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts - aa. can be reversed; bb. may cause irreplaceable loss of resources; and cc. can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk; ix. The outcome of the site selection matrix;	Sections 1 - 5, Section 7

x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity	
A plan of study for undertaking the environmental impact assessment process to be undertaken, including – i. A description of the alternatives to be considered and assessed with the preferred site, including the option of not proceeding with the activity; ii. A description of the aspects to be assessed as part of the environmental impact assessment process; iii. Aspects to be assessed by specialists; iv. A description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists; v. A description of the proposed method of assessing duration and significance; vi. An indication of the stages at which the competent authority will be consulted; vii. Particulars of the public participation process that will be conducted during the environmental impact assessment process; and viii. A description of the tasks that will be undertaken as part of the environmental impact assessment process; ix. Identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored	Section 6
An undertaking oath or affirmation by the EAP in relation to – i. The correctness of the information provided in the report; ii. The inclusion of comments and inputs from stakeholders and interested and affected parties; and iii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties;	Section 11
An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	Section 11
Where applicable, any specific information required by the competent authority; and	N/A
Any other matter required in terms of section 24(4)(a) and (b) of the Act.	N/A

1 BACKGROUND AND INTRODUCTION

1.1 Background

The Department of Human Settlements (DHS) aims at fast tracking the release of serviced stands from State owned land to qualifying beneficiaries through the Gauteng Rapid Land Release Programme (GRLRP). Phumaf Holdings (Pty) Ltd (Phumaf) was appointed as the responsible Engineers to undertake all preliminary planning, planning, design and construction management to enable the release of the identified stands. As part of the GRLRP, the Unitas Park Extension 16 Development has been identified for implementation.

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1.2 Brief Project Description

The site was originally planned to have a township layout, with 2680 residential erven, two primary and one high school, three social/commercial facility erven and three open space erven. This layout was approved; however, not proclaimed or registered as this "standard layout" did not accommodate different residential densities and it did not comply with the latest environmental and geotechnical requirements. The new strategy for this site is a proposed 7 250 units comprising of mixed high density and to achieve the proposed yield, the existing layout will have to be withdrawn and a new application submitted.

The area is currently zoned as agriculture on a dolomitic zone in terms of Geophysics. The site is approximately 149 hectares in extent and is owned by the Gauteng Provincial Government. The proposed site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of watercourses on the site, as well as to the south east of the site. A drainage line appears to run from the site towards Houtkop Road to the south west, where the surface water drains under the road and continues to flow into a National Freshwater Ecosystem Protection Area (NFEPA). The buffer of the NFEPA includes a portion of the south west of the site.

The proposed project entails the phased establishment of a mixed use residential development inclusive of the following land uses: low, medium and high density residential; student village; mixed use; innovation hub; social/educational; public open space and sports facility. (refer to Figure 1-1 below for the draft proposed layout)

Due to capacity constraints identified during the preliminary investigations, the applicant is proposing to include an on-site above ground biological wastewater treatment facility (WWTF) as part of the proposed development. it is envisaged that the proposed WWTF will be designed and constructed in a phased manner, directly aligned with the capacity demand of the implementation of the phased development. The final design of the proposed steel tank aboveground biological WWTF is estimated to treat to general discharge standards with a combined peak capacity of 20Ml/day (with these being phased in two stages of 10Ml/day respectively). (refer to Figure 1-2 for an illustration of a typical aboveground WWTF).

This final effluent is guaranteed to be within general limits as required from the Department of Water and Sanitation (DWS), which is suitable for discharge into reservoirs and water bodies with no potential for environmental damage. The proposed final water usage is envisaged for irrigation and/or environmental discharge.

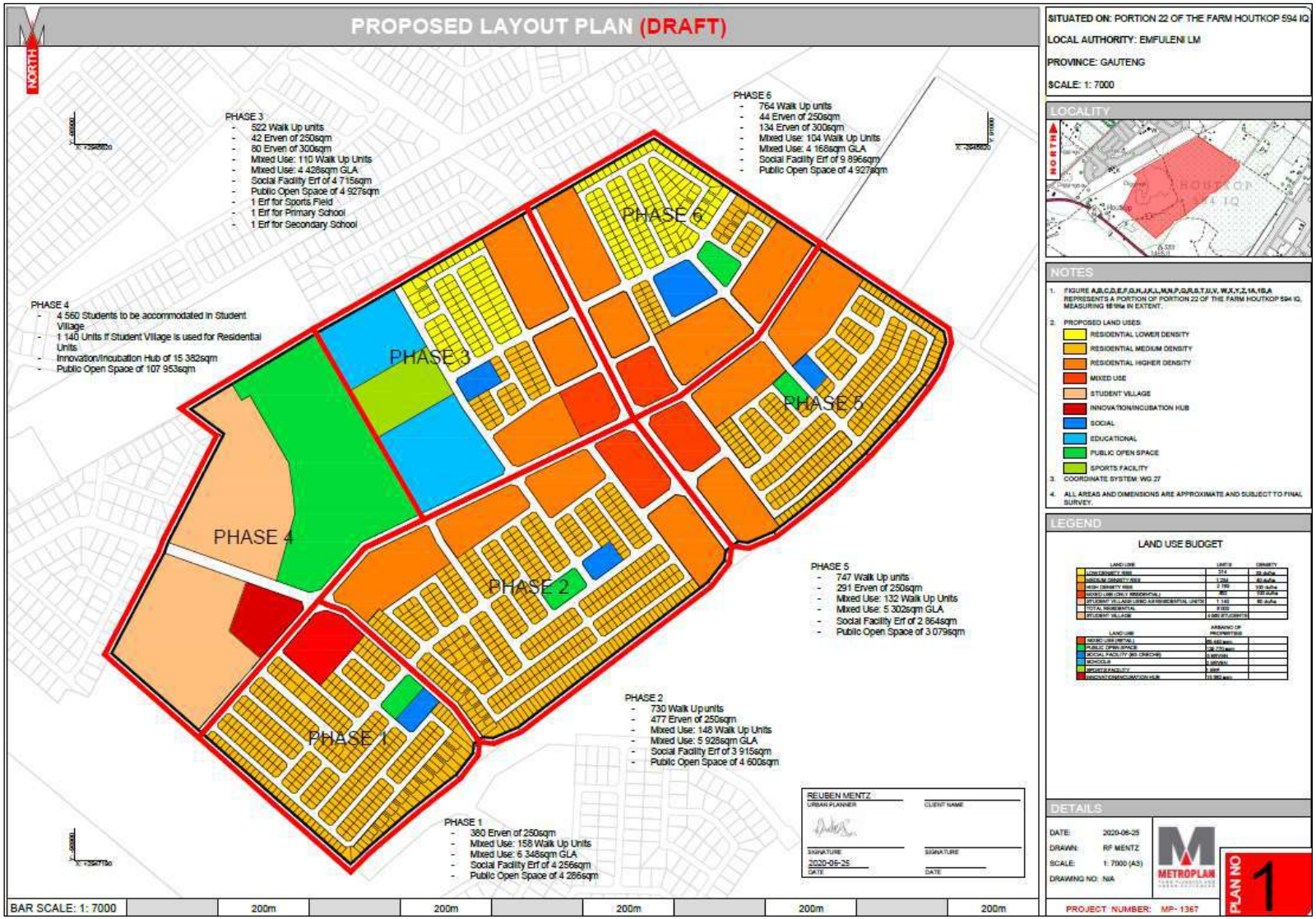

Figure 1-1 Proposed Draft Layout

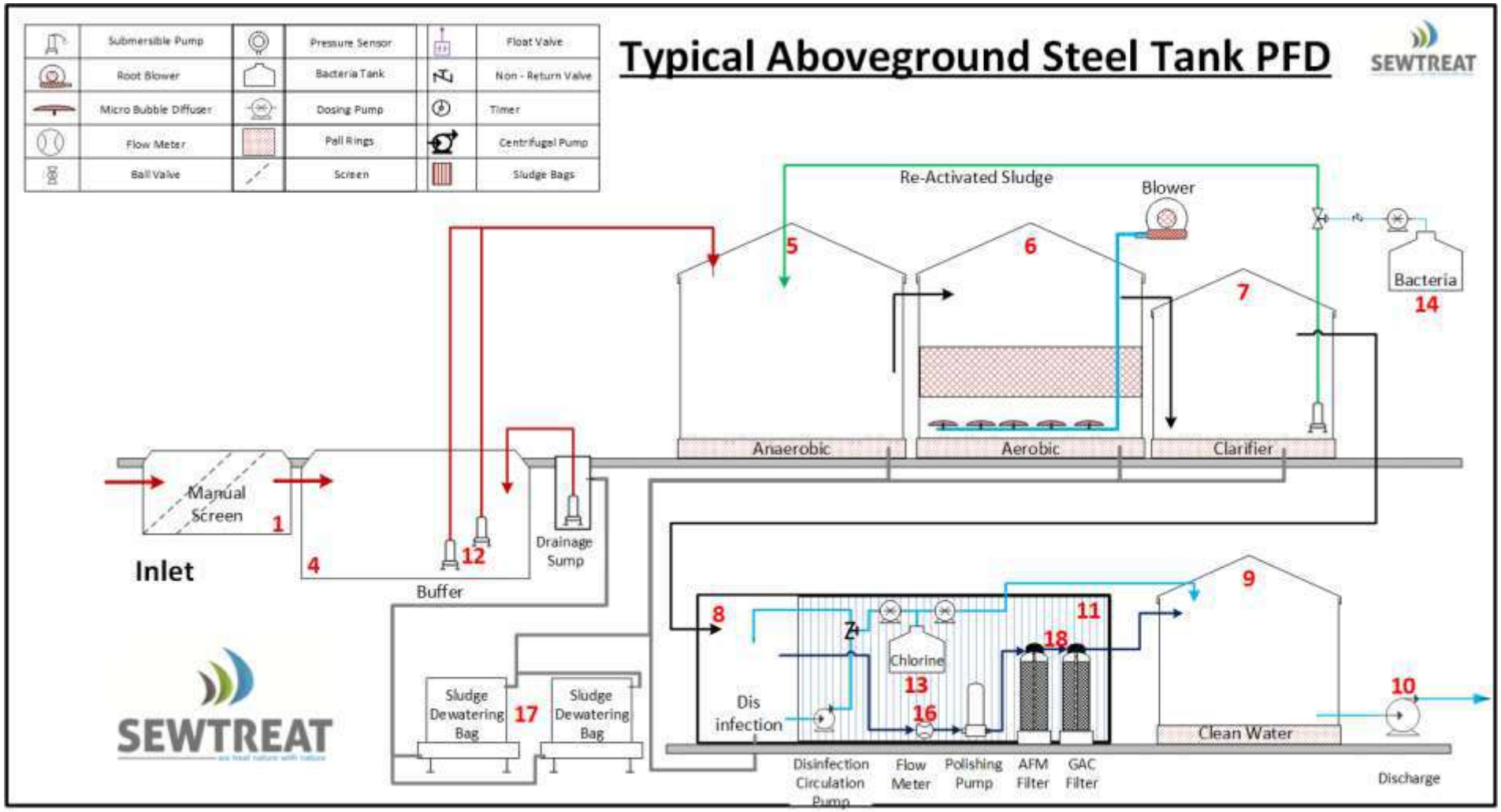

Figure 1-2 Typical Aboveground Steel Tank WWTF

1.3 Details of the Applicant and EAP

The details of the applicant are provided in Table 1.1.

Table 1.1: Name and Address of Applicant

ITEM	COMPANY CONTACT DETAILS
Company Name:	Department of Human Settlements – Gauteng Provincial Government
Company Representative:	Daniel Molokomme
Telephone No.:	011 085 2593
Facsimile No.:	011 355 6211
E-mail Address:	Daniel.Molokomme@gauteng.gov.za
Postal Address:	Private Bag X79, Marshalltown, 2001

GCS Water and Environment (Pty) Ltd (GCS) have been appointed as the independent Environmental Assessment Practitioners (EAP) to undertake the environmental processes required to obtain approval for the proposed listed activities, as requested by the relevant competent authorities. The contact details of the EAP are provided in Table 1.2.

Table 1.2: Name and address of environmental assessment practitioner.

ITEM	COMPANY CONTACT DETAILS
Company Name:	GCS Water and Environment (Pty) Ltd
Company Representative:	Gerda Bothma
Telephone No.:	+27 (0)11 803 5726
Facsimile No.:	+27 (0)11 803 5745
E-mail Address:	gerdab@gcs-sa.biz
Postal Address:	PO Box 2597, Rivonia, 2128

1.4 Project Location

The area is located within Unitas Park, Vereeniging within the Sedibeng District Municipality and Emfuleni Local Municipality, 6 km north-west of the Vereeniging central business district (CBD), sandwiched between roads R54 and R42. The R82 is runs north-south approximately 2.3km to the east of the site. The N1 is about 11 km to the west of the site and R54 runs through the site. Sebokeng lies to the north west of the site, with Vereeniging to the south east. The closest towns include Homer (3.1 km from the proposed site), Roods Gardens (3.3 km from the proposed site), Steelpark (4.9 km from the proposed site), Vereeniging (8.8 km from the proposed site) and Houtkop (9.6 km from the proposed site). Access to the site is via Skippie Botha and Langraad Roads and the predominant adjacent land use is residential and agricultural. Refer to **Figure 1-3** and **Figure 1-5** for the locality of the site.

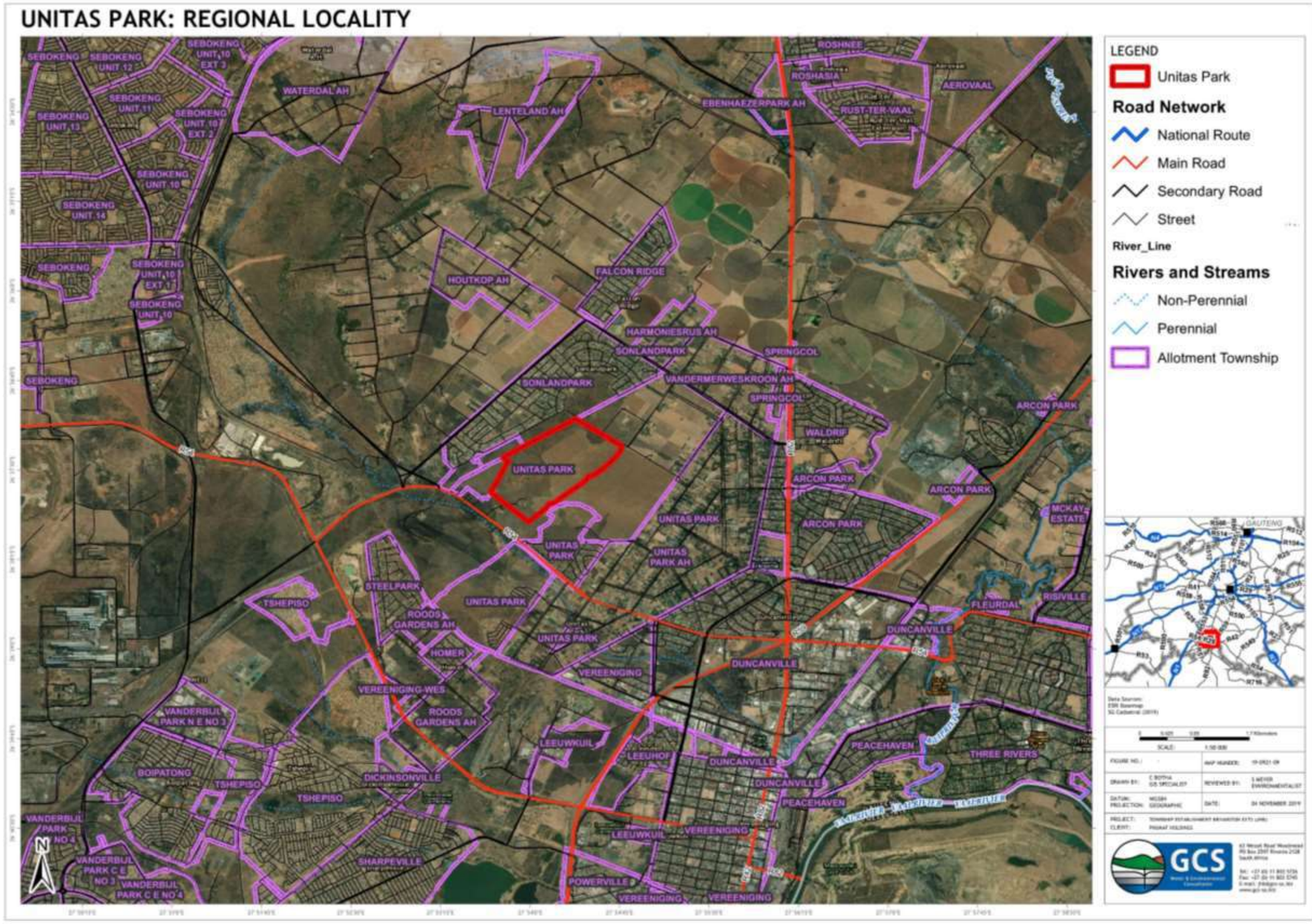

Figure 1-3: Regional Locality of Unitas Park Ext. 16

Figure 1-4: Locality of Unitas Park Ext. 16

1.5 Legislative Context

The policy and legislative context applicable to the Unitas Park project is summarised in Table 1.3 and penalties applicable to non-compliance to the legislation are detailed in Table 1.4.

Table 1.3: Legislation and guidelines applicable to the Unitas Park project

LEGISLATION/ GUIDELINES	APPLICABILITY
The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)	All developers are duty-bound to constitutional, legislative, and other measures to prevent pollution and ecological degradation, promote conservation and to develop in a sustainable manner as far as is reasonably possible. The constitutional environmental right elevates the importance of environmental protection and conservation and emphasises the significance that South Africans attach to an environment that is not harmful to their health or well-being.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by State Departments and to provide for matters connected therewith. These principles serve as guiding principles for a project and they are binding, enforceable and justiciable. In terms of the EIA Regulations of 2014 (as amended in 2017) published in terms of NEMA, an Application for Environmental Authorisation for listed activities is required to be submitted to either the Provincial Environmental Competent Authority, or the National Competent Authority.
National Environmental Management: Waste Act, 2008 (Act No 59 of 2008) (NEM:WA)	The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA), as amended, aims to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development, to provide for specific waste management measures, to provide for the licensing and control of waste management activities, to provide for compliance and enforcement, to name but a few of the purposes of the Act.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA)	The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. This Act is applicable to this application for environmental authorisation, in the sense that it requires the project applicant to consider the protection and management of local biodiversity.
Conservation of Agricultural Resources Act 43 of 1983 (CARA)	To provide for control over the utilization of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith. In terms of the amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties.
National Water Act, 1998 (Act No. 36 of 1998) (NWA)	The NWA is the primary legislation regulating both the use of water and the pollution of water resources. A person can only be entitled to use water if the use is permissible under the Act. Water Use is defined broadly and must be licensed unless it is listed in Schedule 1 as an existing water use or is permissible under general authorization.

LEGISLATION/ GUIDELINES	APPLICABILITY
The National Heritage Resources Act, (Act No. 25 of 1999) (NHRA)	NHRA governs the management of heritage resources which are of cultural significance. The South African Heritage Resources Agency (SAHRA) is the national body responsible for the protection of South Africa's cultural heritage resources. A Notice of Intent to Develop is required to be submitted to SAHRA for this project.
Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA)	In 2013, land use planning was influenced by the promulgations of the Spatial Planning and Land Use Management Act (2013) (SPLUMA) which outlines a set of principles to influence spatial planning, land use management and land development. The general principles of SPLUMA are that spatial planning, land use management and land development must promote and enhance spatial justice, spatial sustainability; efficiency; spatial resilience, and good administration. Integrated Development Plans (IDP) and Spatial Development Frameworks (SDF) are the key planning instruments used by municipalities for new developments (whether residential or commercial). While this does not form part of this document, it is required and will be applied for separately.
Gauteng Environmental Management Framework	Site falls within Zone 1 of the Gauteng Environmental Management Framework, which pertains to the Urban Development Zone. The intention thereof is to concentrate Urban Development to minimise urban sprawl and create a more effective and efficient city area.
Strategic Transmission Corridor – Central Corridor	Site falls within the Central Corridor for the Strategic Transmission Corridor, associated with the Renewable Energy Development Zones.
Air Quality – Vaal Triangle Airshed Priority Area	The Vaal Triangle Airshed Priority Area (VT APA) is the first priority area in South Africa and was declared such due to the concern of elevated pollutant concentrations within the area, specifically particulates. The Vaal Triangle is a highly industrialised area housing numerous industries, a coal fired power station, and various smaller industrial and commercial activities in addition to a few collieries and quarries giving rise to noxious and offensive gasses

Table 1.4: Penalties applicable to non-compliances under the legislation tabulated above

LEGISLATION	SECTION	FINE
NEMA	Section 49A (1) (a), (b), (c), (d), (e), (f) and (g)	Fine not exceeding R 10 million or imprisonment for a period not exceeding 10 years, or both such fine and such imprisonment.
	Section 49A (1) (i), (j) or (k)	Fine not exceeding R 5 million, or imprisonment for a period not exceeding 5 years. In the case of a second or subsequent conviction: fine not exceeding R 10 million, or to imprisonment for a period not exceeding 10 years. Or in both instances to both such fine and such imprisonment.
	Section 49A (1) (h), (l), (m), (n) (o) or (p)	Fine or imprisonment for a period not exceeding one year, or to both a fine and such imprisonment.
NWA	Section 15 and Item 31 of Schedule 4	First conviction: Fine or imprisonment for a period not exceeding 5 years, or both a fine and such imprisonment. Second or subsequent conviction: Fine or imprisonment for a period not exceeding 10 years, or both a fine and such imprisonment.
NEM:WA	Section 67 (1) (a), (g) or (h)	Fine not exceeding R 10 million or imprisonment for a period not exceeding 10 years, or both such fine and such imprisonment, in addition to other penalties that may be imposed in terms of NEMA.
	Section 67 (1) (b), (c), (d), (e), (f), (i), (j), (k) or (l), and Section 67 (2) (a), (b), (c), (d) or (e)	Fine not exceeding R 5 million or imprisonment for a period not exceeding 5 years, or both such fine and such imprisonment, in addition to other penalties that may be imposed in terms of NEMA.
	Section 67 (1) (m)	Fine or imprisonment for a period not exceeding 6 months or both a fine and such imprisonment.

1.6 Listed Activities Triggered

The Unitas Park project triggers listed activities in terms of the NEMA, as contained in the amended 2014 EIA Regulations. The identified listed activities are presented in Table 1.5 and require that a Scoping and Environmental Impact Reporting (S&EIR) process is followed in order to obtain the necessary Environmental Authorisation (EA) in terms of the NEMA.

Table 1.5: NEMA Listed Activities triggered by the Unitas Park project.

LISTING NOTICE	ACTIVITY NO	ACTIVITY DESCRIPTION	PROJECT ACTIVITY WHICH TRIGGERS THE LISTED ACTIVITY:
1	12	The development of — (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) *infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs —* *a)* within a watercourse; or *b)* in front of a development setback; or *c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;* excluding — aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee)where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	The proposed development site is situated within 32 metres of a water resource.
1	25	*The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.*	The development of a sewage treatment package plant which is estimated at being phased in two phases with an expected capacity of 10 mega-litres respectively.
1	27	*The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation,* except where such clearance of indigenous vegetation is required for — (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Site clearance of indigenous vegetation highly likely to exceed 1 ha.
1	28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or*	The proposed development is a Residential Development of 149 ha in extent, on land currently zoned as agriculture.

LISTING NOTICE	ACTIVITY NO	ACTIVITY DESCRIPTION	PROJECT ACTIVITY WHICH TRIGGERS THE LISTED ACTIVITY:
		(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	
2	15	*The clearance of an area of 20 hectares or more of indigenous vegetation,* excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or *(ii)* maintenance purposes undertaken in accordance with a maintenance management plan.	The site is 149ha in extent. It is likely that indigenous vegetation is to be cleared in excess of 20 ha.
2	25	*The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.*	The development of a sewage treatment package plant which is estimated at being phased in two parts with an expected capacity of 10 mega-litres respectively, i.e. potential total of 20 000 cubic metres.
3	4	*The development of a road wider than 4 meters with a reserve less than 13.5 meters in* *c. Gauteng within* *(i) A protected area identified in terms of NEMPAA, excluding conservancies;* *(ii) National Protected Area Expansion Strategy Focus Areas;*	The site is zoned for agriculture and is classified as having a very high sensitivity in respect to the terrestrial biodiversity. Soweto Highveld Grassland = Vu.
3	12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan, in* *c. Gauteng within* *(ii) Within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans*	Site is in 149ha in extent, currently zoned for agriculture and it is highly likely that indigenous vegetation of more than 300 m2 will be cleared.
3	14	*The development of—* *(ii) infrastructure or structures with a physical footprint of10 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;*	Site is in close proximity of NFEPA system, is currently zoned as agriculture and falls within a very high sensitivity of terrestrial biodiversity due to a vulnerable ecosystem.
3	15	*The transformation of land bigger than 1000 square metres in size to residential, commercial, retail, industrial or institutional used where such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010.*	The site is 149ha in extent and is currently zoned as agriculture.

1.7 Department of Environmental Affairs Screening Tool

1.7.1 Purpose of the Screening Tool

The Department of Environmental Affairs (DEA) Screening Tool allows to study the environmental sensitivities of a proposed development site, assist with the identification of specific zones or plans such as industrial development zones or Environmental management Frameworks may be applicable to the proposed development site, and it acts as a guideline as to which specialist assessments may need to be undertaken as part of the environmental assessment process.

The selection of the specialist investigations that were undertaken as part of this environmental assessment process was determined with the assistance of this tool as well as a desktop environmental assessment.

1.7.2 DEA Screening Tool Results

1.7.2.1 Environmental Sensitivities

The DEA Screening Tool has identified the following environmental sensitivities for the development site:

Development Area Themes	Environmental Sensitivity
Agricultural Theme	High
Animal Species Theme	Medium
Aquatic Biodiversity Theme	Low
Civil Aviation Theme	High
Plant Species Theme	Medium
Defense Theme	Low
Terrestrial Biodiversity Theme	Very High

1.7.2.2 Specialist Investigations

The DEA Screening Tool has identified that the following specialist investigations are potentially to be included in the environmental impact assessment process:

Recommended Assessment	Status	Company Undertaking
Agricultural Impact Assessment	Undertaken	Terra Africa Consultants
Landscape/Visual Impact Assessment	-	-
Archaeological and Cultural Heritage Impact Assessment	Undertaken	Heritage Contracts and Archaeological Consulting (HCAC)

Paleontological Impact Assessment	Undertaken	Marion Bamford as subcontracted by Heritage Contracts and Archaeological Consulting (HCAC)
Terrestrial Biodiversity Impact Assessment	Undertaken	GCS
Aquatic Biodiversity Impact Assessment	Undertaken	GCS
Hydrology Assessment	-	-
Socio-Economic Assessment	Undertaken	Urban-Econ Development Economists
Plant Species Assessment	Included in the Ecological Assessment	GCS
Animal Species Assessment	Included in the Ecological Assessment	GCS

1.7.3 Motivation for Inclusion/Exclusion of Assessments

The following table provides an overview of the motivation for the inclusion/exclusion of the specialist assessments as identified by the DEA Environmental Screening Tool in this environmental assessment process:

Specialist Assessment	Included/Excluded	Motivation
Agricultural Impact Assessment	Included	The site possibly have high agricultural potential.
Landscape/Visual Impact Assessment	Excluded	The key underlying impacts will be assessed in the Soil and Heritage Assessment.
Archaeological and Cultural Heritage Impact Assessment	Included	The proposed development triggers an investigation in terms of the NHRA.
Paleontological Impact Assessment	Included	As above.
Terrestrial Biodiversity Impact Assessment	Included	Desktop investigation identified sensitivities to be further investigated.
Aquatic Biodiversity Impact Assessment	Included	Desktop investigation identified that the site falls within the buffer zones of a wetland and/or other watercourses
Hydrology Assessment	Excluded	Technical desktop investigation die not indicate the need for this assessment.
Socio-Economic Assessment	Included	The nature of the development requires the undertaking of such an assessment.

Traffic and Access Impact Assessment	Included.	The nature of the development requires the undertaking of such an assessement.

1.8 Need and Desirability

According to the Sedibeng IDP 2019-2020, there is a great need to improve the quality of housing in the municipality under The Housing Act (Act 207 of 1997), whereby the development of a housing programme is provided and promoted. This project will form one such provision, to promote Urban renewal and modernize urban development, as well as reduce the backlog in the District. There has also been a decline in the proportion of access to formal housing in the Emfuleni Local Municipality (LM), as well as households with access to electricity.

2 SCOPE OF WORK

The aims of this Scoping Report are:

- Identify the relevant policies and legislation relevant to the activity;
- Motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location and layout;
- Identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking processes;
- Identify and confirm the preferred site, through a detailed site selection process, which includes an identification of impacts and risks inclusive of identification of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
- Identify the key issues to be addressed in the assessment phase;
- Agree on the level of assessment to be undertaken; and
- Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

3 PROJECT ALTERNATIVES

In accordance with the principles stipulated in NEMA it is required by law that various alternatives be investigated when considering a development which may impact significantly on the surrounding environment, in order to implement the best practicable environmental option. In definition this means that the options will be assessed in such a manner that the alternative which has the most benefit or cause the least environmental damage to the natural environment be chosen. This option also needs to be of such a nature that the capital and social cost incurred will be of an acceptable nature to society.

The following aspects are taken into consideration when investigating alternatives:

- Biophysical Impacts;
- Socio-economical Impacts.

An Alternative can be defined as an option that will meet the general purpose and requirements of the activity, which may include alternatives to:

a) The property on which, or location where, it is proposed to undertake the activity;
b) The type of activity to be undertaken;
c) The design or layout to be used in the activity;
d) The technology to be used in the activity; and
e) The operational aspects of the activity.

Based on the available information the following feasible and reasonable alternatives for the proposed project have been identified and, in conjunction with reference to various specialist opinions have considered that the following alternatives, should be comparatively assessed, during the EIA Phase of the Project:

1. Design and/or Layout Alternatives
2. Technology/Operational Alternatives
3. The “No-Go” consideration (this is a mandatory option)

Based on the contextual information presented above, and described in detail below, there is no evidence to suggest that other alternatives should be investigated for the proposed activity.

3.1 The “Site” Alternative

This site was selected as it was identified as particularly well suited for the proposed activity (provision of serviced residential stands), in accordance with the GRLRP. This GRLRP aims at

fast tracking the release of serviced stands from State owned land (in this instance land owned by Gauteng Provincial Government) to qualifying beneficiaries.

Based on the above, at this stage, there is no reason to suggest that alternative sites are investigated as these would not meet the general purpose and need of the proposed activity.

Therefore, no alternative sites were investigated for the purpose of this Scoping Report.

3.2 The "Activity" Alternative

The purpose of the activity applied for is very specific, which is to provide serviced stands on State owned land to qualifying beneficiaries. The proposed development site is situated ideally for the proposed activity, i.e. housing, as it is surrounded by residential developments.

Based on the above, at this stage, there is no reason to suggest that any activity alternatives are investigated as these would not meet the general purpose and need of the proposed activity.

Therefore, no activity alternatives were investigated for the purpose of this Scoping Report.

3.3 The "Design/Layout" Alternative

The design or layout is only due to be assessed during the EIA Phase of this Project. The Scoping Phase for this Project has been used to ensure that the site is well-suited to the activity.

Further to the above, the specialist assessments have identified areas of the site which are to be investigated further during the EIA Phase of the Project for the placement of the activity.

The above in in accordance with Appendix 2 of GNR 326, of the National Environmental Management Act (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended). The Scoping Phase of the Project is to enable the Specialists and the EAP to identify the Best Practical Environmental Option (BPEO) for the development footprint, and to identify studies which are required to be refined during the EIA Phase of the Project.

Appendix 2 of GNR 326, NEMA EIA Regulations, 2014 (as amended) states the following objectives of the Scoping Process:

1. The objective of the scoping process is to, through a consultative process –

a) Identify the relevant policies and legislation relevant to the activity;

b) Motivate, the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

c) Identify and confirm the preferred activity and technology alternative through an identification of impacts and risks and ranking process of such impacts and risks;

d) Identify and confirm the preferred site, through a detailed site selection process, which includes an identification of impacts and risks inclusive of identification of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographic, physical, biological, social, economic and cultural aspects of the environment;

e) Identify the key issues to be addressed in the assessment phase;

f) Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and

g) Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

Based on the above, at this stage, no layout alternative has been assessed by the EAP or the specialist assessments, as this is due to be assessed, in detail in the refined Impact Assessments, during the EIA Phase of the Project.

3.4 The "Technology" Alternative

Standard brick and mortar technology will be used in the construction of the housing units. This technology has been tried and tested and the most cost effective in supplying housing. In the final design of the buildings energy saving technologies/sustainable technology alternatives such as solar water heating and grey water harvesting will be considered

Resource demand reducing technologies have been included in the preferred option and include:

- Low flow showerheads
- Dual flush toilets

- Low energy lighting
- Thermal insulation of the ceilings

Based on the information presented within this DSR, it is reasonable to suggest that above-mentioned technology alternatives have been investigated and comprise the preferred alternative.

3.5 No-Go Option

The Assessment Phase requires that all development alternatives be included into the investigation process. The no-go option will be comparatively assessed against the above mentioned alternative during the environmental impact assessment phase and will act as a baseline against which all the other development alternatives are measured.

The “no-go” option would result in the proposed activity not being implemented and the status quo on the property remaining. The No Go alternative usually implies the continuation of the status quo in terms of development potential, zoning and management. The No-Go Alternative would not achieve the general purpose and requirements of the activity, which is to provide services stands for residential purposes. It is clear that the no-go option would result in a significant opportunity loss for the site, provision of housing opportunities in the local area and importantly, the Communities which could potentially be involved in the Project.

4 BASELINE ENVIRONMENTAL DESCRIPTION

The baseline environment is described within this Chapter. The baseline environment provides a status against which to assess the proposed project activities and potential impacts.

4.1 Geology

There are a few geological conditions that could impact development in the region, most notably the presence of dolomite in the region. This can cause problems with construction. There are also areas around Vereeniging, Vanderbijlpark, Meyerton, east of Midvaal, Heidelberg and areas to the east of Lesedi, which have been undermined and so can cause instability (Sedibeng SDF, 2017).

4.2 Topography

The site falls within a fairly flat area, with prominent ridges being present near Walkerville, Suikerbosrand and south of the Vaal Dam (Sedibeng SDF, 2017).

4.3 Climate

The red line in Figure 4-1 below indicates the mean daily maximum temperature, ranging between 18C in winter and 29C in summer, while the blue line indicates the mean daily minimum temperature, which ranger between 2C in winter and 15C in summer months. The maximum temperatures in summer can reach approximately 35C, while in winter, the number of days that frost occurs can reach up to 8 days in July. The mean annual precipitation ranges from a minimum of 1mm per month in winter to a maximum of 107mm per month in summer (Meteoblue, 2020).

Figure 4-1: Mean monthly temperatures and precipitation in the Vanderbijlpark area (Meteoblue, 2020)

4.4 Soils, Land Use and Land Capability

4.4.1 Soil Types

Six different soil forms (Carolina, Cullinan, Dresden, Glencoe, Lichtenburg and Mispah) were identified within the proposed development site. Both the Cullinan and Carolina soil forms are newly described soil forms of the new Natural and Anthropogenic Soil Classification System of South Africa (Soil Classification Group, 2018). The natural soil forms identified on site include soil of the Carolina, Dresden, Glencoe, Lichtenburg and Mispah forms while the Cullinan form is an anthropogenic soil form.

Approximately 95.6ha of the 154ha study site consists of yellow-brown and red sandy-clayloam soil profiles of the Carolina, Glencoe and Lichtenburg forms with soil depth of 1m or deeper than 1m. These soil profiles are located in the northern, eastern, south-eastern and centre of the study area. A small portion (1ha) of shallow Dresden soil profiles are located in the south of the study area. More than 95% of the areas of Carolina, Dresden, Glencoe and Lichtenburg soil forms have been used for maize cultivation the past growing season (2019 – 2020).

The western section of the proposed development area consist of shallow Mispah profiles with soil depth between 0.1 and 0.35m where evidence of a derelict old farmhouse was found. Two areas of previous soil excavations are present in the western section of the site (Cullinan form). The Cullinan form soil form has been described as large, exposed excavations without backfilling (Soil Classification Working Group, 2018).

4.4.2 Land Use

The area is zoned for farming/agricultural. Evidence was found of a derelict farmstead surrounded by what may be the remains of a garden around the house. The current land use of the site largely consists of rainfed production of grains (maize was planted for the 2019-2020 growing season) as well natural veld that may be used for livestock production (will be confirmed when information is received from farmer who leases the property). Within the south-western section of the study site, there are evidence of two areas of previous soil excavation in where gravel and fractured rock was removed without any backfill or active rehabilitation of the area.

Land outside the proposed development site consist of a mixture of land uses, including residential areas and a school to the north-west of the site as well as rainfed crop production and farmsteads towards the north-east, east and south-east of the study site. The R54 (Houtkop Road) is located south of the study site.

4.4.3 Land Capability

Using the soil classification data, the project site can be divided into three different land capability classes i.e. soil with either Moderate-High (Class 10), Moderate (Class 08) and

Moderate-Low (Class 07) land capability. The largest portion of the proposed development area consist of soil with Moderate-High (Class 10) land capability with medium-high to high potential for rainfed crop production. The highest land capability is 9.4 ha of land in the middle section of the site that has Moderate- High (Class 10) land capability. The shallower Glencoe profiles to the east has Class 09 land capability and the areas where the Hutton and Clovelly profiles have already been affected by anthropogenic activities, have Moderate (Class 08) land capability.

4.5 Hydrology

There are numerous water bodies in the area, with a number of wetlands in the Lesedi area and Emfuleni, full assessment has not been conducted and the internal risk assessment matrix will further indicate the need for a full hydrological assessment.

4.6 Wetlands

The wetland assessment identified one unchanneled valley bottom wetland within the 500 m regulated area. It was determined that this system may be impacted upon by the proposed development which necessitated further assessment of its ecological state and functional importance.

The PES of the system was determined to be 'moderately modified' due to serious alterations to the hydrology of the system through canalization and stream channel modifications. The vegetation and geomorphology of the system was determined to be largely natural only being impacted by commercial agriculture in the surrounding area. The functional assessment determined that the system provides good erosion control as well as phosphate trapping.

Based on the findings of the wetland assessment, the following recommendations have been highlighted for consideration

- The wetland system must be demarcated as a no-go zone; and
- A 45 m buffer must be established and maintained during the construction phase of the proposed development. This must be monitored by the ECO.

4.7 Ecology and Biodiversity

4.7.1 Fauna and Flora

The biodiversity assessment identified three (3) habitat types as follows:

- Open grassland;
- Degraded grassland; and
- Freshwater hydrophytes.

The open and degraded grassland were determined to have low to very low naturalness due to the extensive commercial agriculture taking place within the study area. During the infield floral assessment, no species of conservation concern were observed. The study area falls within the Soweto Highveld Grassland which is considered to be endangered. However, very small and scattered areas of open grassland was identified.

Although the area has the potential to provide habitat for a diverse range of fauna species in a natural state, the degraded nature resulted in very few fauna species being observed. One (1) mammal species, namely the *Lepus saxtilis* (Scrub Hare) (LC) was observed. Additionally, large flocks of *Streptopelia decipiens* (African Dove) (LC) were observed.

4.8 Air Quality

The air quality in the Emfuleni LM is very poor, largely due to the high level of industrialisation in the area, with the greater Sedibeng DM being the most polluted municipality. The sources of emissions include: industrial processes, domestic fuel burning, vehicle exhaust emissions and waste facilities. As a result, Emfuleni LM and Midvaal LM are part of the first national priority area in the Vaal Air-Shed Priority Area. PM10 is regarded as the pollutant of most concern, due to its health implications (Sedibeng IDP, 2019). The region's Air Quality Management plan informs management of the air quality in the region, which assists in the issuing of Air Emissions Licences and aims to achieve cleaner air for residents. At present, there are two Ambient Air Quality Monitoring Stations: one in Meyerton and one in Vanderbijlpark (Sedibeng IDP, 2019).

4.9 Noise

The site that is earmarked for the proposed development, which is surrounded by is presently not impacted by any sources of noise. The R54, which occurs towards the southern boundary of the site, can be characterised as having "medium" traffic volumes, and the noise generated from traffic flows from similar roads has been classified as having negligible impacts. The present activity on the site is cultivated fields, and thus significant noise levels do not emanate from this activity, apart from machinery used for ploughing.

4.10 Heritage sites and paleontological importance

A Heritage study was undertaken by HCAC (2020) and a paleontological study by Marion Bamford (2020) to determine the character of the site in terms of cultural resources. T Due to the area being ranked of high significant by SAHRIS (Figure 4-2), a paleontological study was undertaken. The non-intrusive field survey identified some scatted Stone Age artefacts, a stone cairn of unknown purpose and a partially demolished homestead. The paleontological study concluded that, as the site lies on soils that overlay deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation, there is a possibility of fossils being

preserved. However, these rocks are only potentially present more than 50m below the surface. It is therefore unlikely that fossils will be unearthed.

Due to the site being used for the cultivation of maize, a large portion of the site was inaccessible. Although artefacts were identified in the areas that could be accessed, they are rated as having low heritage significance. It is recommended that the area is monitored during the construction phase.

Figure 4-2: SAHRIS palaeosensitivity map for the proposed development in Unitas Park Ext 16 shown within the yellow rectangle.

(Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero)

4.11 Socio-Economic Conditions

According to the Sedibeng Growth and Development Strategy 2 (Sedibeng District Municipality, 2012), the Unitas Park population is of low-Living Standards Measurement with a low access to services. This places the community as vulnerable to impact. The community also has a high unemployment rate. These factors must be considered when proposing development within Unitas Park. The community is not positioned to address impacts to their human health, living conditions or environment. Therefore, it is important that the developer communicate with neighbouring community members in order to minimize negative impacts of the development. This will be focused within the construction phase of the project.

4.12 Traffic

Background

The site is well-connected on a regional scale. To the south is Houtkop Road (R54), to the south-west is the R28 and to the east is the R59 (Old Johannesburg Road). The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary. On a more local level, the extension of Houtkop Road, Skippie Botha Road, and Langrand Road provides connectivity to the north, east, and west.

A strong movement of people occurs between Vanderbijlpark, Vereeniging, and Meyerton towards Johannesburg along the P156 freeway. A strong movement also occurs between Sebokeng and Johannesburg, especially during the morning and afternoon peak hours, as commuter access employment opportunities in Johannesburg and surrounding areas. A strengthening of movement in the future can be expected between Vereeniging and Sebokeng, as urban development and densification occur along this corridor. Movement along the corridor between Vereeniging, Sebokeng, and Johannesburg is supported by the existing commuter railway line.

Rail Network

Emfuleni is served by a rail network that connects Emfuleni to neighbouring areas in Gauteng and the Free State. This rail network consists of three (3) lines.

- The first rail line stretches along with the P156 (R59) freeway and links Sasolburg to Vereeniging, Meyerton, and Germiston. This rail line is primarily a freight line but does contain commuter railway stations along sections of the line.
- The second railway line stretches from Sasolburg, via Vereeniging towards Sebokeng, Orange Farm, and Johannesburg. This railway line also functions as a freight railway line, although it also fulfills a significant commuter railway line function.
- The third railway line stretches from Sebokeng towards Westonaria. This railway line is exclusively used for rail freight purposes.

Road Network

Emfuleni comprises of an extensive bus network that serves the municipal area. A prominent bus route is the bus route linking Vereeniging to Sebokeng along with the K53 (Moshoeshoe Road) and the K45 (Golden Highway). This bus route links Evaton and Sebokeng to the Vereeniging CBD and the industrial areas located within Vereeniging. Equally so, the area comprises of an extensive mini-bus taxi network. This network largely uses the same routes as of the bus routes and serves the same areas within the municipal area. The only significant exception is that the minibus route links Vanderbijlpark CBD to Sebokeng via Mittal Steel; a route that the bus network does not serve.

The proposed development will generate an estimated 566 trips during the weekday AM and weekday PM peak periods, respectively. Whilst this has been identified, it is to be noted that the site is currently underdeveloped and existing capacity constraints, as such the

development needs to meet this along with the increased traffic impacts. As a precautionary measure the analysis performed, found that the impact of the proposed developments can be mitigated by means of several road and intersection improvements

4.13 Visual Aspects

The Unitas Ext. 16 site is visible from the R54 as well as the surrounding peripheral streets. The areas surrounding the site under investigation, are residential in nature, varying between formal residential areas (e.g. Unitas Park, Sonland Park, Van Der Merwes Kroon) to agricultural holdings (e.g. Unitas AH, Houtkop SH) utilized for residential purposes.

The proposed development's land use, although involving a change in land use from agricultural to residential, is thus in line with the surrounding land use, as it is aimed at being transformed into student accommodation, businesses and housing. Consequently, it is not envisaged that the visual character and sense of place of the area will be significantly altered.

5 PUBLIC PARTICIPATION PROCESS

This section of the report documents the process, which was and will be followed with respect to consultation of Interested and Affected Parties (I&APs)/stakeholders and the Government Authorities.

5.1 Purpose of Public Participation

The most important objective of public participation is to provide sufficient and accessible information to potential Interested and Affected Parties ("I&APs") in an objective manner and to provide a platform for constructive participation in the application process, thereby assisting I&APs to:

- Gain an understanding of the Project, the various components and the potential impacts (positive and negative);
- Raise issues of concern and suggestions for enhanced benefits;
- Comment on reasonable alternatives;
- Verify that their issues have been recorded in the Comments and Responses Report ("CRR") and considered in investigations; and
- Contribute relevant local information and traditional knowledge to the process.

5.2 Public Consultation Process

This section provides a short summary of the various activities of the public consultation process to be undertaken in support of the application process. Some of the activities associated with the Scoping Phase have already commenced.

5.2.1 Stakeholder database

A stakeholder database or list of I&APs was compiled and will be updated as the process unfolds and as more I&APs register. The database was compiled: a) using lists of contact details of previous applications in the area; b) using information provided by the applicant's community liaison officers; and c) including responses from I&APs.

The current I&AP database is attached as Appendix D1 to this Report. The I&AP database is the means through which information will be conveyed to stakeholders as part of the announcement of the applications and the availability of the consultation and final reports as these become available for public review. For this Project, I&APs typically include the following:

- Owners or persons in control of the land where the proposed Project activities are to be undertaken ("Project Area");
- Occupiers of the property where the activities are to be undertaken;
- Owners and occupiers of land adjacent to the Project Area;

- Provincial (Gauteng) and local government (Emfuleni Local Municipality and Sedibeng District Municipality);
- Organs of state, other than the competent authorities, which is the Department of Human Settlements, such as the Gauteng Department of Agriculture and Rural Development, Department Public Works and Roads, SANRAL, etc. having jurisdiction in respect of any aspect of the proposed activities;
- Relevant residents' associations, agricultural unions, community based organisations, water user associations, and any catchment management authority and Non-Governmental Organisation ("NGOs");
- Environmental organisations, forums, groups and associations; and
- Private sector (businesses, industries) in the vicinity.

5.2.2 Announcement of the application process

The integrated application process was announced to I&APs by means of the following:

- An advertisement was placed in the Sedibeng Ster on the 14 January 2021;
- A Background Information Document ("BID") was compiled and distributed to all I&APs on the stakeholder database;
- Site Notices were placed all around the Project Area;
- Placement of all notices and the BIDs on the GCS website (http://www.gcs-sa.biz/documents/). The GCS website is used to make documents electronically available to stakeholders. The website address was published in the advertisement, BIDs, site notices and all other communication; and
- A Registration and Comment Sheet was distributed with every BID, inviting stakeholders to register as I&APs and to provide their comments on the proposed application.

5.2.3 Comments and Responses Report

All comments received during the application process will be captured in a Comments and Responses Report (CRR). This CRR will be updated on a continuous basis and will be presented to the authorities and other I&APs together with the consultation and final reports as a full record of issues raised, including responses on how the issues were considered during the application process.

5.2.4 Review of the Draft Scoping Report

The Draft Scoping Report (DSR) will be made available for public comment for 30 days. The DSR has been submitted for public review from 15 January 2021 until 15 February 2021 (30 days). Due to COVID-19 restrictions, no hard copies of the report will be available for review at public venues. However, the report is available electronically via the GCS Website (link provided above) or a CD can be made available upon request.

6 PLAN OF STUDY FOR EIA

6.1 Proposed method of assessing the environmental aspects

6.1.1 Impact Assessment for proposed site

The assessment of potential impacts will be addressed in a standard manner to ensure that a wide range of impacts were comparable. The ranking criteria and rating scales will be applied to all specialist studies for this project. The following methodology will be used to rank these impacts. Clearly defined rating and rankings scales (**Table 6.1** - **Table 6.7**) will be used to assess the impacts associated with the proposed activities. The impacts identified by each specialist study and through public participation will be combined into a single impact rating table for ease of assessment.

Table 6.1: Severity or magnitude of impact.

Insignificant/non-harmful	1
Small/potentially harmful	2
Significant/slightly harmful	3
Great/harmful	4
Disastrous/extremely harmful/within a regulated sensitive area	5

Table 6.2: Spatial Scale – extent of area being impacting upon.

Area specific (at impact site)	1
Whole site (entire surface right)	2
Local (within 5km)	3
Regional/neighbouring areas (5km to 50km)	4
National	5

Table 6.3: Duration of activity.

One day to one month (immediate)	1
One month to one year (Short term)	2
One year to 10 years (medium term)	3
Life of the activity (long term)	4
Beyond life of the activity (permanent)	5

Table 6.4: Frequency of activity - how often activity is undertaken.

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table 6.5: Frequency of incident/impact - how often activity impacts environment.

Almost never/almost impossible/>20%	1
Very seldom/highly unlikely/>40%	2
Infrequent/unlikely/seldom/>60%	3
Often/regularly/likely/possible/>80%	4
Daily/highly likely/definitely/>100%	5

Table 6.6: Legal Issues – governance of activity by legislation.

No legislation	1
Fully covered by legislation	5

Table 6.7: Detection - how quickly/easily impacts/risks of activity on environment, people and property are detected.

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Each identified impact will be assessed in terms of severity, spatial scale and duration (temporal scale). Consequence is then determined as follows:

Consequence = Severity + Spatial Scale + Duration

The risk of the activity is then calculated based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected:

Likelihood = Frequency of Activity + Frequency of Impact + Legal issues + Detection

The risk of each identified impact is then based on the product of consequence and likelihood.

Risk = Consequence x likelihood

Impacts will be rated as either of high, moderate or low significance on the basis provided in Table 6.8.

Table 6.8: Impact significance ratings

SIGNIFICANCE RATING	CLASS (NEGATIVE IMPACT)	CLASS (POSITIVE IMPACT)
1 – 55	(L) Low Significance	(L) Low Significance
56 – 169	(M) Moderate Significance	(M) Moderate Significance
170 – 600	(H) High Significance	(H) High Significance

6.1.2 Risk Reporting Matrix

The Risk Reporting Matrix (Figure 6-1 is typically used to determine the level of risks identified and associated with a project or within a program. The level of risk for each root cause is reported as low (green), low moderate (yellow), high moderate (purple) or high (red). The purpose of a risk assessment process is to move risks from the top right (high risk) to the bottom left (low risk) as reflected in the risk map.

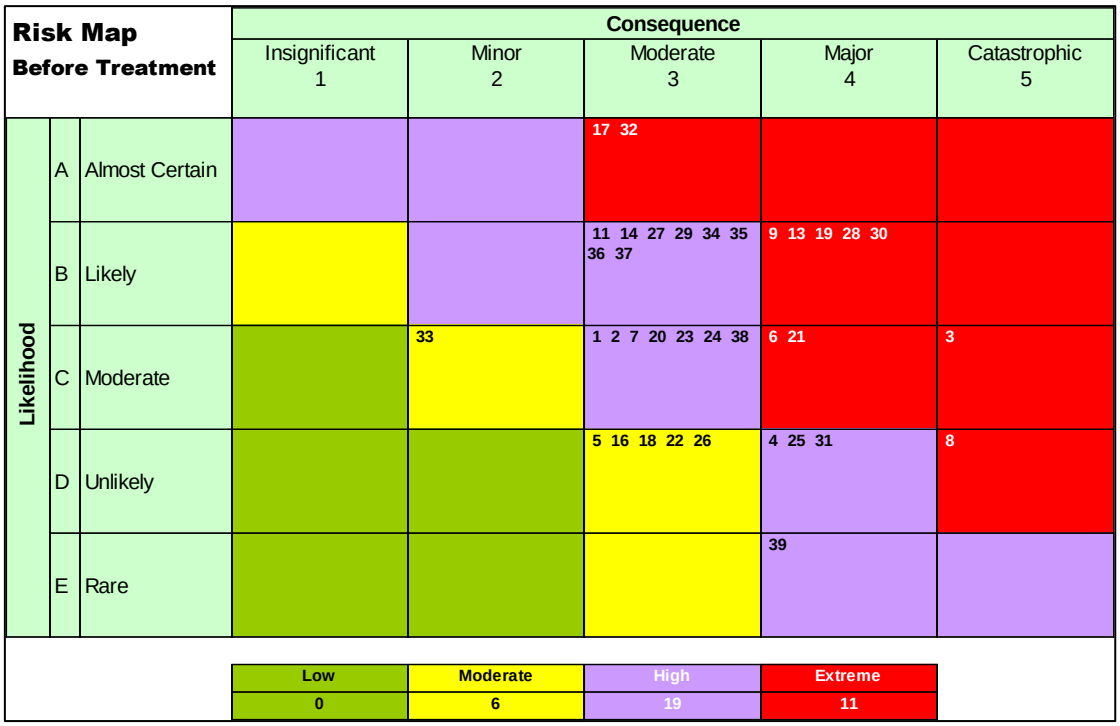

Figure 6-1: Illustrative risk map.

The level of likelihood of each root cause is established utilising specified criteria (**Table 6.9**). For example, if the root cause has an estimated five per cent probability of occurring, the corresponding likelihood is Rare (Level E).

Table 6.9: Likelihood categories of root causes.

LIKELIHOOD CATEGORY				
E	**D**	**C**	**B**	**A**
Rare	**Unlikely**	**Moderate**	**Likely**	**Almost Certain**
Highly unlikely to occur on this project	Given current practices and procedures, this incident is unlikely to occur on this project	Incident has occurred on a similar project	Incident is likely to occur on this project	Incident is very likely to occur on this project, possibly several times

The level and types of consequences of each risk are established utilising criteria such as those described in Table 6.10. For each type of consequence there is a description that relates to a specific consequence value. The results for each risk are then plotted in the corresponding single square on the Risk Reporting Matrix.

Table 6.10: Levels and types of consequences.

CONSEQUENCES					
	1 - Insignificant	2 - Minor	**3 - Moderate**	**4 - Major**	**5 - Catastrophic**
Safety and Health	First Aid Case	Minor Injury, Medical Treatment Case with/or Restricted Work Case.	Serious Injury or Lost Work Case	Major or Multiple Injuries - permanent injury or disability	Single or Multiple Fatalities
Environment	No impact on baseline environment. Localized to point source. No recovery required	Localized within site boundaries. Recovery measurable within 1 month of impact	Moderate harm with possible wider effect. Recovery in 1 year	Significant harm with local effect. Recovery longer than 1 year.	Significant harm with widespread effect. Recovery longer than 1 year. Limited prospect of full recovery
Reputation	Localised temporary impact	Localised, short term impact	Localised, long term impact but manageable	Localised, long term impact with unmanageable outcomes	Long term regional impact
Business Impact	Impact can be absorbed through normal activity	An adverse event which can be absorbed with some management effort	A serious event which requires additional management effort	A critical event which requires extraordinary management effort	Disaster with potential to lead to collapse of the project

6.2 Terms of reference for the specialist studies

The following terms of reference (ToR) were utilized in appointing the specialist consultants to undertake detailed investigations to assess the significance of potential impacts to the receiving environment.

6.2.1 Heritage Impact Assessment

Field study

Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development.

Reporting

Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project.

Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

6.2.2 Paleontological Impact Assessment

The ToR for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.

The methods employed to address the ToR included:

- Consultation of geological maps, literature, paleontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
- Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (not applicable to this assessment);
- Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (not applicable to this assessment); and
- Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (not applicable to this assessment).

6.2.3 Agricultural Agro-Economic Assessment

Literature Review and Desktop Assessment

- Review all existing and relevant previous soil reports compiled for the study area;
- From this assessment, gaps in the baseline information available will be identified and these will guide the site survey to ensure that these gaps are addressed with the new information; and
- In addition to this, aerial photography as well as broad soil and land capability classes as obtained from the Environmental Potential Atlas of South Africa (ENPAT) and the Agricultural Research Council (ARC) will be studied.

Field Survey

- A detailed soil survey based on a 1-hectare (ha) grid must be undertaken where the proposed footprint area, and a 100 metre (m) buffer zone around the proposed footprint, will be assessed.
- In areas of great soil form variety, more sample points should be evaluated in order to establish soil form boundaries.
- Observations must be made regarding soil form, texture, soil profile depth, presence of soil structure and slope of the area.

Reporting

- A Soil, Land Use and Land Capability Scoping Report must be compiled that describes the desktop study as well as the site survey and adheres to the NEMA requirements.
- Once soil form groups have been outlined, the land capability classification of the area will be determined and mapped using the 2006 Guidelines of the ARC. Similarly, the agricultural potential of the study area must be assessed based on these guidelines, taking other agricultural potential calculation factors into consideration. The assessment of the potential impacts of the proposed project on the soil, land use and land capability properties of the project site must then be determined using the standard GCS risk rating methodology.

6.2.4 Socio-economic Assessment

Social Impact Assessment

The SIA report for the Project must include the following:

- Literature review, data collection and high-level stakeholder consultation;
- Scoping Report input and the determination of anticipated impacts (construction, operation, and closure phases);
- Environmental Impact Report input including a detailed impact assessment and rating of anticipated impacts (construction, operation, and closure phases); and
- A management plan applicable to anticipated social impacts.

Economic Impact Assessment

- Identify, predict and evaluate economic aspects of the environment that may be affected by the project activities and associated infrastructure; and
- Advise on the alternatives that best avoid negative impacts or allow to manage and minimise them to acceptable levels, while optimising positive effects.

Site Visit

Urban-Econ will contact the concerned surface owners and provide them with a description of the proposed project team, the dates of the proposed site assessments as well as the equipment to be used. Any special requests for access will be communicated, and the contact details of the surface owners will be provided to the specialist team. In the event that the proposed site visit dates change from what was presented originally, the deviations must be discussed and confirmed between the surface owner and specialist prior to the site visit.

Site visits/consultations can only be initiated once the final project schedule has been agreed to with Phumaf. This will be discussed directly with both the social and economic specialists directly once the schedule has been finalised.

6.2.5 Ecological and Wetland Assessment

Literature Review

Desktop information on the expected biodiversity of the project area, including expected vegetation communities must be obtained from relevant sources. In addition to information on expected species assemblages, the project area will be assessed in terms of the following:

- North West Biodiversity Sector Plan (NWBSP, 2015);
- Relevant SANBI GIS data regarding ecologically important and sensitive areas in terms of fauna will be incorporated where relevant.
- Whether the study area is situated within a Listed Ecosystem in terms of Section 52 of the National Environmental Management: Biodiversity Act (Act 10 of 2004) or in a vegetation that is classified as Vulnerable or Endangered;
- Whether any portion of the vegetation community in the project area is protected by legislation;
- The presence of suitable habitats for faunal or floral species of conservation concern;
- Whether any portion of the project area contributes to important ecological processes such as ecological corridors, hydrological processes and whether important topographical features such as ridges are present in the project area; and
- Whether rivers and wetlands in the project area are listed as Freshwater Ecosystem Priority Areas (FEPAs) (SANBI, 2011).

Baseline Surveys

- Vegetation communities must be sampled using random stratified sampling. This method entails the mapping of vegetation units prior to the site visit and placing at random 5 – 10 sampling plots per vegetation unit to obtain a species list. Size of sample plots will fit the type of vegetation as per methods used in the compilation of VEGMAP.

Each sample plot will be sampled using the Braun-Blanquet methodology (Westhoff and Van der Maarel, 1978).

- Terrestrial faunal surveys will include field assessments, direct sightings and indirect evidence (calls, scat, tracks, etc.) of fauna species must be recorded. Surrounding areas, up- and down-slope must be scanned as needed. Since fauna may not always be directly observed, the field survey must focus on identifying habitat and micro-habitats to determine the likelihood of habitat specialists occurring on site with focus on ecologically significant species. An assessment of likelihood of occurrence of ecologically significant species must be provided, based on site survey findings.
- An assessment and mapping of any sensitive areas in terms of fauna must be provided. Identification of areas of current and future potential threat to fauna species, with focus on ecologically significant species. The development of a fauna management and monitoring plan is required.
- The wetland areas must be delineated in accordance with the DWAF (2005) guidelines.

Impact Assessment

Once the baseline assessment has been completed the specialists will commence with the impact assessment. The significance of potential impacts on the above-mentioned attributes will be assessed using the GCS impact assessment matrix. Suitable and practically implementable mitigation measures will be identified, and the significance of potential impacts will be reassessed post mitigation.

7 POTENTIAL IMPACTS

Based on the investigation of the receiving environment, as well as the understanding of activities to be carried out for the construction and operation phases of the project, the potential impacts during the various phases of the operation will be identified and addressed in detail during the EIA phase. Potential impacts that have been identified at this stage are presented in Table 7.1.

Table 7.1: Preliminary impacts identified.

POTENTIAL ENVIRONMENTAL IMPACT	SPECIALIST STUDY TO INVESTIGATE POTENTIAL IMPACT
Altering of geological strata	Soils, Land Capability and Agricultural Potential Assessment
Alteration of natural topography	Soils, Land Capability and Agricultural Potential Assessment
Loss of soil resource, land use and land capability	Soils, Land Capability and Agricultural Potential Assessment
Contamination of soil resources	Soils, Land Capability and Agricultural Potential Assessment
Change in drainage patterns	Design Stormwater Management Plan Implement Environmental Awareness and Response Plan
Contamination of surface water resources	Design Stormwater Management Plan and Environmental Management Plan Environmental Awareness and Response Plan
Potential contamination of groundwater resources	Environmental Management Plan
Disruption of ecological connectivity	Environmental Management Plan
Loss and degradation of faunal habitat	Environmental Management Plan
Loss of biodiversity	Environmental Management Plan
Spreading of weeds and alien vegetation	Environmental Management Plan
Noise nuisance	Environmental Management Plan
Fugitive dust releases	Environmental Management Plan
Possible damage to heritage artefacts	Environmental Management Plan and Environmental Awareness and Response Plan
Increase in crime	Environmental Management Plan Stakeholder Communication Strategy and Grievance Mechanism

8 RECOMMENDATIONS

8.1 Socio-Economic Assessment

- Prioritise employment of construction workers from nearby areas and ensuring the transfer skills
- Create strict controls on the roads leading to the facility and prevent people from parking on the side of the roads, driveways, and other public areas that may inconvenience other road users and cause traffic congestion
- Vehicles should be towed away if parked in the non-designated areas and such practices should be made abundantly clear among the construction workers and construction managers to avoid unnecessary conflicts
- The construction of the development should take place during the day where most of the residents in the area are anticipated to be at school or work or occupied by other activities. No construction activities are anticipated to take place during the day
- Utilise domestically produced building material and equipment and prioritise the procurement of goods and services from the local SMMEs
- Prioritise local people for employment opportunities
- Provide contracts that stipulates the required hours of work as well as the pay rate/wage or salary amount for labour during construction and operational phase
- Employment contrasts should stipulate the duration of employment (temporal or permanent) depending on the phase of the development and the salary must be competitive or adhere to the minimum wage standards
- Ensure adequate parking on site to accommodate the number of people in the development.

8.2 Heritage Assessment

It is recommended by the specialist that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- Feature 1, 2, 4, 5 and 6 must be monitored during construction to determine if in-situ subsurface layers are present;
- It is recommended that Feature 3 should be monitored during earthworks in the area;
- No mitigation is required for Feature 7, unless it is proven that the site is older than 60 years;

- Confirmation of any grave sites in the study area as part of the social consultation process;
- Graves should ideally be retained in-situ in open spaces; and
- Implementation of a chance find procedure (archaeological and paleontological) for the project.

8.3 Paleontological Assessment

Based on the lack of any previously recorded fossils from the area, it is highly unlikely that any fossils would be preserved in the overlying soils and sands of the Vryheid Formation. Dolerite does not preserve fossils and the uppermost potentially fossiliferous layer is more than 50 m below the surface so would not be affected by any urban development. A Fossil Chance Find Protocol is recommended for the very small chance that the excavations might reveal some fossil plants. There would be no fossils in the surface soils.

8.4 Ecology and Biodiversity Assessment

- The open grassland areas must be avoided as far as reasonably practicable;
- Vegetation clearing must be limited to the site plan only. No unnecessary vegetation clearing is permitted;
- An Invasive Alien Plant Species (IAPS) management plan must be compiled prior to the commencement of the construction phase. This plan must be implemented throughout the construction and operational phase and must be monitored by the ECO;
- Soil disturbance must be limited to the site plan only. Construction machinery may only use the existing pathways. Suitable drip trays must be placed beneath stationary construction machinery;
- No fires are permitted on site;
- Dust control measures must be implemented;
- Erosion control measures must be implemented throughout the site. Stockpiles may not exceed 5 m in height and must be covered using an impermeable material; and
- Suitable waste receptacles must be placed around the site which are both scavenger and wind proof.

8.5 Market Study

The recommendations provide two different scenarios that incorporate development potential and requirements for a mixed use residential development.

Scenario 1

This scenario considers all residential units within a given year. Looking at the requirements and demand for various facilities for the proposed mixed-use development. The following are recommended:

- An agreement is established with tertiary institutions in order to secure a sustainable number of students for the proposed student housing development
- The retail and office space are student-orientated to ensure that the student housing development is supported with the necessary retail and office services and thereby making the provision of student housing more sustainable.

Scenario 2

This scenario excludes CRU and subsidised housing. Looking at the requirements and deman for various facilities for the proposed mixed-use residential development. The following are recommended:

- That each unit accommodate four students (beds). Therefore, the projected demand for units is 926 for the year 2021 and is expected to grow to 1 188 units by 2030.
- An agreement is established with tertiary institutions in order to secure a sustainable number of students for the proposed student housing development.
- The office space developed for Unitas Park Extension 16 be used for these industries.
    - Wholesale and retail trade, catering and accommodation;
    - Finance, insurance, real estate and business services; and
    - Community, social and personal services.
- With the development of a student-orientated living space, it is recommended that office space/s are mainly focused on providing essential services to students and thereby creating a student friendly environment.

8.6 Traffic Impact Assessment

- The developers of the latent rights developments are required to contribute towards roads and intersection upgrades. The upgrading will be as per the requirements of ELM and GDRT.
- It is a requirement that pedestrian access must be provided to and from the development, particularly from public transport facilities. Currently, they are no formal transport facilities in the vicinity of the development exist.

- The planning of the development will however take into consideration possible future road-based public transport infrastructure along various provincial routes (existing or planned).
- The conflict between vehicular and pedestrian/bicycle traffic must be minimised.
- It is recommended that road K180 be provided with a pair of public transport lay-bys in the form of bus and taxi stops at each access point where access to the township is gained.
- The proposed lay-bys be constructed to the appropriate design standards of the relevant roads authority.

9 LIMITATIONS AND ASSUMPTIONS

9.1 Heritage Impact Assessment

The only limitation identified for the heritage assessment was the inaccessibility to the majority of the site. The Chance Find Protocol has been recommended, should any artefacts or structures of interest arise.

9.2 Paleontological Impact Assessment

Based on the geology of the area and the paleontological record, it can be assumed that the formation and layout of the sandstones, shales, coal, dolomites, cherts, basalts and lavas of the early Proterozoic Transvaal Supergroup and Palaeozoic Karoo Supergroup, are typical for the country. As a result, it is not anticipated these formations will contain fossils in the early Proterozoic Transvaal Supergroup, and could contain fossils in the Palaeozoic Karoo Supergroup. No fossils have been reported from this area. Borehole cores for the coalmines indicate that the coal seams are far below the surface.

9.3 Agricultural Agro-Ecosystem Assessment

At the time of submission of the Version 1 report, no data has been obtained from the farmer(s) that cultivate the land on any historical production figures of the project area for the past five years. It is likely that this data will become available as the public participation process commences. No anticipated employment figures has yet been received from the developer and will be included in the report when available. Similarly, it is expected that the farmer who leases the land from the Gauteng Department of Human Settlements will be identified during the public participation process. He will then be asked to discuss the current employment opportunities created by his farming activities on the property.

It was also assumed that the desktop grazing capacity and field crop boundary data obtained from DAFF, has high correlation with the actual conditions on site. No other uncertainties and gaps have been identified that may affect the conclusions made in this report.

9.4 Socio-Economic Assessment

In terms of the primary data, information could be gathered due Corona Virus pandemic and the lockdown that was announced on March 26, 2020. While all due care was taken to ensure that the assessment of impacts is accurate (and follows the conservative approach), provision of additional data could potentially impact the assessment of the significance of some impacts. Project-related information supplied by the team involved in the project for the

purpose of the analysis is assumed to be reasonably accurate. Thus, all impacts are analysed based on this information. Any changes hereon cannot be accounted for in the analysis.

The secondary data sources used to compile the economic baseline (dynamics of the economy and labour force), although not exhaustive, can be viewed as being indicative of broad trends within the study area. Possible impacts, as well as stakeholder responses to these impacts, cannot be predicted with complete accuracy, even when circumstances are similar, and these predictions are based on research and years of experience, taking the specific set of circumstance into account.

10 CONCLUSION AND WAY FORWARD

10.1 Conclusion

Local knowledge, professional experience and specialist knowledge of the area have all been used to identify the potential environmental issues associated with this development and the resultant potential environmental impacts. There is no guarantee that all the potential impacts arising from the proposed development have been identified within the Scoping Phase, however the report provides an outline of the established measures that were taken to best identify all the potential impacts. The purpose of the Scoping Phase is NOT to assess and mitigate the potential environmental impacts and issues identified but rather to scope them and determine which need further investigation before an assessment can be undertaken.

The circulation of this Draft Scoping Report for public comment aims to give the public a chance to review the outcomes of the Scoping Process and identify additional possible issues that have not been identified. This will further enhance the rigour of the scoping process. The Plan of Study for EIA outlines the strategy to identify and assess all these potential impacts and concerns in the Impact Assessment Phase.

10.2 Way Forward

The Draft Scoping Report will be submitted to all I&AP's for a 30 day comment period. All comments received from I&AP's will be included in the Comments and Response Report and included as an appendix to the Final Scoping Report.

Thereafter the Final Scoping Report, including the Plan of Study for EIA, will be submitted to the GDARD for review. Upon receipt of comment from the GDARD regarding the Final Scoping Report, the Terms of Reference for any further studies will be amended should it be required, and the studies initiated.

Following completion of the specialist studies and assessment of the impacts, a Draft Environmental Impact Report will be compiled and will follow a similar public participation procedure to that undertaken for the Scoping Phase whereby opportunities for engagement will be provided through stakeholder meetings and dissemination of project information. I&APs will, again, be afforded the opportunity to review the Draft Environmental Impact Report prior to submission to GDARD for assessment.

11 UNDERTAKING BY EAP

11.1 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I, Gerda Bothma, herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected Parties received since project announcement, have been correctly recorded in the report.

Signature of the EAP

Date: January 2021

11.2 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I, Gerda Bothma, herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with Interested and Affected Parties and stakeholders since announcement of the project, has been correctly recorded and reported herein.

Signature of the EAP

Date: January 2021

DEIR: List of Appendices

Appendix A- EAP Declaration

Appendix B- Gerda Bothma CV

Appendix C- Specialist Reports

Appendix C1- Ecological Impact Assessment Report

Appendix C2- Bulk Services Availability Report

Appendix C3- Bulk Electrical Services Report

Appendix C4- Outline Scheme Report

Appendix C5- Traffic Impact and Access Study Report

Appendix C6- Civil Engineering Services Outline Scheme Report

Appendix C7- Heritage Impact Assessment

Appendix C8- Palaeontological Impact Assessment

Appendix C9- Highest and Best Use Market Study

Appendix C10- Agricultural Agro-Ecosystem Specialist Assessment

Appendix C11- Socio-Economic Impact Assessment Study

Appendix D-Public Participation Process Documents

Appendix D1- IAP database

Appendix D2- Advertisements 2019

Appendix D3- BID

Appendix E- EMPr

APPENDIX A

Environmental Assessment Practitioner (EAP) Declaration

ADDENDUM 3

10. DECLARATION OF THE EAP

I **Gerda Bothma**, declare that -

- I act as the independent environmental practitioner[1] in this application for **Gauteng Rapid Land Release Programme: Unitas Park – Extension 16;**
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation, policies and guidelines;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public at large and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties, state department and competent authority will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- all the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and

Signature of the Environmental Assessment Practitioner:

GCS

Name of company:

2020/10/27.

Date:

Signature of the Commissioner of Oaths:

2020-10-27

Date:

CHIEF TELLER

Designation:

Commissioner of Oaths Official stamp (below)

KLOOF 3540
2020-10-27

RONALD NADOO
COMMISSIONER OF OATHS EX OFFICIO
CHIEF LEGAL ADVISOR
33 VILLAGE ROAD, KLOOF, 3610

[1] In the event where the EAP or specialist is not independent (Regulation 13(2) and (3) of the EIA Regulations, 2014), the proponent or applicant must, prior to conducting public participation, appoint another EAP or specialist which meets all the general requirements including being independent, to externally review all work undertaken by the EAP or specialist, at the applicant's cost appointed to manage the application.

APPENDIX B

Environmental Assessment Practitioner (EAP)
Curriculum Vitae (CV)

GCS
Water & Environmental
Consultants

Gerda Bothma

Senior Environmental Consultant

CORE SKILLS

- Project Management
- Technical & Impact Assessment Guidance
- Environmental Assessment
- Water Use Licencing
- Waste Management Licencing
- Environmental & Waste Auditing and Compliance Monitoring

DETAILS

Qualifications

- B.Sc. Microbiology (Honours) University of Pretoria 1996
- B.Sc. Biological Sciences University of Pretoria 1994

Memberships

- International Association for Impact Assessors of South Africa (IAIA)
- Institute of Waste Management of South Africa (IWMSA)
- SACNASP (No.117348) (South African Council for Natural Scientific Professionals)

Languages

- Afrikaans
- English

Countries worked in:

South Africa, Zambia, Namibia

PROFILE

Gerda has over 20 years' experience within the environmental and waste management field and strives to deliver custom environmental services to clients.

Gerda began her career in the environmental field within the government sector, managing environmental aspects and impacts as well as reviewing environmental assessments with the view of authorizing or declining authorization of the developments.

After six years within the government sector she joined a consulting engineering firm where she was ultimately responsible for the Management of the Environmental Sub-Division. Gerda has experience in project and client management, financial management and the compilation and costing of project proposals and tenders. She has been involved in several engineering projects as the Environmental Assessment Practitioner as well as the Environmental Control Officer during construction working closely with the Occupational Health and Safety Officer. Gerda has also been involved in projects where waste licensing as well as water use licensing processes formed an integral part of the services offered. Environmental auditing and compliance monitoring of waste disposal sites also forms part of her experience gained. She also has experience in dealing with projects which involve NEC3 Contracts.

Gerda has specialist skills in the following areas:

- Project proposals, planning, costing and timing
- Project and Client Management
- Authority Liaison
- Basic Assessments & Scoping/EIA Processes
- Compilation
- Amendment of EA's & EMP's
- Facilitation of Public Participation Processes & stakeholder engagement
- IWULA & IWWMP Applications
- Environmental Control Officer (ECO) duties
- Environmental Compliance Auditing (IFC Performance Standards & Equator Principles)
- Mentorship & Guidance

Year	Client	Project Description	Role/ Responsibility
Strategic and Environmental Guidance Projects			
1999 to 2003	Gauteng Department of Agriculture, Conservation & Environment	Development of a Health Care Risk Waste Management Strategy for Gauteng.	Part of Development Team
2001 to 2003	Gauteng Department of Agriculture, Conservation & Environment	Development of Minimum Domestic Waste Collection Standards for Gauteng Province.	Part of Development Team
2002	Gauteng Department of Agriculture, Conservation & Environment	Development of new EIA guidelines and regulations for the Gauteng Province.	Part of Development Team
2005	Gauteng Department of Agriculture, Conservation & Environment	GDACE Green Procurement Project: Development of the GDACE Green Procurement Policy, Gauteng	Project Manager & Reviewer
2008	GAUTRAIN Project Engineers (i.e. KV3 Engineers)	Environmental Assistance for the Gautrain Project: Environmental Evaluation of various documentation and engineering designs in terms of their environmental compliance.	Project Manager & Reviewer
2009	Department of Environmental Affairs	Alignment of MIG Project Process with EIA Process: Evaluation of the EIA process as well as the MIG process in order to produce a process alignment guideline to the municipalities to streamline the two processes.	Part of Development Team
Environmental Feasibility and Screening			
2008	Nu Way-property Developments	Management of Environmental Screening and Due Diligence Assessment for several proposed Nu Way-property Developments, Gauteng.	Project Manager
2008	Department of Water Affairs	Mokolo Croc WAP Environmental Feasibility and Screening, Limpopo.	Project Manager & Senior Environmental Assessment Practitioner (EAP)
2016	Kwadukuza Municipality	Environmental Feasibility for Civil Engineering Project Foxhill Road Alignment and Construction, Tongaat, Kwa-Zulu-Natal.	Environmental Project Leader
2016	King Sabata Dalindyebo Local Municipality (C/O OR Tambo District Municipality)	Environmental Screening Investigation of six proposed development corridors for the Mthatha Bulk Water Infrastructure Presidential Intervention – Phase 2: Secondary Bulk Infrastructure project.	Environmental Project Leader
Development Environmental Assessments			
2003 to 2005	ABSA DevCO	Environmental Impact Assessment for a change of land-use from agricultural to Residential and Town Development of the farm Brakfontein 399 JR, Centurion, Gauteng.	Project Manager & Senior EAP
2005 to 2010	Air Traffic Navigation Services	The project entails the upgrading of existing, and the provision of new air navigation	Project Manager & Senior

Year	Client	Project Description	Role/ Responsibility
	(ATNS)	sites (27 in total) throughout South Africa. Civil and electrical infrastructure to the sites needed to be upgraded to accommodate the equipment. Various Environmental Impact Assessments for various individual projects in various provinces within South Africa.	EAP
2006 to 2009	Amathole District Municipality	Elliotdale Rural Sustainable Human Settlement Pilot Project Environmental Impact Assessment. Responsible for the environmental assessment process which was based on a strategic approach for the Elliotdale Rural Housing Project, Elliotdale, Eastern Cape.	Project Manager & Senior EAP
2007	Elkem Ferroveld	Environmental Basic Assessment for the upgrading and expansion of the Ferroveld Plant in Ferrometals, Emahlaheni, Mpumalanga.	Project Manager & Senior EAP
2008	ABSA DevCO	Environmental Impact Assessment for a change in land use from agricultural to Residential and Town development of Montana X40, Pretoria, Gauteng.	Project Manager & Senior EAP
2012	Transnet Capital Projects	Environmental Basic Assessment and technical environmental investigations for the proposed expansion of the existing tug jetty and construction of a new tug jetty for Transnet Capital Projects in the Port of Durban, KwaZulu-Natal.	Project Manager & Senior EAP
2014 to 2016	Dube TradePort	Environmental Impact Assessment for the proposed construction of the Dube TradePort TradeZone 2 in La Mercy, KwaZulu-Natal.	Project Manager & Senior EAP
2014 to 2017	Dube TradePort	Environmental Impact Assessment for the proposed Support Precinct 2 Development in La Mercy, KwaZulu-Natal.	Project Manager & Senior EAP
2016 to 2017	Areena Resort	Application for rectification in terms of S24G and associated Environmental Basic Assessment for the alleged unlawful construction activities at the Areena Resort, Great Kei Municipality, Eastern Cape.	Project Manager & Senior EAP
2016 to 2017	Areena Resort	Application for rectification in terms of S24G and associated Environmental Basic Assessment for the alleged unlawful construction activities on Hillsdrift Farm, Great Kei Municipality, Eastern Cape.	Project Manager & Senior EAP
2018 to 2019	Watchman Properties (Pty) Ltd	Environmental Basic Assessment for the proposed Vendome Residential Development on Portion 1 of Farm 1766 and Portion 2 of Farm 1766, Paarl, Western Cape, South Africa.	Project Manager & Senior EAP
2018 to 2019	Keysha Investments 213 (Pty) Ltd	Environmental Basic Assessment for the proposed River Farm Estate Development and associated infrastructure on remainder of farm Rivierplaas No. 1486, Erf 111 and Erf 197, Paarl, Western Cape, South Africa.	Project Manager & Senior EAP
2018 to 2019	Paarl Vallei Developments (Pty) Ltd	Environmental Basic Assessment for the proposed Paarl Valleij Retirement Village Development, Paarl, Western Cape, South Africa.	Project Manager & Senior EAP
2018 to 2019	Val de Vie Investments (Pty) Ltd	Parallel Substantive Amendment Application process for the authorised Pearl Valley II & Levendal Residential Developments, Paarl, Western Cape, South Africa.	Project Manager & Senior EAP
Renewable Energy Environmental Assessments			
2011	Farmsecure Carbon	Environmental Basic Assessment and Water Use License Application process for a proposed Biogas Waste to Energy project for a pig farm, Mooiriver, KwaZulu-Natal.	Project Manager & Senior EAP

Year	Client	Project Description	Role/ Responsibility
2018 to 2019	GPIPD – Doornfontein Solar Farm (Pty) Ltd	Environmental Impact Assessment for the proposed 230 MW Doornfontein Photovoltaic Solar Energy Facility (PVSEF) located on Remainder of Farm 118, Doornfontein, Piketberg, Bergrivier Local Municipality, Western Cape.	Project Manager & Senior EAP
2018 to 2019	GPIPD – Kruispad Solar Farm (Pty) Ltd	Environmental Impact Assessment for the proposed 150 MW Kruispad Photovoltaic Solar Energy Facility (PVSEF) located on Remainder of Farm 120, Kruispad, Piketberg, Bergrivier Local Municipality, Western Cape.	Project Manager & Senior EAP
2018 to 2019	Brandvalley Wind Farm (Pty) Ltd	Substantive Amendment Application for the authorised 140 MW Brandvalley Wind Energy Facility (WEF) located within the Karoo Hoogland, Witzenberg and Laingsburg Local Municipalities in the Northern and Western Cape Provinces.	Project Manager & Senior EAP
2018 to 2019	Copperton Wind Farm (Pty) Ltd	Non-Substantive Amendment Application to update the information of the Holder of the Environmental Authorisation & an EMPr Amendment Process to update the Airstrip Alignment and to provide an updated "outcomes based" EMPr for the Copperton Wind Energy Facility near Copperton in the Northern Cape.	Project Manager & Senior EAP
2018 to 2019	WKN Windcurrent SA (Pty) Ltd	Environmental Impact Assessment for the proposed 150 MW Haga Haga Wind Energy Facility (WEF) & Environmental Basic Assessment for the associated Haga Haga Overhead Powerline (OHPL) in Haga Haga, Great Kei Local Municipality, Eastern Cape.	Project Manager & Senior EAP
Mining Environmental Assessments			
2007	Chris Hani Municipality	Environmental Assessment and DME Licence Application on behalf of Chris Hani Municipality. Responsible for exemption application from Mining Permit and Environmental Management Programmes for 17 borrow pits in Middelburg, Eastern Cape.	Project Manager & Senior EAP
2010	Samancor Chrome Limited	The Lwala Greenfields Mine and Smelter EIA and EMP. Responsible for the Environmental impact assessment and technical investigations for the waste management issues for the proposed development of a new chrome smelter project in the Steelpoort area, Limpopo.	Project Manager & Senior EAP
2011	Xtrata Alloys	Xtrata Alloys Western Mines PSV application for authorization in terms of the MPRDA. Responsible for the undertaking of the EIA and compilation of the amended EMPr and technical environmental investigations for the proposed development of an open cast mine in Rustenburg, North West.	Project Manager & Senior EAP
Waste Management Environmental Assessments			
2003	Assmang Chrome Machadodorp	Environmental Impact Assessment for the permitting of the H:H Hazardous Waste Disposal Facility at Assmang Chrome, Machadodorp.	Senior EAP
2004	Emfuleni Local Municipality	Environmental Impact Assessment for the closure of the Zuurfontein Landfill site for the Emfuleni Local Municipality, Sedibeng, Gauteng	Senior EAP
2004	Ekurhuleni Municipality	Environmental Impact Assessment for the closure of the Sebenza Landfill Site for the Ekurhuleni Municipality, Gauteng.	Senior EAP
2004	Tzaneen Local Municipality	Application for authorisation and EIA for the permitting of an existing solid waste disposal site for the Tzaneen Local Municipality, Mpumalanga.	Senior EAP

Year	Client	Project Description	Role/ Responsibility
2006	Samancor Chrome Middelburg	Environmental Basic Assessment for the permitting of the existing Slag Waste Disposal facility for Samancor Chrome Middelburg, Mpumalanga.	Senior EAP
2006	Samancor Chrome Ferrometals	Environmental Basic Assessment for the permitting of the existing Slag Waste Disposal facility for Samancor Chrome Ferrometals Witbank, Mpumalanga.	Senior EAP
2007	Steve Tshwete Municipality	Environmental Impact Assessments for four Solid waste Transfer Stations for the Steve Tshwete Municipality, Mpumalanga.	Senior EAP
2008	Assmang Chrome Machadodorp	Environmental Impact Assessment for the expansion of the existing Slag Waste Disposal Facility at Assmang Chrome. Responsible for the EIA application for authorization for the proposed expansion project in Machadodorp, Mpumalanga.	Project Manager & Senior EAP:
2010	ArcelorMittal	ArcelorMittal BOF Slag Disposal site licensing of new site and closure of old site, Newcastle, KwaZulu-Natal.	Project Manager & Senior EAP:
2010	Lekwa Municipality	Waste Management License Application for authorization and the conducting of an EIA and technical environmental investigation for the proposed development of two landfill sites for the Lekwa Municipality, Mpumalanga.	Project Manager & Senior EAP:
2015 to 2017	Umgungundlovu Municipality	Advanced Solid Waste Management Project for Umgundgundlovu Municipality for proposed Materials Recovery Facilities located in various Local Municipalities, Umgungundlovu Municipality, KwaZulu-Natal.	Project Manager & Senior EAP:
Water and Wastewater Environmental Assessments			
2004	Msukaligwa Municipality	Environmental Impact Assessment for the installation of a water reticulation system at Nganga for the Msukaligwa Municipality, Mpumalanga.	Senior EAP
2006 to 2010	eThekwini Municipality: Water and Sanitation	Proposed upgrading of the WWTW capacity in the Northern Areas of the eThekwini Municipality. Responsible for EIA application for authorization, technical environmental investigations, and waste management license application for the proposed expansion of the WWT capacity in Northern eThekwini, KwaZulu-Natal.	Project Manager & Senior EAP
2008	Johannesburg Water	Environmental Management Services for Johannesburg Water: Environmental Impact Assessment (Exemption) for various individual projects related to the upgrading of the Bryanston Water Mains, Gauteng.	Project Manager & Senior EAP
2014 to 2017	eThekwini Municipality: Water and Sanitation	Environmental Basic Assessment and Water Use License Application for the Northern Aqueduct Water Augmentation Project (Phase 5), Durban, KwaZulu-Natal.	Project Manager & Senior EAP
Electrical and Linear Environmental Assessments			
2005	Magallies Water	Application for (exemption) authorisation on behalf of Magallies Water for the installation of the Rising Main from the Roodeplaat Waterworks to the Wallmannsthal Reservoir, in Wallmannsthall, Gauteng.	Senior EAP
2010	Moloto Rail Corridor Development	EIA for the Moloto Rail Corridor Development. Responsible for the EIA application for authorization and technical environmental investigations for the proposed Moloto Rail Corridor Development, Moloto, Gauteng.	Project Manager & Senior EAP

Year	Client	Project Description	Role/ Responsibility
2010	ESKOM	Environmental Basic Assessment of for the ESKOM Honingklip 88kV & ESKOM Randjiesfontein 88kV overhead line and Sub-Stations, Johannesburg, Gauteng.	Project Manager & Senior EAP
2010	ESKOM	Environmental Basic Assessment of for the ESKOM Ubertas Strategic Servitude Sub-Station, Johannesburg, Gauteng	Project Manager & Senior EAP
2014 to 2017	Msunduzi Municipality	Environmental Impact Assessment for the proposed Msunduzi IRPTN project, Pietermaritzburg, KwaZulu-Natal	Project Manager & Senior EAP
Environmental and Waste Management Compliance Monitoring and Auditing			
2005 to 2009	Sedibeng District Municipality	Auditing of Zuurfontein and Boitshepi Landfill sites for the Sedibeng District Municipality, Gauteng.	Part of Audit Team
2006 to 2009	ABSA DevCO	Environmental Compliance monitoring in accordance with relevant authorisation conditions and environmental management plans for the Amberfield Development on the farm Brakfontein 399 JR, Centurion, Gauteng.	Project Manager & Environmental Control Officer (ECO)
2007 to 2009	ABSA DevCO	Environmental Compliance monitoring in accordance with relevant authorisation conditions and environmental management plans for the Zambezi Estate Development, Montana, Gauteng.	Project Manager & ECO
2008 to 2009	Steve Tshwete Municipality	Auditing of Middelburg Landfill Site for the Steve Tshwete Municipality, Mpumalanga.	Part of Audit Team
2008 to 2009	ABSA DevCO	Environmental Compliance monitoring in accordance with relevant authorisation conditions and environmental management plans for the Cedar Creek Development, Fourways, Gauteng.	Project Manager & ECO
2017 to 2018	Dube TradePort	Environmental Compliance monitoring in accordance with relevant authorisation conditions and environmental management plans for the construction of TradeZone 2, Dube TradePort, La Mercy, KwaZulu-Natal.	Project Manager & ECO
2017	Richards Bay Minerals	Environmental Legal Compliance Audit to determine the level of compliance of Richards Bay Minerals' to their various mining, water and waste licenses and environmental authorisations and permits, Richards Bay, KwaZulu-Natal.	Project Manager & Environmental Auditor
2017 to 2018	eThekwini Municipality	Environmental Compliance monitoring in accordance with relevant authorisation conditions and environmental management plans for the construction of the Northern Aqueduct Phase 5, Durban, KwaZulu-Natal.	Project Manager & ECO
Integrated Water Use License Applications			
2010	FOSKOR	Integrated Water Use License Application for a new storage dam for FOSKOR, Richards Bay, KwaZulu-Natal.	Part of Project Team
2014 to 2015	SANRAL	Integrated Water Use License Applications as required for the proposed SANRAL N2 Road upgrade from Mthunzini to Empangeni, KwaZulu-Natal.	Project Manager & Senior EAP
2014	eThekwini Municipality: Roads	Integrated Water Use License Application for the proposed Realignment of Inanda Arterial Road, Durban, KwaZulu-Natal.	Project Manager & Senior EAP

Year	Client	Project Description	Role/ Responsibility
2015 to 2017	SMEC (Umzimkulu Municipality)	Integrated Water Use License Application for the proposed Licensing of the existing Umzimkhulu Waste Water Treatment Works, Umzimkhulu, KwaZulu-Natal.	Project Manager & Senior EAP
2014 to 2016	eThekwini Municipality: Roads	Water Use License Application for the proposed eThekwini BRT Route C1A, Durban, KwaZulu-Natal.	Project Manager & Senior EAP
Management and Master Plans			
2005	Livingstone Municipality	Development of the Livingstone Integrated Development Plan, Zambia.	Part of the Project Team
2008	Steve Tshwete Municipality	Development of an Integrated Waste Management Plan for the Steve Tshwete Municipality, Mpumalanga.	Part of the Project Team
2008	Kungwini Local Municipality	Development of an EMP (Framework) for Kungwini Local Municipality, Mpumalanga.	Part of the Project Team
2010	KZN Department of Public Works – Southern Region	Compilation of an Environmental Management Plan for the Fort Napier sewage upgrading project, Pietermaritzburg, Kwa-Zulu Natal.	Project Manager & Senior EAP

APPENDIX C
Specialist Reports

APPENDIX C1

Ecological Impact Assessment Report

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Proposed Residential and Mixed-Use Development in Unitas Park Extension 16, Emfuleni Local Municipality Gauteng: Ecological Impact Assessment Report

Version – Version 1

24 March 2020

GCS Project Number: 19-0921

Prepared for: Phumaf Engineering

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	Name	**Signature**	**Date**
Author	Gareth Preen		24/03/2020
Author, Document Reviewer & Ecology Unit Manager	Sean Ripley		24/03/2020
Director	Adam Gunn		16/10/2020

DECLARATION

I, Gareth Preen, declare that:

- I act as an independent specialist;
- Results will be interpreted in an objective manner, even if the viewpoints are not favourable to the applicant;
- I have the relevant expertise to conduct a report of this nature, including knowledge of the National Environmental Management Act (Act 107 of 1998) and the National Water Act (Act 36 of 1998);
- I will comply with the act(s) and other relevant legislation; and
- I understand that any false information published in this document is an offense in terms of regulation 71 and is punishable in terms of Section 24 (f) of the Act.

_____
Gareth Preen
Environmental Contractor

EXECUTIVE SUMMARY

GCS Water and Environmental Consultants (Pty) Ltd (GCS) have been appointed by Phumaf Engineering (Phumaf) to undertake the Environmental Impact Assessment (EIA) process for the proposed development of residential and mixed land uses as part of the Gauteng Rapid Land Release Programme (GRLRP) hereafter referred to as the 'proposed development'. As part of the EIA process, Phumaf require terrestrial ecological and wetland assessments of portion 222 of the farm, Houtkop 594, otherwise known as Unitas Park Extension 16 and will hereafter be referred to as the 'proposed development area'.

Wetland Assessment

The wetland assessment identified one unchanneled valley bottom wetland within the 500 m regulated area. It was determined that this system may be impacted upon by the proposed development which necessitated further assessment of its ecological state and functional importance.

The PES of the system was determined to be 'moderately modified' due to serious alterations to the hydrology of the system through canalization and stream channel modifications. The vegetation and geomorphology of the system was determined to be largely natural only being impacted by commercial agriculture in the surrounding area. The functional assessment determined that the system provides good erosion control as well as phosphate trapping.

Based on the findings of the wetland assessment, the following recommendations have been highlighted for consideration

- The wetland system must be demarcated as a no-go zone; and
- A 45 m buffer must be established and maintained during the construction phase of the proposed development. This must be monitored by the ECO.

Biodiversity Assessment

The biodiversity assessment identified 3 habitat types as follows:

- Open grassland;
- Degraded grassland; and
- Freshwater hydrophytes.

The open and degraded grassland were determined to have low to very low naturalness due to the extensive commercial agriculture taking place within the study area. During the infield floral assessment, no species of conservation concern were observed. The study area falls

within the Soweto Highveld Grassland which is considered to be endangered. However, very small and scattered areas of open grassland was identified.

Although the area has the potential to provide habitat for a diverse range of fauna species in a natural state, the degraded nature resulted in very few fauna species being observed. One (1) mammal species, namely the *Lepus saxtilis* (Scrub Hare) (LC) was observed. Additionally, large flocks of *Streptopelia decipiens* (African Dove) (LC) were observed.

Based on the findings of the biodiversity assessment, the following recommendations have been highlighted for consideration:

- The open grassland areas must be avoided as far as reasonably practicable;
- Vegetation clearing must be limited to the site plan only. No unnecessary vegetation clearing is permitted;
- An Invasive Alien Plant Species (IAPS) management plan must be compiled prior to the commencement of the construction phase. This plan must be implemented throughout the construction and operational phase and must be monitored by the ECO;
- Soil disturbance must be limited to the site plan only. Construction machinery may only use the existing pathways. Suitable drip trays must be placed beneath stationary construction machinery;
- No fires are permitted on site;
- Dust control measures must be implemented;
- Erosion control measures must be implemented throughout the site. Stockpiles may not exceed 5 m in height and must be covered using an impermeable material; and
- Suitable waste receptacles must be placed around the site which are both scavenger and wind proof.

Licensing Requirements

Following the undertaking of the risk assessment matrix, it was determined that in a post-mitigation scenario, the proposed development will have a low risk of impacting the wetland system. As such, it is the opinion of the specialist that the proposed development be granted a general authorisation under GN 509.

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1 INTRODUCTION

GCS Water and Environmental Consultants (Pty) Ltd (GCS) have been appointed by Phumaf Engineering (Phumaf) to undertake the Environmental Impact Assessment (EIA) process for the proposed development of residential and mixed land uses as part of the Gauteng Rapid Land Release Programme (GRLRP) hereafter referred to as the 'proposed development'. As part of the EIA process, Phumaf require terrestrial ecological and wetland assessments of portion 222 of the farm, Houtkop 594, otherwise known as Unitas Park Extension 16 and will hereafter be referred to as the 'proposed development area'.

GCS undertook the infield assessment on the 04th of March 2020. The proposed development site is approximately 146.54 hectares (Ha) in size and the current land use practices observed are commercial agriculture, residential infrastructure and road infrastructure.

According to the National Water Act (Act 36 of 1998) wetlands are defined as, 'land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil'. The aforementioned definition is widely accepted within the South African Context. Wetlands are an integral component of life support system on earth through the provision of freshwater and niche habitats (Ramsar Convention Secretariat, 2010). Wetlands provide several goods and services, not only for the environment but for humankind as well. Some of these goods and services include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, erosion control, carbon storage, provision of water, resources and food (Kotze *et al*, 2007).

Prior to the 1960s, wetlands were perceived to be of little to no use and destruction of wetlands was the norm globally. This perception was much the same in South Africa where wetlands were often converted for agriculture, dams, forestry, waste disposal sites and pastures. Accordingly, wetlands are considered as threatened ecosystems. In response, the Department of Water and Sanitation (DWS) set up a programme known as 'Working for Wetlands' which funds the implementation of much needed wetland rehabilitation projects (King *et al*, 2015).

According to the National Environmental Management: Biodiversity Act (NEM:BA) (Act 10 of 2004) Biodiversity refers to, "the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species and of ecosystems". South Africa is considered as the third most diverse country in the wold with approximately 95 000 known species. However, measures to protect biodiversity are generally under-funded

and are of low priority at national level (Turpie, 2003). This problem arises due to the social value of biodiversity being unknown and therefore the impact of the loss of biodiversity on social well-being is not recognised (Turpie, 2003).

In an attempt to avoid further degradation of these valuable ecosystems, it is imperative that the baseline condition or natural state of the systems are determined and identify potential impacts of the proposed development. Following this the mitigation hierarchy of avoidance, mitigation and rehabilitation measures will be provided to ensure minimal impact to biodiversity and wetlands on the proposed development area.

1.1 Locality

The proposed development area and associated study area are located approximately 5.1 kilometers (kms) north west of the town of Vereeninging, within the Emfuleni Local and Sedibeng District Municipalities, Gauteng (Figure 1-1). The approximated centre point coordinates for the proposed development area are provided in Table 1:1 below.

Table 1:1: Approximate centre point coordinates of the proposed development.

DESCRIPTION	LATITUDE	LONGITUDE
Approximate centre point of the proposed development	26°37'30.35"S	27°54'12.42"E

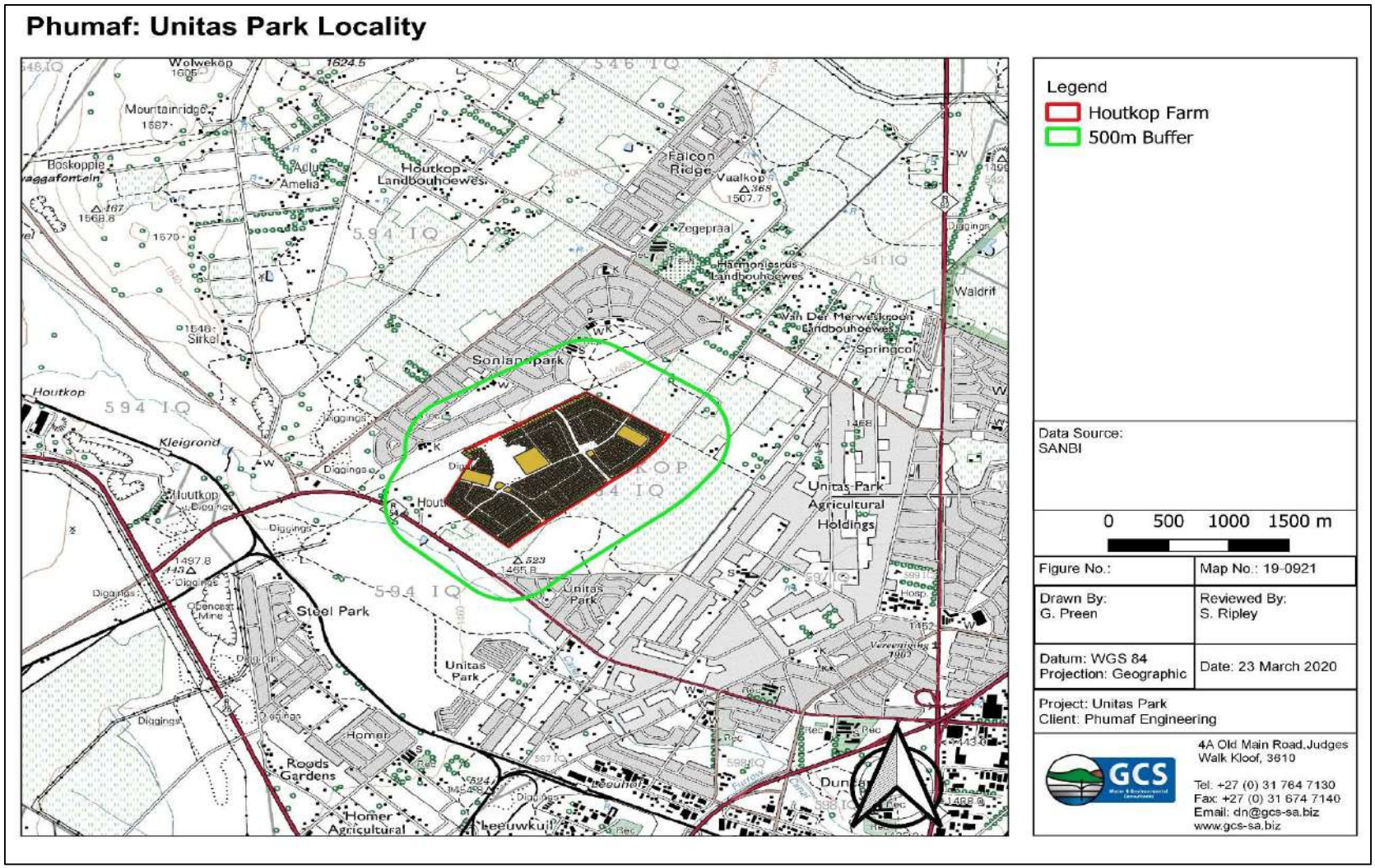

Figure 1-1: Map illustrating the site locality.

1.2 Scope of Work

The scope of work to undertake the wetland and biodiversity assessments are as follows:

1.2.1 Wetland Study

- Desktop delineation and illustration of the wetland systems within the study area utilising available satellite imagery and relevant geospatial data sources;
- Infield ground truthing and delineation of wetland boundaries in accordance with the methodologies outlined in 'A Practical Field Procedure for the Identification and Delineation of Wetland and Riparian Areas' (DWAF, 2009);
- Classification of the Hydrogeomorphic (HGM) setting of the wetlands identified on site using the National Wetland Classification System by the South African National Biodiversity Institute (SANBI) (2009);
- Assessment of the Present Ecological State (PES) and Ecological Goods and Services (EcoServices) of the Wetland;
- Identification, prediction and description of the potential impacts of the proposed development on the wetland systems within the study area;
- Mitigation measures for the identified potential impacts;
- Rehabilitation guidelines for disturbed areas associated with the proposed development; and
- Monitoring protocol for the proposed development.

1.2.2 Biodiversity Study

- Desktop assessment of relevant internet based and geospatial data sources;
- Phytosociological classification to identify dominant vegetation species;
- Visual based survey of fauna species within the study area;
- Identification, prediction and description of the potential impacts of the proposed development on biodiversity within the study area;
- Mitigation measures for the identified potential impacts;
- Rehabilitation guidelines for disturbed areas associated with the proposed development; and
- Monitoring protocol for the proposed development.

2 METHODOLOGIES

2.1 Wetland Study

2.1.1 Desktop Assessment

The desktop assessment made use of satellite imagery of the study area as well as geospatial data as listed in Table 2:1. The data sources were utilised to identify potential wetland systems within the study are and the expected boundaries were mapped. The potential wetland areas were then classed into their respective Hydrogeomorphic (HGM) units based on the 'National Classification System (SANBI, 2009) (Table 2:2) (Figure 2-1). The completed map was then used as a guide during the infield assessment and the location, boundaries and classification of the HGM units were confirmed.

Table 2:1: Data sources utilised during the desktop wetland assessment.

DATA	SOURCE	APPLICABILITY
Google Earth Satellite Imagery	Google Earth Pro ™	Up to date and historical satellite imagery of the study area, desktop wetland identification and delineation.
Contour Lines	Surveyor General	Desktop identification of drainage lines and potential freshwater resources.
Vegetation of South Arica, Lesotho and Swaziland.	Mucina and Rutherford (2006)	Determination of the vegetation unit within which the study area is located.
National Freshwater Ecosystem Priority Areas (NFEPAs)	CSIR (2011)	Identification of any conservation important freshwater resources.

Table 2:2: National Wetland Classification System (Source: SANBI, 2009).

HGM Type	Landscape Setting	Hydrological Characteristics		
		Inputs	Throughputs	Outputs
1. Channelled Valley Bottom Wetland	Valley floor	• Overland flow from adjacent valley-side slopes • Lateral seepage from adjacent hillslope seeps • Channel overspill during flooding	• Diffuse surface flow • Temporary storage in depressions • Short-lived concentrated flows during flood events	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation
2. Un-channelled Valley Bottom Wetland	Valley floor / plain	• Concentrated or diffuse surface	• Diffuse surface flow,	• Diffuse or concentrated surface flow,

HGM Type	Landscape Setting	Hydrological Characteristics		
		Inputs	Throughputs	Outputs
		flow from upstream • Channels and tributaries • Overland flow from adjacent valley-side slopes • Lateral seepage from adjacent hillslope seeps • Groundwater	• interflow, temporary storage of water in depressions, • Possible short-lived concentrated flows during high-flow events	• Infiltration and evaporation (particularly from depressional areas)
3. Floodplain Wetland	Valley floor / plain	• Channel overspill during flooding (predominantly) • Some overland flow from adjacent valley-side slopes (if present) • Lateral seepage from adjacent hillslope seeps (if present)	• Diffuse surface flow • interflow temporary storage of water in depressions • possible short-lived concentrated flows during flooding events	• Diffuse surface flow and interflow into adjacent channel • Infiltration and evaporation (particularly from depressional areas)
4. Exorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
5. Exorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Storage of water • Slow through-flow	• Concentrated surface flow
6. Endorheic Depression with channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Concentrated and (possibly) diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
7. Endorheic Depression without channelled inflow	Slope / valley floor / plain / bench	• Precipitation • Diffuse surface flow • Interflow • Groundwater	• Containment and storage of water	• Evaporation • Infiltration
8. Flat	Plain / bench	• Precipitation • Groundwater	• Containment of water • Some diffuse surface flow and/or interflow	• Evaporation • infiltration
9. Hillsope Seep with channelled outflow	Slope	• Groundwater • Precipitation (perched)	• Diffuse surface flow • Interflow	• Concentrated surface flow
10. Hillslope Seep without	Slope	• Groundwater • Precipitation (perched)	• Diffuse surface flow • Interflow	• Diffuse surface flow • Interflow

HGM Type	Landscape Setting	Hydrological Characteristics		
		Inputs	Throughputs	Outputs
channelled outflow				• Evaporation • Infiltration
11. Valley Head Seep	Valley floor	• Groundwater • Diffuse surface flow • Precipitation	• Diffuse surface flow • Interflow	• Concentrated surface flow

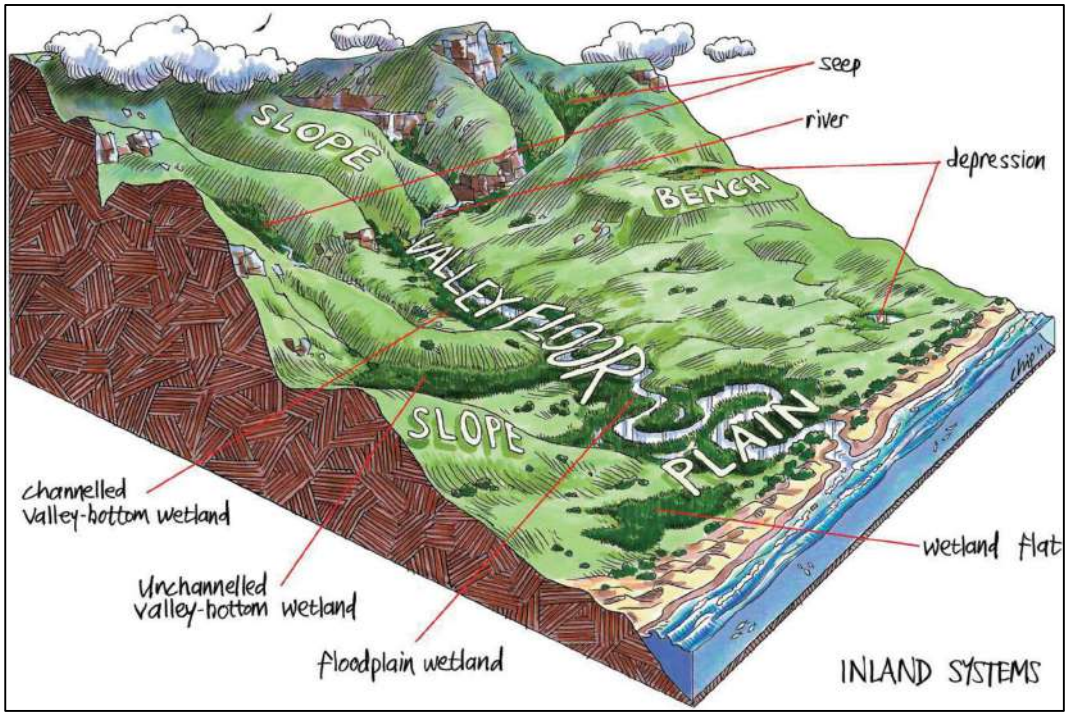

Figure 2-1: National Wetland Classification System (Source: SANBI, 2009).

2.1.2 Present Ecological State (PES)

For the purposes of this report, Present Ecological State (PES) of a wetland is a measure of how much a wetland's structure and functioning has been changed from its natural state. The 'WET-Health: A technique for rapidly assessing wetland health' by Macfarlane *et al*(2007) was applied to determine the PES. The WET-Health assists in determining the health of wetlands using indicators based on geomorphology, hydrology and vegetation. The tool allows for the determination of the source of ecosystem degradation.

WET-Health was utilised to quantify the impacts of anthropogenic impacts on wetland health which was then converted to an impact score (PES). It was necessary to assess the spatial extent and intensity of each identified impact on the wetland system. Subsequent to this, an overall magnitude of impact score was determined as outlined in Table 2:3 for geomorphology, hydrology and vegetation within the wetland system.Table 2:3: Guideline for determining the magnitude of impacts (Source: Macfarlane *et al*, 2008).

Table 2:3: Guideline for determining the magnitude of impacts (Source: Macfarlane *et al*, 2008).

IMPACT CATEGORY	DESCRIPTION	SCORE
None	No discernible modification or the modification is such that it has no impact on this component of wetland integrity.	0 - 0.9
Small	Although identifiable, the impact of this modification on this component of wetland integrity is small.	1 - 1.9
Moderate	The impact of this modification on this component of wetland integrity is clearly identifiable, but limited.	2 - 3.9
Large	The modification has a clearly detrimental impact on this component of wetland integrity. Approximately 50% of wetland integrity has been lost.	4 - 5.9
Serious	The modification has a highly detrimental effect on this component of wetland integrity. Much of the wetland integrity has been lost but remaining integrity is still clearly identifiable.	6 - 7.9
Critical	The modification is so great that the ecosystem processes of this component of wetland integrity are almost totally destroyed, and 80% or more of the integrity has been lost.	8 - 10

Impact scores obtained for each of the above-mentioned components indicate the degree of change from natural conditions. The resultant health scores fall into one of six health categories on a gradient from 'unmodified/natural (Category A) to 'critically modified' (Category F). The descriptions of each health score category is provided in Table 2:4.

Table 2:4: Description of health scores used in the WET-Health tool (Source: Macfarlane *et al*, 2008).

IMPACT CATEGORY	DESCRIPTION	RANGE	PES CATEGORY
None	Unmodified, natural.	0 - 0.9	**A**
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1 - 1.9	**B**
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2 - 3.9	**C**
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4 - 5.9	**D**

IMPACT CATEGORY	DESCRIPTION	RANGE	PES CATEGORY
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6 - 7.9	**E**
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8 - 10	**F**

The overall wetland health score was calculated by weighting the scores obtained for hydrology, geomorphology and vegetation and combining them to produce an overall health score using the following formula:

$$Overall\ Health\ Rating = [(Hydrology \times 3) + (Geomorphology \times 2) + (Vegetation \times 2)] \div 7$$

2.1.3 Wetland Functional Importance (EcoServices)

WET-Ecoservices was utilised to determine and assess the goods and services that the wetland provides. The first step that needed to be undertaken was to classify the wetland according to its HGM unit. Ecosystem service delivery was then assessed either at Level 1, based on existing knowledge or at Level 2, based on a field assessment of key descriptors. For the purposes of this assessment, a Level 2 assessment was undertaken. Several ecosystem goods and services were assessed as outlined in Table 2:5.

Table 2:5: List of EcoServices provided by wetlands (Source: Kotze *et al*, 2007).

Ecosystem services supplied by wetlands	Indirect benefits	Regulating and supporting benefits	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland, thereby reducing the severity of floods downstream
			Streamflow regulation		Sustaining streamflow during low flow periods
			Water quality enhancement benefits	Sediment trapping	The trapping and retention in the wetland of sediment carried by runoff waters
				Phosphate assimilation	Removal by the wetland of phosphates carried by runoff waters
				Nitrate assimilation	Removal by the wetland of nitrates carried by runoff waters
				Toxicant assimilation	Removal by the wetland of toxicants (e.g. metals, biocides and salts) carried by runoff waters
				Erosion control	Controlling of erosion at the wetland site, principally through the protection provided by vegetation.
			Carbon storage		The trapping of carbon by the wetland, principally as soil organic matter
	Direct benefits	**Biodiversity maintenance[2]**			Through the provision of habitat and maintenance of natural process by the wetland, a contribution is made to maintaining biodiversity
		Provisioning benefits	Provision of water for human use		The provision of water extracted directly from the wetland for domestic, agriculture or other purposes
			Provision of harvestable resources		The provision of natural resources from the wetland, including livestock grazing, craft plants, fish, etc.
			Provision of cultivated foods		The provision of areas in the wetland favourable for the cultivation of foods
		Cultural benefits	Cultural heritage		Places of special cultural significance in the wetland, e.g., for baptisms or gathering of culturally significant plants
			Tourism and recreation		Sites of value for tourism and recreation in the wetland, often associated with scenic beauty and abundant birdlife
			Education and research		Sites of value in the wetland for education or research

As with the WET-Health tool, the WET-EcoServices tool a gradient of rating classes is provided based on the overall scores allocated to the different ecosystem services. The allocation of the rating classes is based on Table 2:6.

Table 2:6: EcoServices rating classes (Source: Kotze *et al*, 2009).

SCORE	<0.5	0.5 - 1.2	1.3 - 2.0	2.1 - 2.8	>2.8
Rating of the likely extent to which a benefit is being supplied.	Low	Moderately	Intermediate	Moderately High	High

2.2 Biodiversity Assessment

In order to determine the current status of biodiversity within the study area and evaluate the extent of site-related impacts in terms of certain ecological indicators as well as the identification of specific important ecological attributes such as conservation important species, the biodiversity assessment was split into a floral and faunal component. The floral component consisted of conducting a phytosociological classification as guided by Brown *et al*, (2013). The faunal field assessment component involved sight-based observations in the field and adetailed desktop animal assessment per animal group (mammals, birds, amphibians, reptiles and invertebrates).

Prior to the infield investigation of the flora and fauna, detailed desktop assessments were undertaken for each which is described in the following section.

2.2.1 Desktop Assessments

The desktop biodiversity assessment made use of internet-based data sources and relevant geospatial datasets in order to compile species lists and to highlight the conservation status of each species which may occur within the study area. The International Union for Conservation of Nature (IUCN) website (https://www.iucnredlist.org/resources/grid) and the Fitzpatrick Institute of African Ornithology: Virtual Museum website (http://vmus.adu.org.za) were utilised to compile species lists for the study area (Table 2:7). The data from both websites were merged to form one comprehensive table of faunal species for the study area. Within these species lists, an outline is provided of species which have been recorded within the study area in the past or have been known to inhabit the area and, where data was available, the number of species recorded, and the date of last record. The red data and protected status of each species, according to the IUCN website, have also been included to gather an indication or the conservation importance of the study area from a faunal perspective.

The geospatial dataset produced by the South African National Biodiversity Institute (SANBI) (2018) in conjunction with Mucina and Rutherford (2012) was utilised to identify the vegetation type within which the study area occurs (Table 2:7). This dataset also provides the conservation status of the relevant vegetation type as well as species of conservation concern which are known to occur within the vegetation type. A species list with accompanying conservation status of the aforementioned species was also compiled.

Table 2:7: Internet based and geospatial datasets utilised during the desktop assessment.

DATASET	SOURCE/S	APPLICABILITY
Amphibian Geospatial Dataset	IUCN (2019) Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of amphibian species within the study area.
Avifaunal Dataset	Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of avifaunal species within the study area.
Butterfly Dataset	Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of butterfly species within the study area.
Dragonflies and Damselflies	Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of dragonfly and damselfly species within the study area.
Mammal Geospatial Dataset	IUCN (2019) Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of mammal species within the study area.
Reptile Dataset	IUCN (2019) Virtual Museum. Accessed 25 February 2020. www.vmus.org.za	Identification of reptile species within the study area.
Vegetation Map of South Africa, Lesotho and Swaziland	Mucina and Rutherford (2012) SANBI (2018)	Identification of the vegetation type and species of conservation concern within the study area.

The primary objective of the compilation of the fauna and flora species lists, as described above, was to provide a guide for the field assessment. The lists highlighted the species of conservation concern which needed to be identified if present within the study area. This allowed for any special mitigation and rehabilitation measures to be suggested. However, any other species included in the list which are not of conservation concern were not overlooked during the field assessment. The field assessment was, therefore, necessary to confirm the presence or absence of the listed species within the study area. Where applicable, additional sightings not included in the lists, were included in the final dataset produced within this report.

2.2.2 Phytosociological Classification

The methodology outlined in the, 'Guidelines for phytosociological classifications and descriptions of vegetation in Southern Africa' by Brown *et al* (2013) was implemented to carry out the phytosociological classification.

As per the guidelines, it was necessary to identify homogenous vegetation units within the study area using Remote Sensing and a Geographic Information System (GIS). Relevant geospatial datasets such as land use and land cover were utilised in conjunction with satellite imagery to aid in the identification of the vegetation units for the infield survey. During the field assessment, sampling plots were randomly identified ensuring that the plot is representative of the perceived plant community within the larger study area. The sample plots were outlined into quadrants using nylon rope. In order to comply with statistical requirements in local phytosociological studies, a minimum of three (3) sample plots per stratified physiognomic-physiographic units would need to be identified.

Each plant species within the sample plots were identified and recorded. Cover abundance of each species was then assigned based on visual inspection.

3 LEGISLATION APPLICABLE TO WETLANDS AND BIODIVERSITY

3.1 Legislation Applicable to Wetlands

LEVEL	LEGISLATION/POLICY	DESCRIPTION
National	National Water Act (Act 36 of 1998) (NWA)	The NWA protects South Africa's water resources and associated ecosystems and their biological diversity. This act serves to reduce and prevent the pollution and degradation of water resources.

		Section 21 (c) and (i) of the NWA makes provision for impeding or diverting the flow of a watercourse and the altering of the bed, banks, course or characteristics of a watercourse, respectively. Should a watercourse be located within the 500 m regulated area of a proposed development, a water use license in respect of the above-mentioned water uses will need to be applied for. General Notice 509 published in Government Gazette no. 40229 under section 39 of the NWA makes provision for General Authorisations (GA). The 2015 DWS Risk Assessment Matrix (RAM) is used to determine the risk of the proposed water use to the receiving aquatic environment in terms of Section 21 (c) and (i). The three risk categories are; low, moderate and high. If the water use is determined to be of a low risk to the watercourse, then a GA may be applicable, subject to consultation with the DWS. Should the risk be determined to be moderate or high then full WULA process will need to be followed.
National	National Environmental Management Act (Act 107 of 1998) NEMA.	NEMA is the overarching legislation with regards to the environment which fundamentally promotes sustainable development. The listed activities related to wetlands that require environmental authorization is as follows: Listing Notice 1 (GNR 327) Activity 12: The development of- (i) infrastructure or structures with a physical footprint of 100 square meters or more; where such development occurs- (a) within a watercourse; (b) if no development setback exists, within 32 meters of a watercourse, measured from the edge of a watercourse;- excluding- (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;

		(bb) where such development activities are related to the development or a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structure where such infrastructures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.

3.2 Legislation Applicable to Biodiversity

LEVEL	LEGISLATION/POLICY	DESCRIPTION
International	The Convention of Biological Diversity (Rio de Janeiro, 1992).	The purpose of the Convention on Biological Diversity is to conserve the variability among living organisms at all levels. Primary objectives of this convention are to conserve biodiversity, use biodiversity in a sustainable manner and sharing the benefits of biodiversity fairly and equitably.
National	South African Constitution (Act 108 of 1996).	The Constitution is the supreme law of South Africa and is inclusive of the Bill of Rights. This includes the right to an environment which is not harmful to human health or well-being and to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures.
	National Environmental Management Act (NEMA) (Act 107 of 1998).	NEMA is the overarching legislation with regards to the environment which fundamentally promotes sustainable development. The 'precautionary approach' and 'polluter pays' principles are rooted in NEMA and requires responsibility for impacts to be undertaken throughout the life cycle of a proposed project.
	National Environmental Management: Biodiversity Act	NEMBA ensures the management and conservation of biodiversity in South Africa within the framework of NEMA. The purpose of NEMBA is to protect species and ecosystems as well as to promote the sustainable use of biodiversity resources. NEMBA also addresses aspects

LEVEL	LEGISLATION/POLICY	DESCRIPTION
	(NEMBA) (Act 10 of 2004).	such as the protection of threatened ecosystems and necessitates a duty of care in terms of alien invasive species. The South African National Biodiversity Institute (SANBI) was established through this act and is responsible for coordinating and implementing programs relating to biodiversity.
	Conservation of Agricultural Resources Act (Act 43 of 1967).	The aim of this act is prevent the exploitation of South Africa's natural agricultural resources and to ensure the conservation of soil and water resources and natural vegetation. The act has also categorised a large number of invasive alien species. The act also provides obligations to landowners on which these species occur such as the removal of categorised invasive alien invasive species and to prevent the proliferation thereof.
	National Forest Act (Act 84 of 1998)	This act provides a comprehensive mandate for the protection of all natural forests in South Africa. Section 3 of the act stipulates that no development may take place if it impacts on a forest. Only in exceptional circumstances may this be allowed. Section 7 of the act prohibits the cutting, disturbance, distruction or removal of any indigenous tree whether it be living or dead in a forest without a license. Section 15 of the act institutes a similar prohibition on protected tree species listed under the act.
	National Environmental Management: Protected Areas Act (Act 57 of 2003).	This Act provides for the protection and conservation of ecologically important areas which represent South Africa's biodiversity and natural landscapes. The act provides for the sustainable utilisation of protected areas and to promote participation of local communities in the management of protected areas.
	Mountain Catchments Areas Act (Act 62 of 1970)	This act provides for the conservation, use, management and control of land in mountain catchment areas. Land users and land owners within these areas are mandated to manage that land through the prevention of soil erosion, removal or exotic and alien invasive vegetation and fire protection.
	Natural Heritage Resources Act (Act 25 of 1999)	This act promotes good management of natural heritage resources and to enable and encourage communities to nurture and conserve their legacy so that it may be passed on to future generations.

LEVEL	LEGISLATION/POLICY	DESCRIPTION
Provincial	Transvaal Nature Conservation Ordinance (Act 12 of 1983)	This act ensures the protection of protected areas, flora and fauna in the Gauteng Province.
	GDARD Requirements for Biodiversity Assessments Version 2	This guides the format and requirements of the biodiversity assessment.

4 LOCAL SETTING AND CONTEXT

4.1 Climate

The study area lies approximately 1445 m above sea level with a warm and temperate climate. The average annual temperature is in the region of 16.5° C and the annual average rainfall is approximately 659 mm. According to the Koppen-Geiger Climate Classification, the study area falls within the Dry-winter subtropical highland climate (Cwb) where winters are noticeably dry and rainy summers.

4.2 Topography, Drainage and Watercourses

From a southerly to northerly direction, the topography across the study area is relatively undulating with a steady rise from the south to the north. A similar topographic profile is evident from the west to the east of the proposed development area. There is a steady undulating decrease of the topographic slope west to east.

The proposed development area falls within the C22F Quaternary Catchment and the Upper Vaal Water Management Area (WMA). (Figure 4-1). The ephemeral drainage line which falls within the study area and which is approximately 426 m south of the proposed development sites drains south east towards the Vaal Rivier.

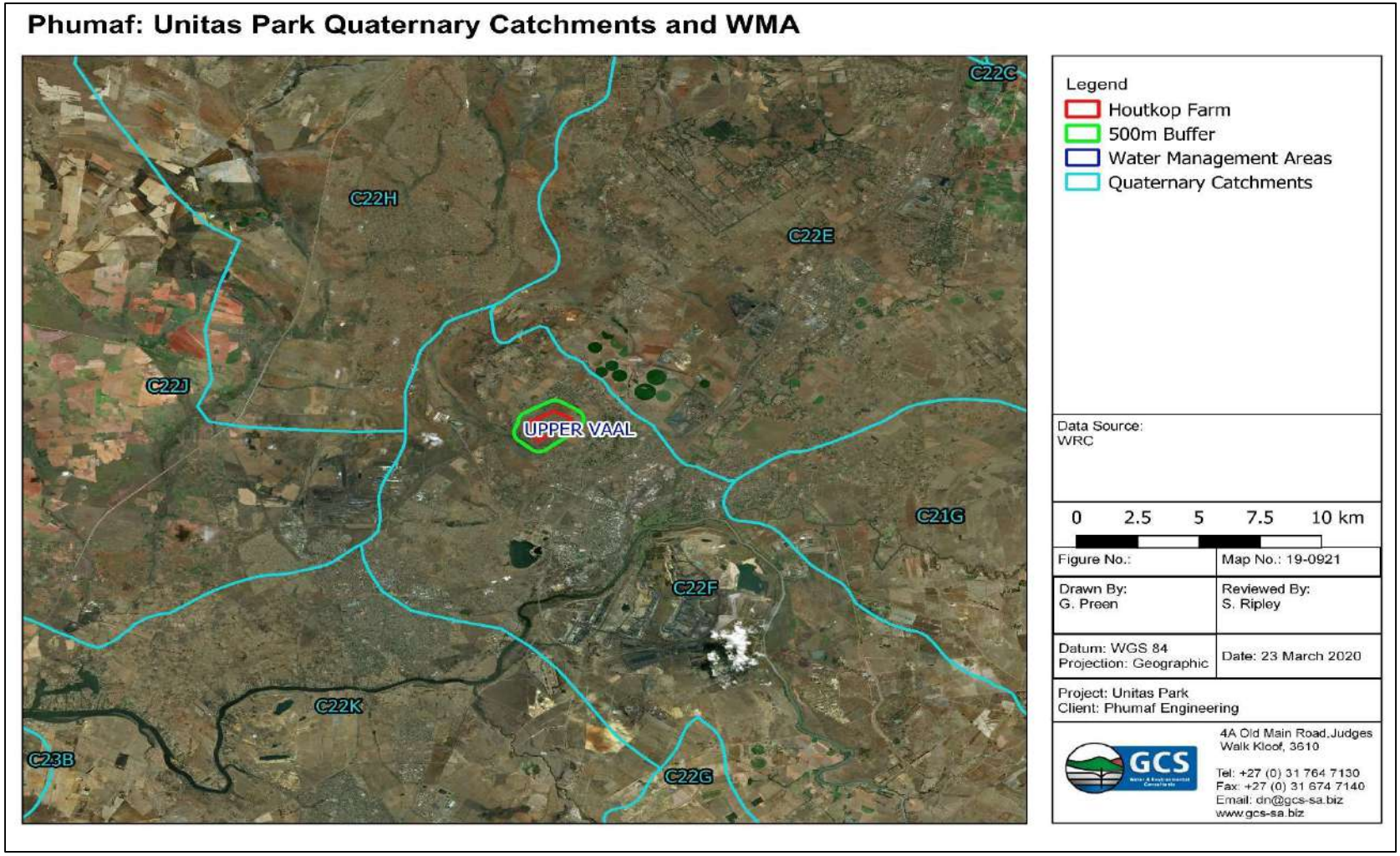

Figure 4-1: Map illustrating the quaternary catchments and WMAs

4.3 Geology and Soils

According to the Environmental Protection Atlas (ENPAT) geology data for the Gauteng Province, the site is underlain by a Quartzite Geology. The associated patterns with the geology in this area are rare upland duplex and margalitic soils and widespread dystrophic and/or mesotrophic red soils. The ENPAT data also indicates that the soil form that overlays this geology is the Hutton Formation.

The Hutton soil formation is characterised by an orthic A-horizon over a red apedal B-horizon. This soil form is generally reddish coloured with a weak structure in which water stagnation does not generally take place.

4.4 Land Cover & Land Use of the Region

For the purpose of this assessment, land cover is loosely categorised into classes that represent natural habitat and categories that contribute to habitat degradation and transformation on a local or regional scale. In terms of the importance for biodiversity, the assumption is that landscapes exhibiting high transformation levels are normally occupied by plant communities and faunal assemblages that do not necessarily reflect the original or pristine status. This is particularly important in the case of conservation important taxa as these plants and animals generally exhibit extremely low tolerance levels towards disturbances. This is one of the main reasons for the threatened status of these species. Changes in the natural environment available to these species are therefore likely to result in severe impacts on these species and, subsequently, their conservation status.

Three important aspects are associated with habitat changes that accompany certain land uses.

- Permanent transformation of natural habitat by land uses such as agriculture, mining and urbanisation results in the permanent decimation of available habitats. These areas will not recover to the original pristine status.
- A second aspect of habitat transformation or degradation is that it affects species directly, namely changes in species presence / absence and – composition. This result from the exodus of species for which habitat conditions have become unfavourable, the decrease in abundance of certain species because of decreased habitat size, or an influx of species that are better adapted to the altered environment. While some, or most, of the new species that occupy an area might be indigenous, they are not necessarily endemic to the area.

- Lastly, a larger threat to the natural biodiversity of a region is represented by the influx of invasive exotic species that can effectively sterilise large tracts of remaining natural habitat.

The proposed development site is located approximately 5.1 kilometers (kms) north west of the town of Vereeninging, within the Emfuleni Local and Sedibeng District Municipalities, Gauteng, covering an area of approximately 146.54 ha. The Biodiversity GIS (BGIS, 2010) assessment indicates that approximately 28% is currently considered untransformed and remaining natural areas. However, this figure is regarded as an overestimation of the true extent of the remaining natural habitat.

4.5 Flora and Fauna

4.5.1 Mucina & Rutherford Vegetation Units (2006)

According to Mucina and Rutherford (2006) the proposed development area falls within the Soweto Highveld Grassland vegetation unit (Figure 4-2). This vegetation unit has been classified as 'endangered' with almost half already having been impacted or transformed due to cultivation, urban sprawl, mining and building of road infrastructure (Mucina and Rutherford, 2006). Despite the ongoing impacts to this vegetation unit, only 0.2% is protected which is far below the conservation target of 24%. A summary of the Soweto Highveld Grassland vegetation unit is provided in Table 4:1.

Table 4:1: Summary of description of the Soweto Highveld Grassland unit. (Source: Mucina and Rutherford, 2006).

NAME OF VEGETATION UNIT	Soweto Highveld Grassland
CONSERVATION TARGET FROM NSBA	24%
PROTECTED FROM NSBA	0.2%
REMAINING FROM NSBA	52.7%
DESCRITPION OF CONSERVATION STATUS FROM NSBA	Endangered
DESCRIPTION OF THE PROTECTION STATUS FROM NSBA	Hardly Protected
AREA OF THE FULL EXTENT OF THE VEGETATION UNIT (SQUARE KILOMETERS)	14513.32
NAME OF THE BIOME	Grassland Biome

4.5.2 NEMBA Threatened Ecosystems

SANBI were requested by the Department of Environmental Affairs (DEA) in conjunction with provincial conservation authorities to identify threatened ecosystems to be listed.

Threatened ecosystems were identified based on several principles and follows:

- The approach must be explicit and repeatable;
- The approach must be target driven and systematic, especially for threatened ecosystems;
- The approach must follow the same logic as the IUCN approach to listing threatened species, whereby a number of criteria are developed and an ecosystem is listed based on its highest ranking criterion; and
- The identification of ecosystems to be listed must be based on scientifically credible, practical and simple criteria, which must translate into spatially explicit identification of ecosystems.

According to the National Threatened Ecosystems database (SANBI, 2011), the study area falls within the vulnerable Soweto Highveld Grassland vegetation unit (Figure 4-2).

4.5.3 Gauteng Conservation Plan/Ecological Support Areas

As per the Gauteng Conservation Plan, the ephemeral drainage line to the south of the study area is of conservation importance due to the following ecological processes (Figure 4-2)

- groundwater dynamics;
- hydrological processes,
- nutrient cycling; and
- wildlife dispersal.

4.6 National Freshwater Ecosystem Priority Areas (NFEPAs)

The NFEPA database highlights areas or priority in terms of conserving South Africa's freshwater ecosystems and supporting the sustainable use of water resources. NFEPAs were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (Driver *et al*, 2011). Although the NFEPA database is suitable for use at a desktop level for planning and decision-making purposes at a national level, confidence in its accuracy decreases at more local levels of planning. As such, it is important to groundtruth NFEPAs at a local planning level and to potentially refine them with additional local data and knowledge.

Subsequent to a desktop analysis of the NFEPA dataset, it was observed that there is one (1) NFEPA Channelled Valley Bottom Wetland within the study area (Figure 4-2). According to the dataset, this wetland was artificially created and has a wetland condition rating of 'Z3' or 'Heavily to Critically Modified'.

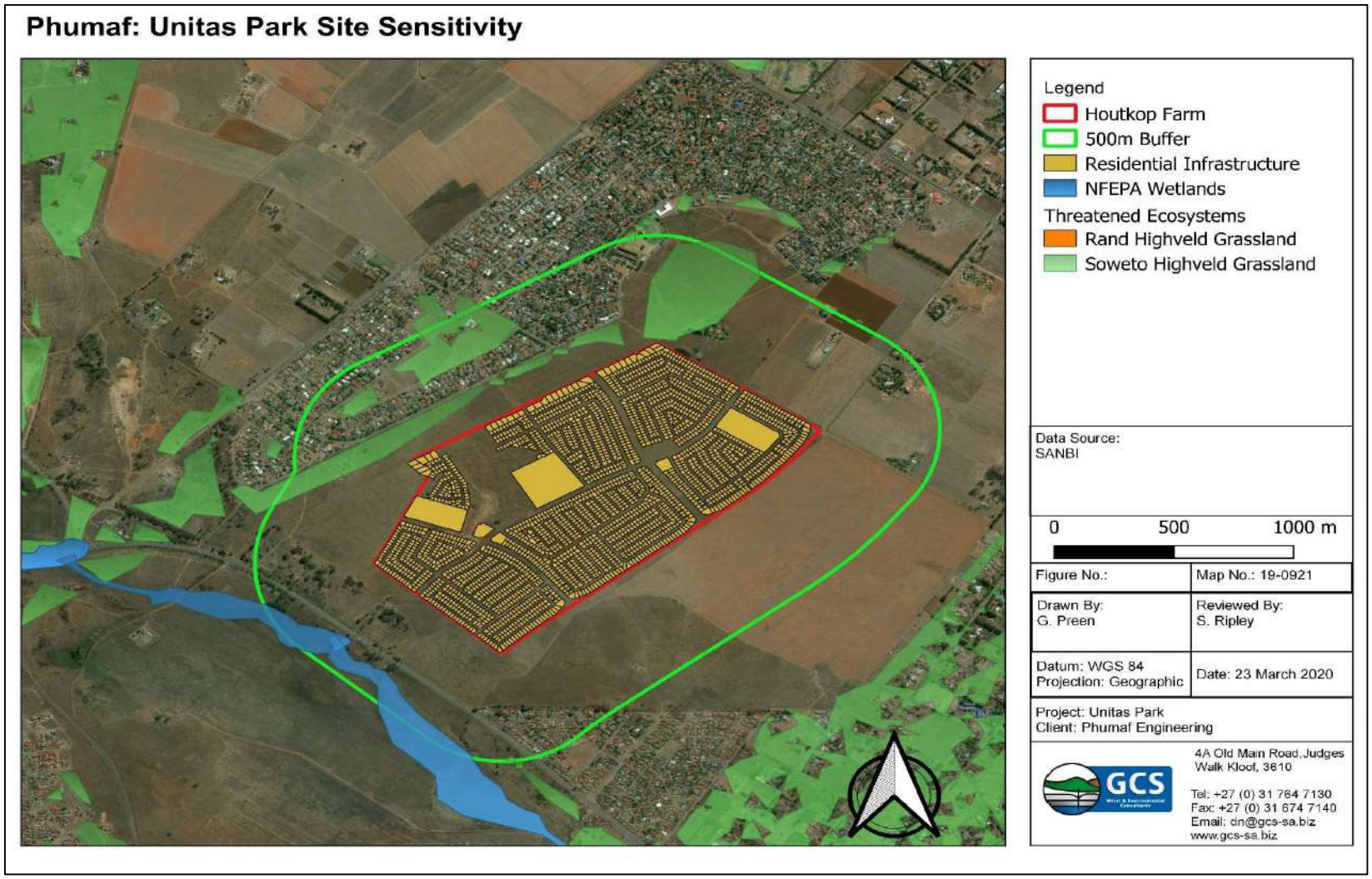

Figure 4-2: Map illustrating sensitive environments.

5 RESULTS AND FINDINGS

Following the desktop and infield assessments the following findings and results were obtained.

5.1 Wetland Assessment

A review of satellite imagery and relevant geospatial data identified one (1) wetland system within the study area (Figure 5-2). The infield assessment which was undertaken on the 03rd of March 2020, confirmed the location and boundaries of the wetland and subsequent screening confirmed that this wetland will be impacted upon by the proposed development (Table 5:1).

The wetland is located within a valley bottom with no clearly defined stream channel or banks. The topography through the wetland system was noted to be gently sloping with water entering mainly from a channel entering the system and from adjacent slopes (Figure 5-1). In accordance with the Classification System (SANBI, 2009), this wetland was classified as an unchanneled valley bottom wetland and will hereafter be referred to as UVB01.

Table 5:1: Wetlands within the study area and potential risk of impact.

HGM Unit	Water Resource Type	Characteristic Potentially Impacted (Yes/No=Y/N)				Risk Rating	Need for further Assessment	Justification
		Habitat	Biota	Water Quality	Flow Regime			
UVB01	Unchanneled Valley-Bottom Wetland	Y	Y	Y	Y	**Low Risk**	**Yes**	UVB01 was calculated to be approximately 408 m downslope of the proposed development footprint. The lack of dense vegetation cover between UVB01 and the proposed development site provides minimal buffer area from potential increased runoff and pollutants. This is coupled with a lack of suitable stormwater infrastructure along the R54. Therefore, it was determined that UVB01 will likely impacted upon by the proposed development.

Figure 5-1: Topographical profile of UVB01 (Source: Google Earth Pro, 2020).

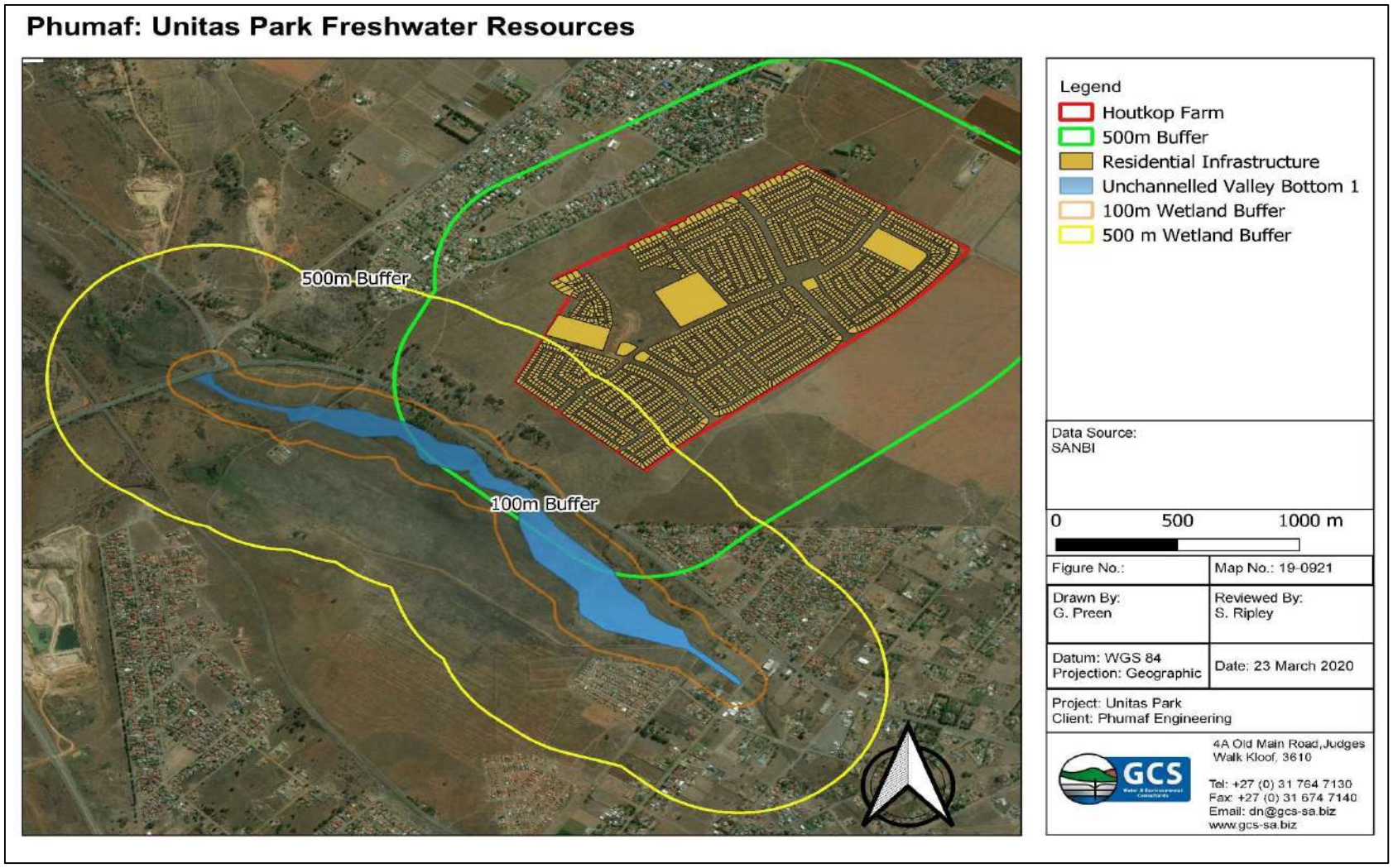

Figure 5-2: Map illustrating the location of UVB01.

5.1.1 Catchment and site-specific impacts

Historically and currently, UVB01 has been impacted upon by several land use changes in the surrounding environment. These changes have altered the topography, hydrology and vegetation of the surrounding area and has thus impacted on the health of UVB01. Each catchment and site-specific impacts have been described in the following sections.

5.1.1.1 Commercial maize cultivation

During the infield assessment, it was observed that the catchment has been highly transformed from its natural vegetative state; that which is consistent with the Soweto Highveld Grassland. The main contributing factor to this is the current level of commercial maize cultivation taking place within the catchment. As a result, indigenous vegetation has been lost with very few indigenous species present in the catchment area.

It is further expected that maize cultivation has had an impact on the hydrology of the wetland as it is reliant on good water supply and utilises large volumes of pesticides and fertilisers which may runoff into the system polluting the water (Matavire, 2015). However, it must be noted that during the infield assessment, no evidence was observed that water is being abstracted from this system for irrigation purposes. Nonetheless, it is expected that nitrates and phosphates have entered the system as a result of the application of pesticides and fertilisers. Wetlands act as periodic or permanent sinks for inorganic sediments, nutrients, organic carbon and toxic substances thus making them very vulnerable to inadequate management of the catchment areas. Wetlands are highly influenced by the surrounding catchment area and the activities taking place within them. Therefore, run-off contaminated by fertilisers and pesticides can significantly increase the nutrient levels of receiving wetlands thus disrupting their ecosystem processes (Walters and Koopman, ND). No formal water quality assessments were carried out.

Erosion and degradation of the study area has also taken place as a result of maize ultivation where the natural vegetation has been removed to make way for cultivation, thus leaving large areas of soil exposed. In addition, the constant tilling of the soil breaks-up soil peds and reduces their cohesiveness. This therefore results in increased surface flow velocities and associated erosion and deposition within the wetland system negatively affecting geomorphology and hydrology. Walters and Koopman (ND) maintain that increased sedimentation within and surrounding the wetland has the potential to diminish habitat diversity and destroy ecological corridors within the landscape. Furthermore, the continual growth and removal of sugarcane from the surrounding area gradually reduces the nutrient composition of the soil thus resulting in slower growth rates of the sugarcane. Therefore, increasing amounts of fertilisers are required to be added to the soil to compensate for this.

5.1.1.2 Road and Residential Infrastructure

During the infield assessment, it was observed that regional road R54 and residential infrastructure is located approximately 84m and 230m upslope of UVB01 respectively. The most obvious impact that the abovementioned infrastructure would have on UVB01, is runoff. There is very little dense vegetation capable of intercepting runoff before it enters the wetland system. It is expected that this will have an impact on the hydrology of UVB01 through increased flow into the systems as well as impacts on the water quality. Additionally, the vegetation of UVB01 may potentially be impacted.

5.1.2 Present Ecological State (PES)

The PES of UVB01 was assessed based on an understanding of both catchment and on-site impacts and the impacts these aspects have on the hydrology, geomorphology and vegetation of the system. WET-Health works by comparing a wetland in its current state with baseline/reference conditions (Macfarlane, *et al* 2007).

A summary of the overall health scores for the wetland system that was assessed is presented in Table 5:2.

Table 5:2: Summary of the WET-Health Scores for the UVB01 wetland system.

WET-Health Scores				
HGM Unit	**Hydrology**	**Geomorphology**	**Vegetation**	**Overall Score**
UVB01	E (7)	1.2 (B)	0.6 (A)	3.5 (C)

5.1.2.1 UVB01

UVB01 is located within a relatively gentle valley bottom receiving water inputs from the adjacent slopes as well as an ephemeral drainage line. The system has experienced significant canalisation at the head and toe areas (Figure 5-3). The surrounding catchment area has been subject to large scale, commercial agriculture which has altered the natural vegetation of the area as well as the surface runoff regime.

The PES of the wetland systems is defined as 'Moderately Modified' (D) which describes a situation in which a moderate change in ecosystem processes and loss of natural habitats has taken please but the natural habitat remains predominantly intact (Table 5:3). The hydrological component has been 'Seriously Modified' (E) due to the canalisation of the stream channel as well as impeding feature such as informal road infrastructure. The geomorphology of the system has been 'slightly modified' (C) as a result of the changes to the runoff regime of the surrounding area. This is due to the large-scale agriculture taking place within the surrounding area. The vegetation within the wetland system was assessed to be 'largely natural' (B) with few dispersed areas of invasive alien plants.

Table 5:3: WET-Health Assessment

WET-HEALTH ASSESSMENT	
HYDROLOGY	The hydrological component of the wetland system has been seriously modified through the canalization and stream channel modification or the system. It was observed that the head and the toe of the system has been impacted by canalisation. Canals tend to reduce diffuse surface flow and retention of water in favour of more concentrated flow. Unchannelled valley bottom wetlands are generally characterised by diffuse surface flow in their natural states. As such, it was determined that canalization and stream channel modifications have had serious impacts on the hydrology of the system.
VEGETATION	The vegetation within the system was observed to be natural and comprised mainly of *Typha capensis*. Impacts to the vegetation were noted to be informal tracks, scattered IAPS (*Arundo donax*) and commercial agriculture.
GEOMORPHOLOGY	The geomorphology was assessed to be largely natural. Impacts to geomorphology included artificial wetland infilling and deposition due to the informal track which dissects the system

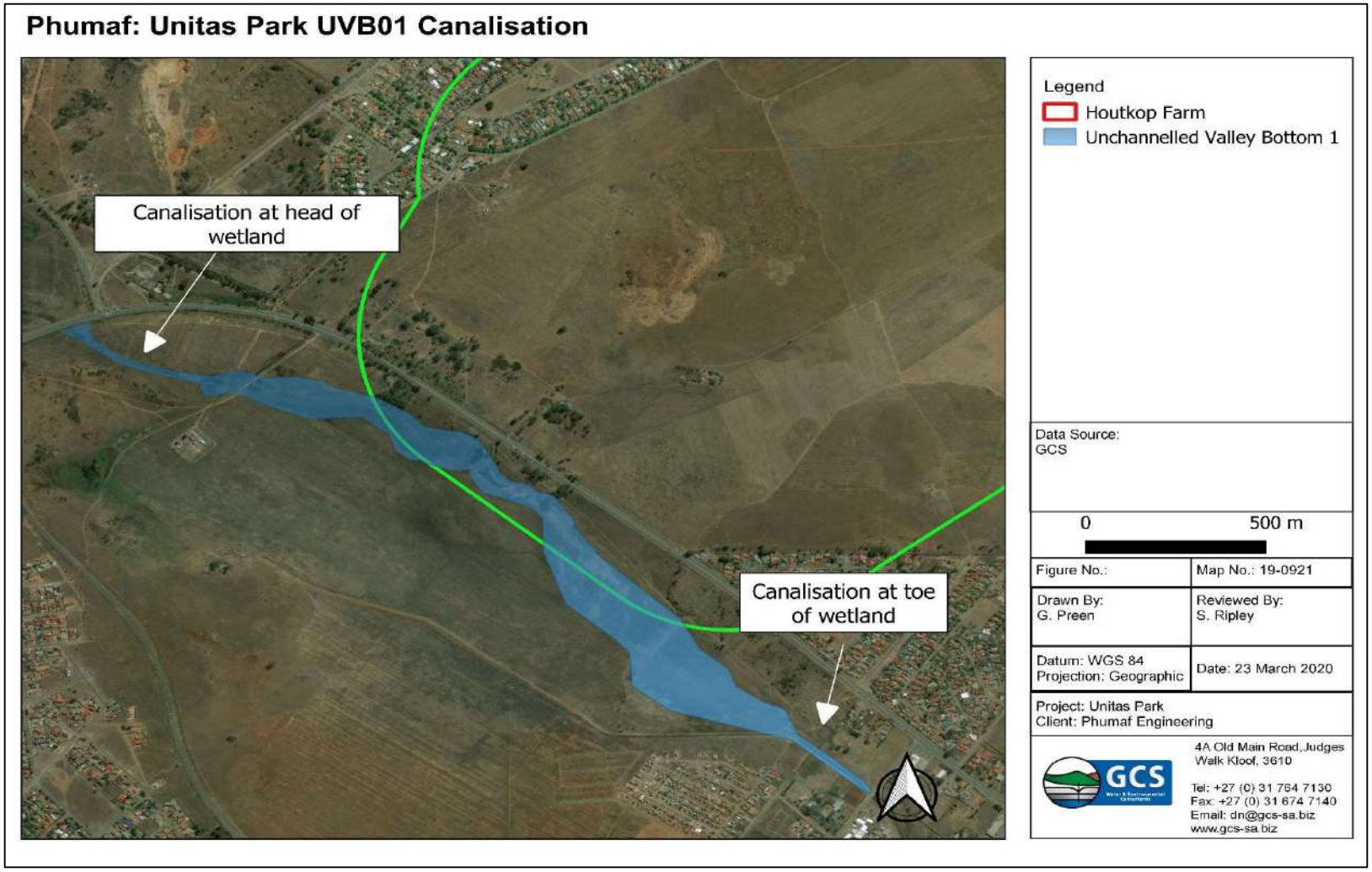

Figure 5-3: Map illustrating the canalisation at the head and toe of the wetland.

5.1.3 Wetland Functional Importance

Wetland benefits can be classified into classified into goods/products (directly harvested from wetlands), functions/services (performed by wetlands) and ecosystem scale attributes. The WET-Ecoservices tool is utilised to assess the goods and services that individual wetlands provide which assists with informed planning and decision-making. The tool provides guidelines for scoring the importance of a wetland in delivering each of the 15 different ecosystem services.

The overall goods and services provided by UVB01 were assessed to be moderate to low (Figure 5-4). The highest service provided by the system is erosion control. This is likely due to the diffuse flow which dominates the system as well as the level of vegetation within the system. Diffuse flow and vegetation allow for the reduction in flow velocity thus mitigating erosivity. The system also scored high for phosphate trapping. Due to the diffuse flow and vegetation, the system is able to trap phosphates originating from the surrounding agricultural practices. The system is not significant in terms of tourism, education or socio-cultural due to the lack of endangered species and the small size of the system. This is likely due to its ability to trap phosphate arising from the surrounding commercial agriculture.

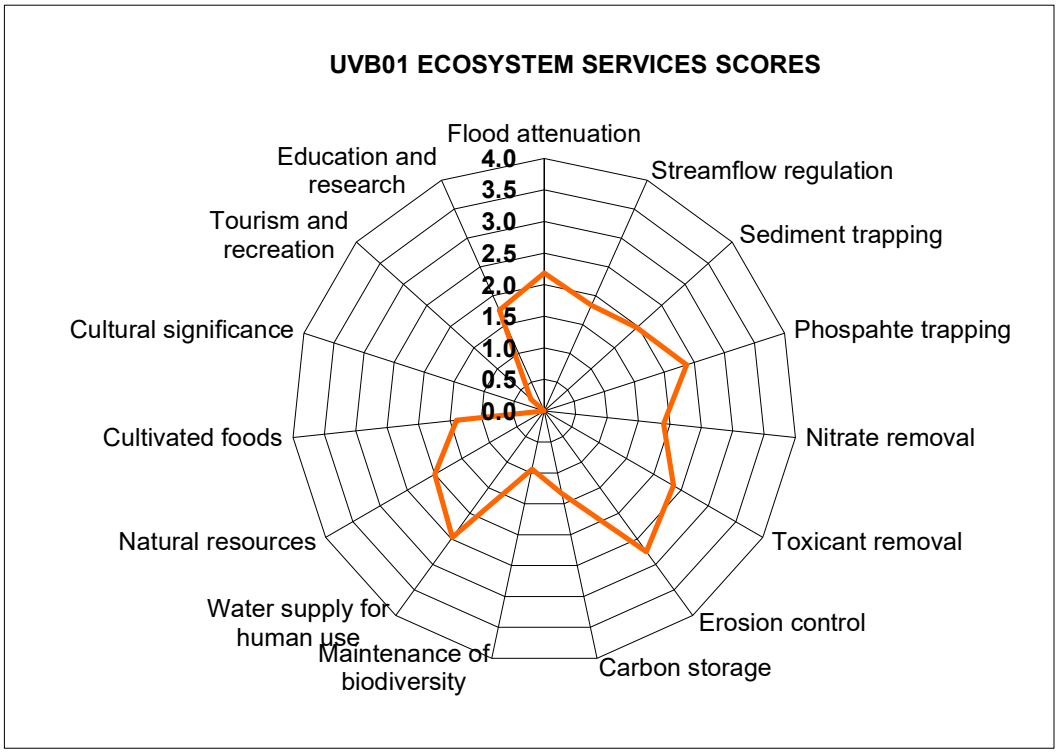

Figure 5-4: Diagram illustrating the extent and variety of ecosystems services provided by UVB01.

5.2 Biodiversity Assessment

5.2.1 Study area and site-specific impacts

The study area has undergone significant transformation in the form of urban sprawl and commercial agriculture. This has impacted in the natural state of the study area particularly in terms of loss of suitable habitat and biodiversity. Impacts on the biodiversity within the study area have been described below.

5.2.1.1 Commercial agriculture

In general, agriculture is the largest contributor to biodiversity loss with ever expanding impacts due to population growth and food consumption needs. Agriculture necessitates the need to convert natural habitats to intensely managed systems (Dudley and Alexander, 2017). During the infield assessment, it was noted that agriculture is the most significant contributor to the loss of biodiversity and suitable habitat (Figure 5-5)Figure 5-5: Aerial photograph taking at the northern portion of the site looking south illustrating the expanse of agriculture across the study site.. Natural plant species consistent within the Soweto Highveld Grassland have been cleared through tillage leaving only small areas of intact grassland. Cultivated areas retain very low natural vegetation and are considered to be of a low EIS. Other impacts on biodiversity associated with agriculture include drainage, intercropping, rotation, grazing and

extensive use of pesticides and fertilizers (McLaughlin and Mieau, 1995).

5.2.1.2 Urban Sprawl

The expansion of urban areas also results in the loss of or fragmentation to biodiversity. Often, natural areas are fragmented into patches which are not big enough to support complex ecological linkages. The infield assessment revealed that urban sprawl has also contributed to the loss of suitable habitat and biodiversity (Figure 5-6).

5.2.1.3 Excavation

It was noted that historical excavation has taken place in the study area. This has resulted in the removal of the topsoil and disturbance of the natural soil profile. Also, the disturbance of the soil has resulted in the proliferation of IAPS (*Acacia mearnsii*, *Acacia dealbata*, *Datura Stramonium*, *Eucalyptus* sp., *Pinus* sp., *Solanum mauritianum* and *Verbena bonariensis)*.

Figure 5-5: Aerial photograph taking at the northern portion of the site looking south illustrating the expanse of agriculture across the study site.

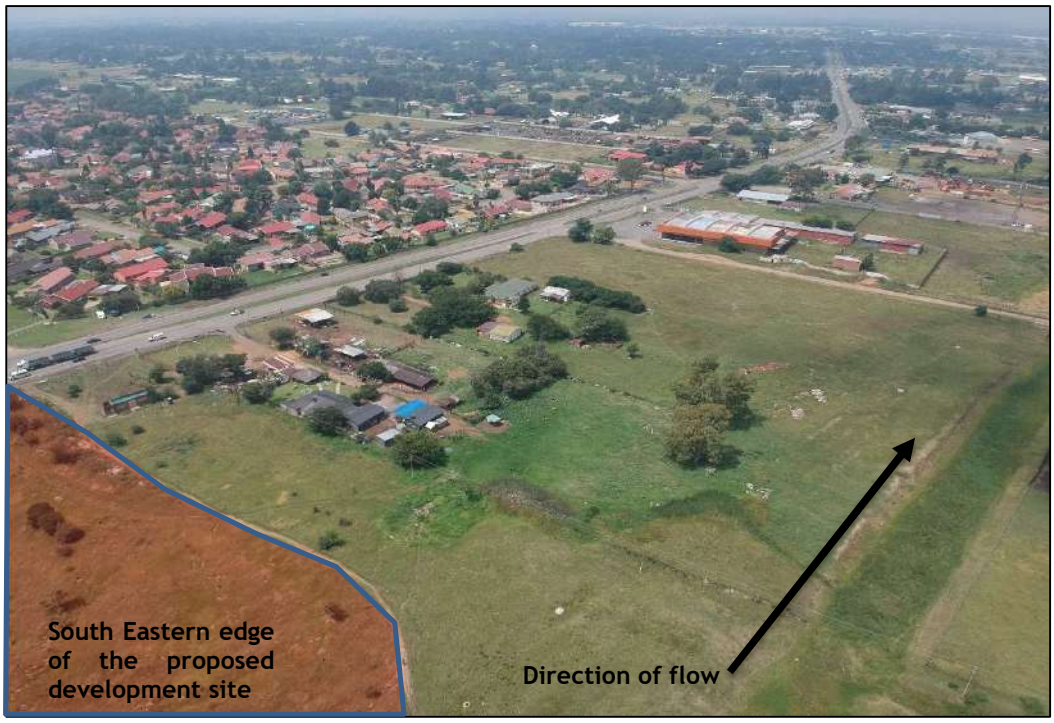

Figure 5-6: Aerial photograph taking near the southern portion of the site looking east illustrating the level of urban sprawl. The canalised valley bottom wetland is indicated.

5.2.2 Habitat Diversity

The significant transformation of land cover in the study area has resulted in the large-scale loss of suitable habitat for a variety of flora and fauna. It was estimated that 80% of the study area has been transformed from natural habitat due to agriculture and urban sprawl as discussed in the previous subsection. A phytosociological survey was undertaken to identify the dominant floral species (Figure 5-10). During the infield assessment the following habitats were identified:

- Open grassland (Table 5:4) (Figure 5-9),
- Degraded grassland (Table 5:5) (Figure 5-9), and
- Freshwater hydrophytes (Table 5:6) (Figure 5-9).

Transformed areas were also identified and are inclusive of commercial agriculture, formal and informal residential infrastructure.

Several phytosociological classification surveys were carried out to identify the plant species that are representative of the larger area (Figure 5-7 and Figure 5-8).

Small patches of IAPS were observed within the study area. Majority of the species observed were categorized as 1a while only one species observed is categorized as 3 according to the NEMBA. Species categorized as 1b require some control as part of an invasive species control programme. Species under this category must be removed and destroyed. Category 3 species may be retained as long as reasonable steps are taken to prevent their spread such as an invasive management plan.

Figure 5-7: Photograph illustrating the phytosociological classification being undertaken in the open grassland (Red lines indicate the 4 x 4m quadrant).

Figure 5-8: Photograph illustrating the phytosociological classification being undertaken in the degraded grassland (Red lines indicate the quadrant).

Table 5:4: Description of the open grassland.

HABITAT UNIT 1	**OPEN GRASSLAND**	
DESCRIPTION	There are scattered patches of open grassland surrounding the proposed development. A variety of grass species were identified within the various patches which were between 50 and 150 cm in height.	
PHOTOS		
VEGETATION	Overall vegetation cover is good, however, certain areas where overgrazing has occurred were observed. Given such small areas where grassland is able to flourish, species diversity was fairly high despite the level of transformation which has taken place. Indigenous grass species which were identified during the field assessment are as follows:	

	Aristida congesta (LC), Chloris virgate (LC), Cymbopogan Validus(LC), Cynodon dactylon (LC), Digitaria longiflora (LC), Eragrostis lehmanniana (LC), Eragrostis plana (LC), Eragrostis Rigidior(LC), Heteropogon Contortis (LC), Melinis repens (LC), Panicum natalense (LC), Themeda triandra (LC), Trachypogan Spicatus (LC), Elionurus muticus (LC), Setaria sphacelate (LC), Sporobolus centrifugus (LC), Sporobolus fimbriatus (LC).
INVASION BY EXOTIC SPECIES	Despite the level of transformation of area, the level of proliferation of invasive species was relatively low; approximately 10%. The invasive species observed were as follows: *Cirsium vulgare, Eucalyptus globulus, Ipomoea indica, Melia azedarach, Nerium oleander, Pinus sp.,* and *Verbena Opuntia.*
NATURALNESS	30 to 40% (Medium-Low)
EXISTING IMPACTS	The most significant impact to the open grassland is agriculture and urban sprawl. Additional impacts include cattle grazing/trampling and informal dirt tracks.

Table 5:5: Description of the degraded grassland.

HABITAT UNIT 2	DEGRADED GRASSLAND
DESCRIPTION	One patch of degraded grassland was observed during the field assessment. A few grass species were identified with an average height of approximately 100 to 150 cm.
PHOTOS	 
VEGETATION	In contrast to the open grassland areas, the diversity of grass species within the degraded area was fairly low. The grass species identified during the phytosociological survey were as follows: *Aristida congesta (LC), Cynodon dactylon (LC), Eragrostis* rigidior (LC), *Eragrostis lehmanniana (LC), Melinis repens (LC)*and *Themeda triandra (LC).*
INVASION BY EXOTIC SPECIES	Despite the level of transformation of area, the level of proliferation of invasive species was relatively low; approximately 15%. The invasive species observed were as follows: *Cirsium vulgare, Eucalyptus globulus Ipomoea indica, Melia Azedarach, Nerium oleander, Pinus sp., Verbena opuntia.*
NATURALNESS	10% (Very Low)
EXISTING IMPACTS	This area has been subject to historical excavation which has resulted in the removal of topsoil. In turn, this has altered the natural soil profile of the area as well as vegetation dynamics.

Table 5:6: Description of the freshwater hydrophytes.

HABITAT UNIT 3	FRESHWATER HYDROPHYTES
DESCRIPTION	The freshwater hydrophytes were confined to the wetland area to the south of the proposed development area. Two reed species were observed in this area with a height of between 150 to 200 cm.

HABITAT UNIT 3	FRESHWATER HYDROPHYTES	
PHOTOS		
VEGETATION	Only one dominant vegetation species was observed within the wetland system, namely *Typha capensis*. The surrounding grasslands comprised of a mixture of the following: *Aristida congesta (LC), Chloris virgate (LC), Cymbopogan Validus(LC), Cynodon dactylon (LC), Digitaria longiflora (LC), Eragrostis lehmanniana (LC), Eragrostis plana (LC), Eragrostis Rigidior(LC), Heteropogon Contortis (LC), Melinis repens (LC), Panicum natalense (LC), Themeda triandra (LC), Trachypogan Spicatus (LC), Elionurus muticus (LC), Setaria sphacelate (LC), Sporobolus centrifugus (LC), Sporobolus fimbriatus (LC).*	
INVASION BY EXOTIC SPECIES	The alien invasive species which were observed are as follows: *Cirsium vulgare and Verbena.*	
NATURALNESS	80% (High)	
EXISTING IMPACTS	The vegetation in the area has been impacted slightly by exotic species, informal tracks and litter.	

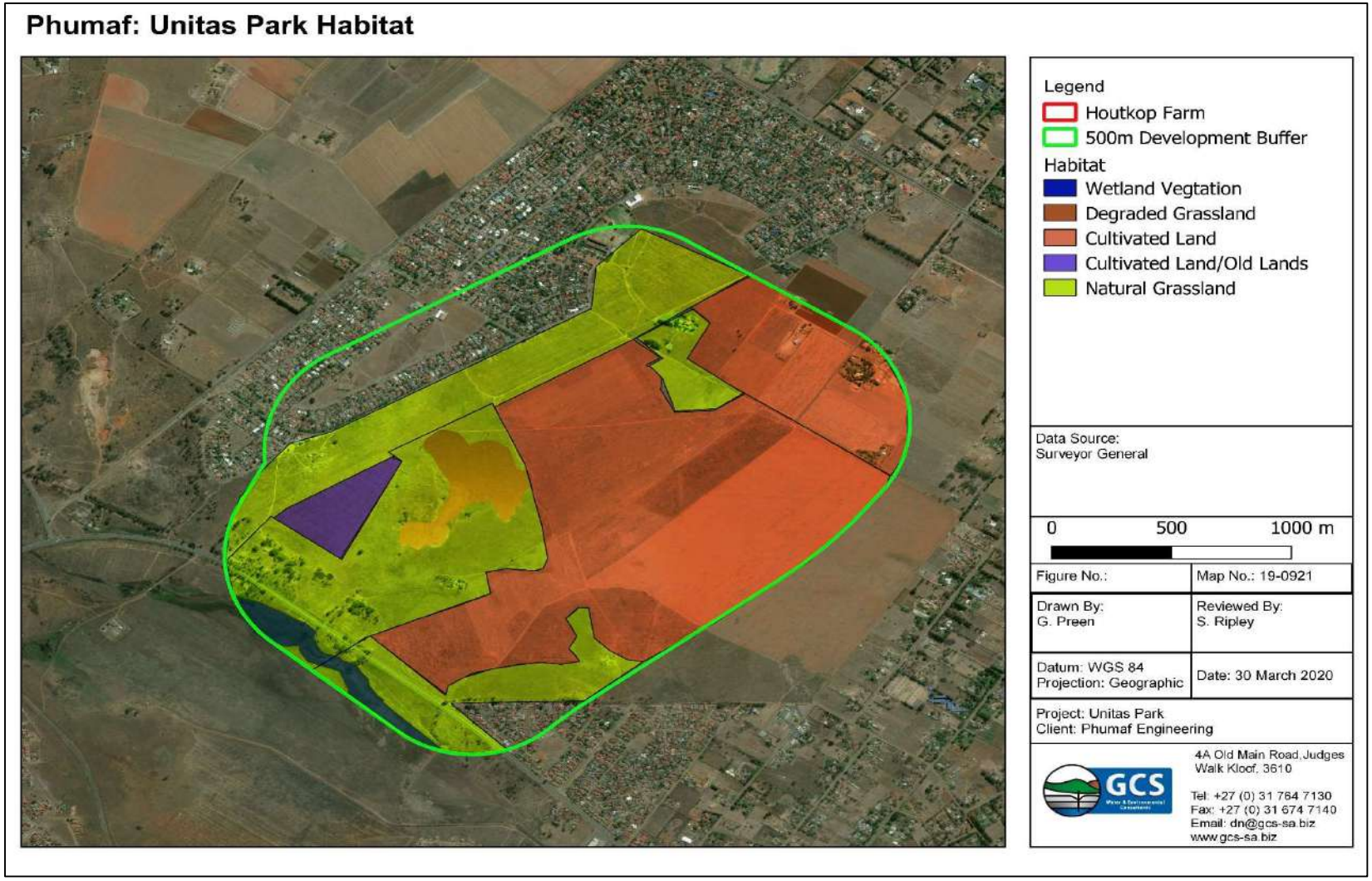

Figure 5-9: Map illustrating the different habitats

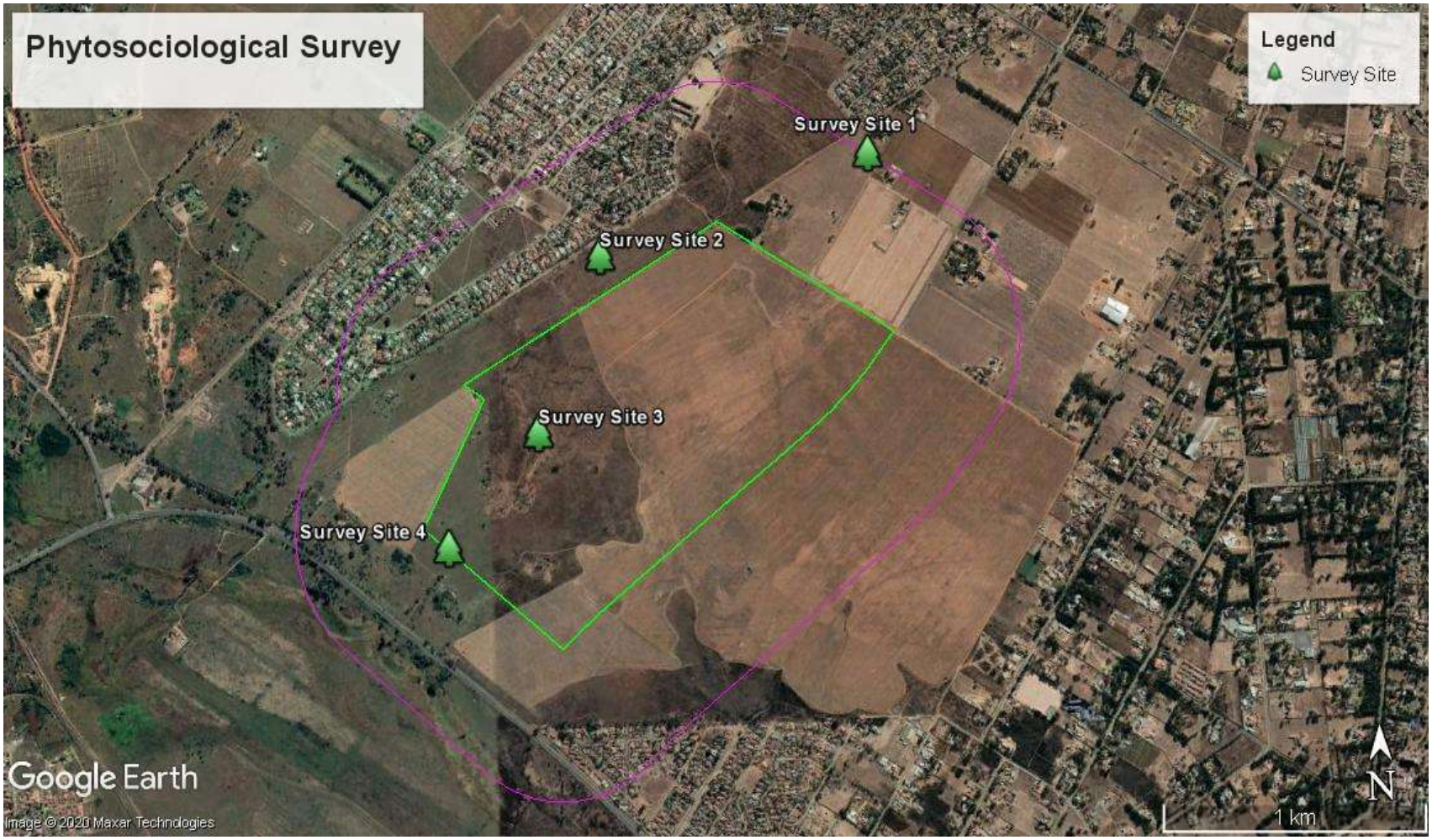

Figure 5-10: Map illustrating the floral survey points

5.2.3 Flora of Conservation Concern

Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's biodiversity and include not only threatened species that have been classified as 'at high risk of extinction in the wild' (Critically Endangered CR, Endangered EN, Vulnerable VU) but also those classified in the categories Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient. Protected species are listed in international conventions, national acts and provincial ordinances that regulate activities such as hunting, collection and trade of species. If a subpopulation of a species of conservation concern is found to occur on a proposed development site, it would be one indicator that development activities could result in significant loss of biodiversity, bearing in mind that loss of subpopultations of these species will either increase their extinction risk or may in fact contribute to their extinction Figure 5-11.

Following a review of the SANBI red list database, it was found that there are no species of conservation concern within the development area.

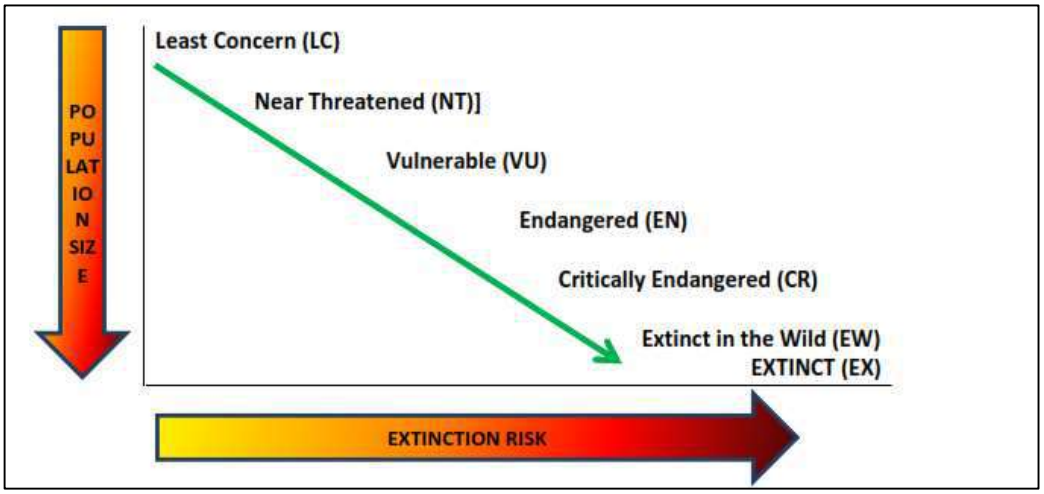

Figure 5-11: Graph illustrating the relationship between population size and extinction risk. (Source: SANBI, 2010).

5.2.4 Mammals

The Red Data list categories were obtained and included in the list. According to the IUCN website, the Red Data categories are described in Table 5:7.

Table 5:7: Description of the red data list categories (Source: IUCN, 2019).

RED DATA LIST CATEGORY	DESCRIPTION
Data Deficient	This occurs when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on distribution and/or population status.

RED DATA LIST CATEGORY	DESCRIPTION
Least Concern	This occurs when a species does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened according to the Red List Criteria.
Vulnerable	These species are considered to face a high risk of extinction in the wild.
Near Threatened	This occurs when a species has been evaluated against the Red List criteria but does not qualify for Critically Endangered or Vulnerable at present but is close to qualifying or is likely to qualify for a threatened category.
Endangered	These species are considered to face a very high risk of extinction in the wild.
Critically Endangered	These species are considered to face an extremely high risk or extinction in the wild.

It was determined that the proposed development site has the potential to support minimal biodiversity due to the impacts of agriculture and urban sprawl on suitable habitat. According to the IUCN and Virtual Museum, there are approximately 81 mammal species which are likely to occur or have been recorded within the proposed development site. The red data status of these species is distributed between Least Concern, Vulnerable, Near Threatened and Critically Endangered (Figure 5-12).

One critically endangered species, namely the *Diceros bicornis* (Black Rhinoceros) has been known to take refuge in the area or areas of similar habitat type. However, this is based on a desktop assessment and is highly unlikely in reality given the current land use practices within the proposed development area. Additionally, seven Near Threatened, three Vulnerable and seventy Least Concern species have been known to occur within the area. The Virtual Museum website indicates that there have been 16 recorded sightings of listed mammals in the area.

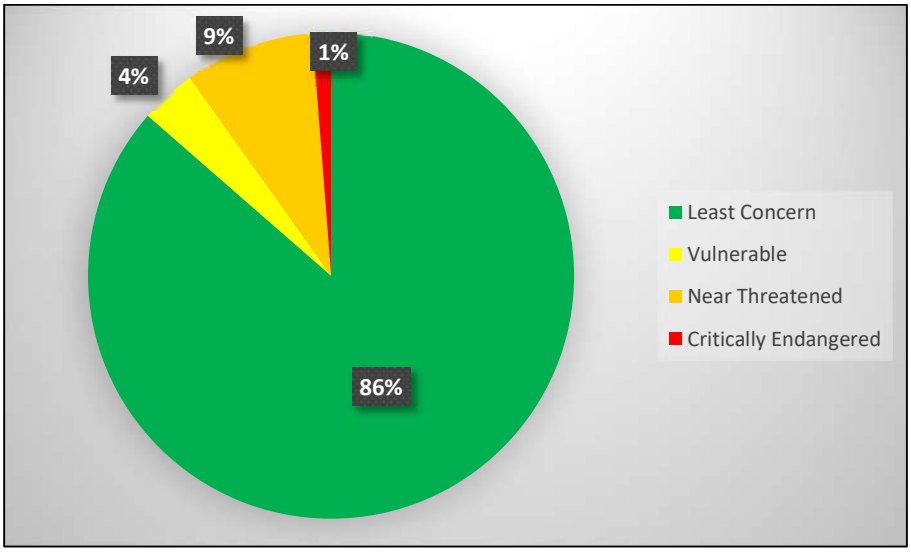

Figure 5-12: Pie chart illustrating the red data status distribution of mammal species.

During the field assessment, 1 mammal was observed, namely the *Lepus saxtilis* (Scrubhare) (Figure 5-13) which has been classed as being of 'Least Concern'. The observation was made in the agricultural fields. According to Chapman *et al* (1990) the scrub hare is attracted to cultivation and garden crops as well as open sandveld, bushveld or forest.

Figure 5-13: Photograph of a Scrub Hare (Source: www.fascinatingafrica.com)

5.2.5 Amphibians

The data sourced pertaining to the amphibian species was obtained from the IUCN and Virtual Museum websites. No amphibian species were observed during the infield assessment likely due to the transformed nature of the site and the surrounding area.

According to the abovementioned websites, there are 20 amphibian species which have occurred or are likely to occur within the study area. Of these 20 species, 1 has been classified as being 'Near Threatened', namely the *Pyxicephalus adspersus* (Giant Bull Frog) (Figure 5-15). The remaining species have all been classed as 'Least Concern' (Figure 5-14). This species inhabits the grasslands and savannahs of Southern Africa. The diet consists mainly of locusts, insects, cockroaches, worms, moths and beetles. However, given the transformed nature of the site coupled with the large-scale use of pesticides, it is expected that there is limited food sources for the Giant Bull Frog. Thus, the likelihood of this species to still be present in the area is negligible.

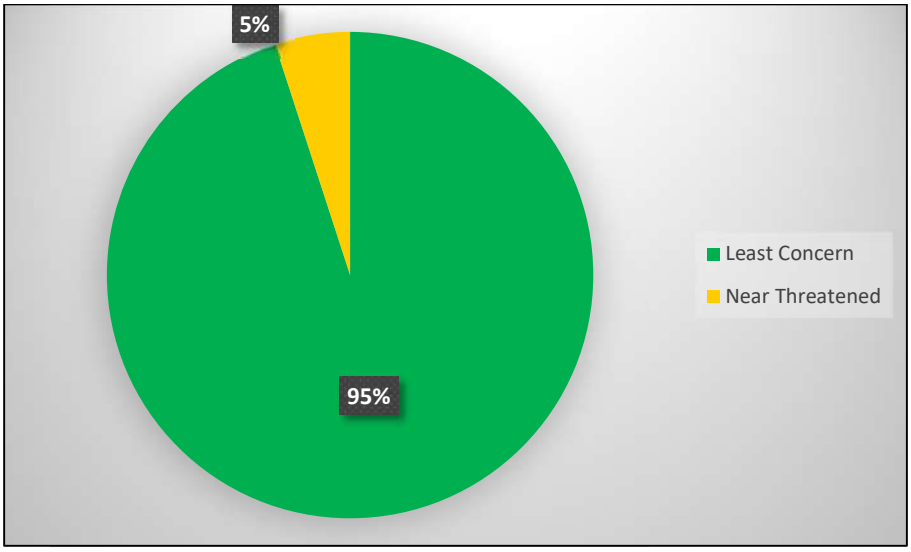

Figure 5-14: Pie chart illustrating the red data status distribution of amphibian species.

Figure 5-15: Photograph of a Giant Bullfrog (Source: www.lafebar.com)

5.2.6 Reptiles

The IUCN and Virtual Museum websites were used to source data relating to the reptile species which are likely to occur or have been recorded in the study area. During the infield, investigation, no reptile species were observed.

There are 32 species which are likely to occur or have occurred within the study area. 31 of these species have been classed as being of 'Least Concern' while 1 species is 'Data Deficient' (Figure 5-16). According to the Virtual Museum website, there have been 22 recorded sightings of the various reptile species which are likely to occur within the study area.

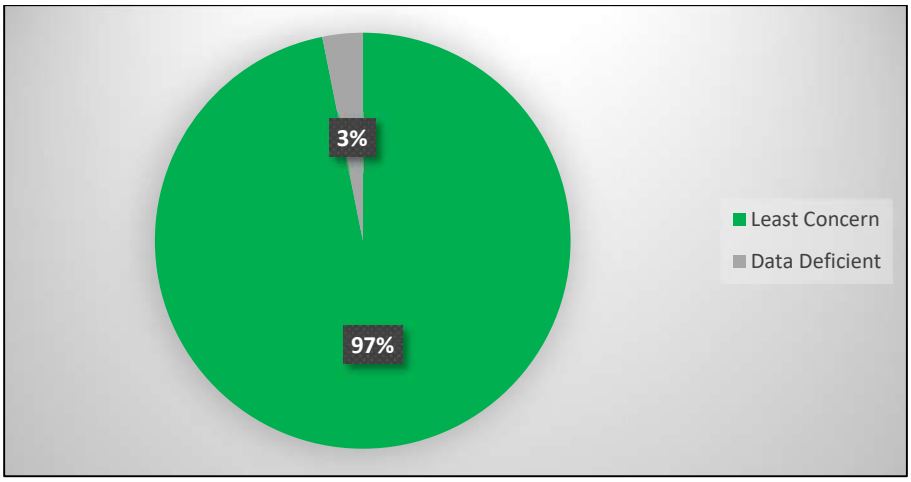

Figure 5-16: Pie chart illustrating the red data status distribution of reptile species.

5.2.7 Dragonflies and Damselflies

Only the Virtual Museum website was used to collect data pertaining to dragonflies and damselflies only as the IUCN website had no data available.

The Virtual Museum website indicates that there are eighteen dragonfly and damselfly species which have been recorded within the study area. Sixteen of these species have been classed as 'Least Concern' while two are 'Data Deficient' (Figure 5-17). The Virtual Museum indicates that there have been forty-five recorded sightings of the various species that are likely to be present in the study area.

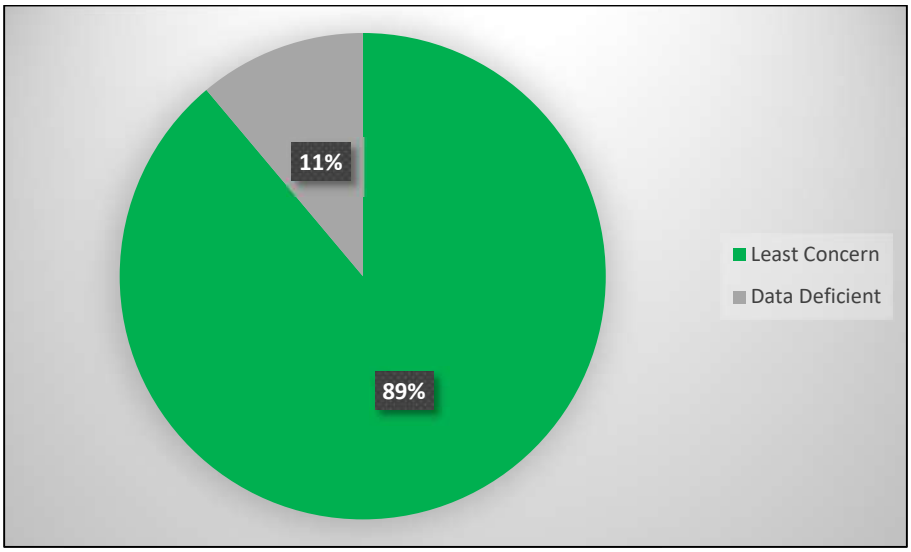

Figure 5-17: Pie chart illustrating the red data status distribution of dragonfly and damselfly species.

5.2.8 Avifauna

The Virtual Museum website was used to source data relating to the avifauna in the area. The IUCN website had no data available.

There are approximately 40 avifauna species which have occurred within the study area. 37 have been classes as being of 'Least Concern' while the remaining 3 are 'Data Deficient' (Figure 5-18). The Virtual Museum also indicated that there have been 95 recorded sightings of the various avifauna species in the study area.

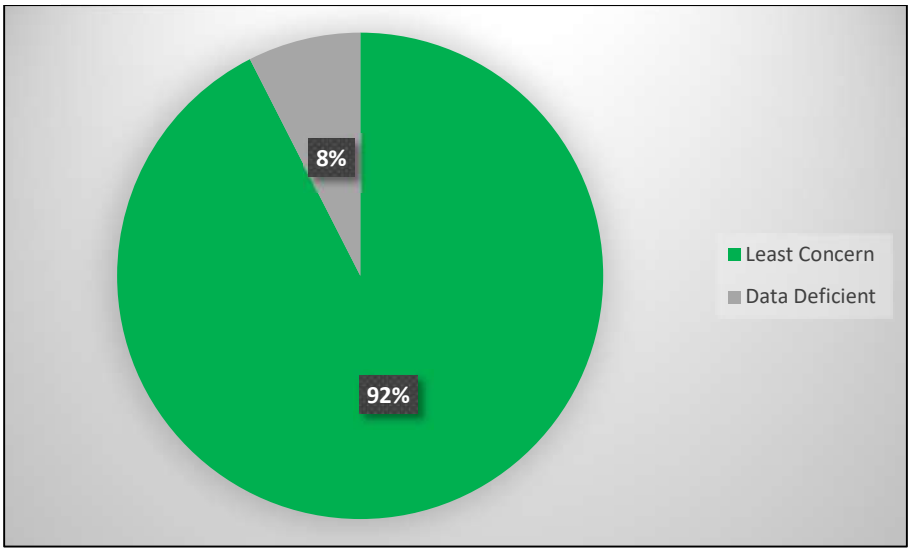

Figure 5-18: Pie chart illustrating the red data status distribution of avifauna species.

During the infield assessment, large flocks of *Streptopelia decipiens* (African Dove) were observed. This species has been classed as being of 'Least Concern'. This species feeds predominantly on grasses, seeds and small fruit. In respect of this species only, it is likely that the maize fields present at the time of the assessment is providing some source of food. The remaining grassland around the maize fields will also be a food source for the African Dove.

6 PRELIMINARY WETLAND IMPORTANCE AND SENSITIVITY

6.1 Wetland and River FEPA's

Following a review of the NFEPA wetland database, it was observed that one (1) NFEPA wetland occurs within the study site and is contained within the larger boundary of UVB01 in the C22F Quaternary Catchment and Upper Vaal WMA. The NFEPA database describes this wetland as a Channelled Valley Bottom wetland, however, following the infield investigation,

it was determined that it has now been transformed into an Unchannelled Valley Bottom wetland. It is presumed that the channelled valley bottom system has been subjected to historical sedimentation due to the disturbance of the soil in the surrounding area. This has likely resulted in the infilling of the once easily identifiable stream channel.

Although the ephemeral drainage line that runs through UVB01 is not considered to be a priority area, the sub-catchment in which it occurs drains into an FEPA River (Figure 6-1). As such, the sub-catchment and the wetland systems occurring within should be considered as ecologically important.

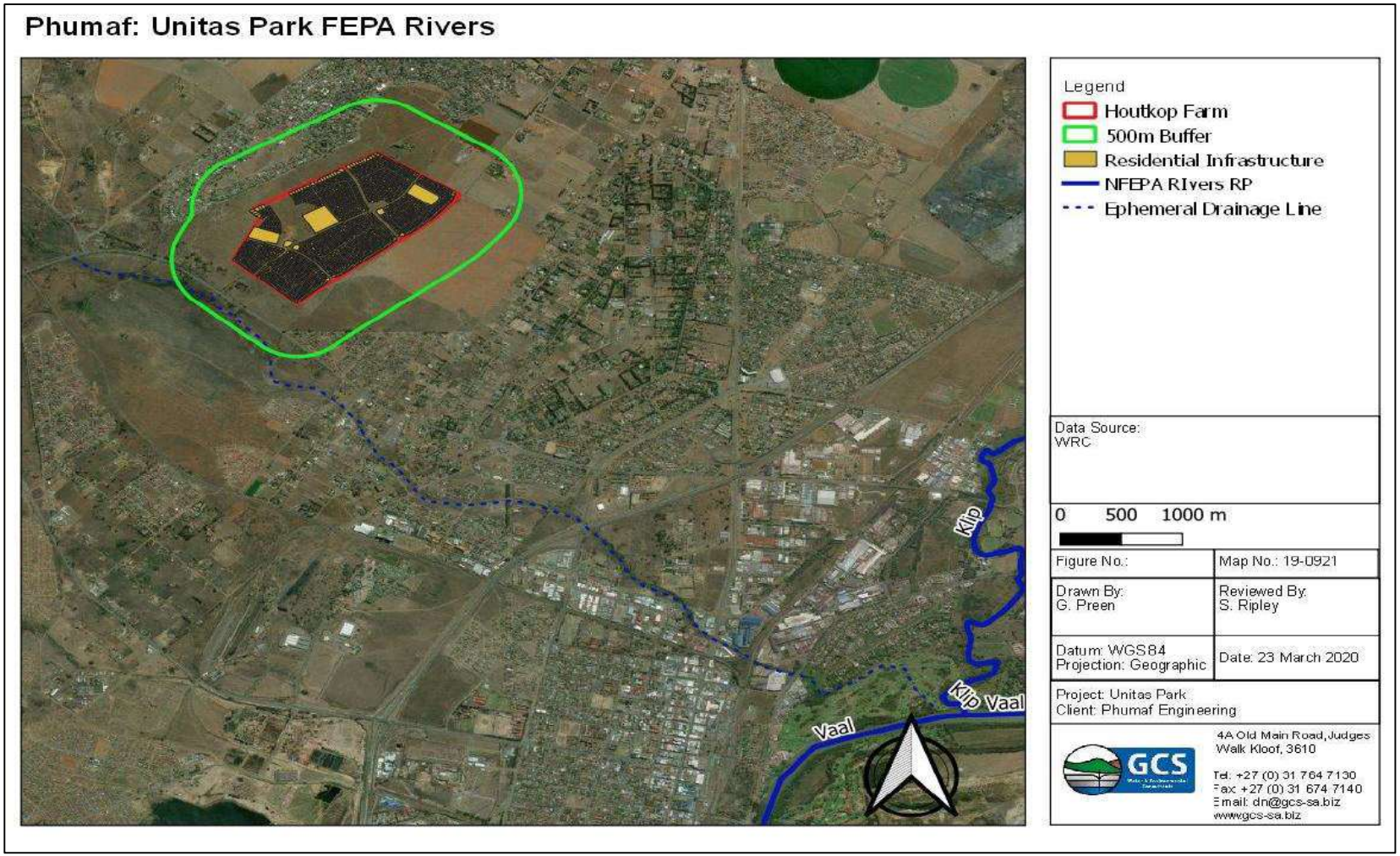

Figure 6-1: Map illustrating the ephemeral drainage line flowing into an FEPA Rive

7 POTENTIAL PLANNING IMPLICATIONS AND CONSTRAINTS

7.1 NFEPA Constraints and Management Requirements

The proposed development site is located within the sub-catchment of the Vaal FEPA river. In accordance with the NFEPA project, river FEPAs need to be maintained in their current state to achieve biodiversity targets for river ecosystems and threatened or near-threatened fish species. It was noted that the UVB01 provides important ecological links from freshwater resources upstream to freshwater resources downstream and ultimately the Vaal River. Although it is expected that the proposed development will have a minimal impact on UVB01, there is still some risk that remains. Therefore, it is imperative that a suitable buffer/no-go area be established around UVB01. This will ensure that impacts to UVB01 and associated national freshwater conservation goals and targets are avoided. The buffer zone requirements are discussed in subsection 7.3.

7.2 Ecological Importance and Sensitivity Constraints

According to the National Environmental Management: Biodiversity Act (10/2004) (NEMBA), the entire study area falls within a threatened ecosystem due to the presence of the endangered Soweto Highveld Grassland vegetation unit. However, according to the 'Threatened Ecosystem Remaining Extent', there is no naturally occurring grassland within the proposed development site boundary. Despite this, some naturally occurring grassland has been identified just outside the boundaries. It would therefore be important to implement avoidance, mitigation and rehabilitation measures where necessary in an attempt to maintain natural grasslands within the area.

Developing within a threatened ecosystem will require environmental authorisation in terms of NEMA and EIA regulations. The following listed activity may apply:

Listing Notice 3 (GNR 324) Activity 12-

The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan

- (c)(i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
    - (ii) Within Critical Biodiversity Areas or Ecological Support Areas identified in the Gauteng Conservation Plan or bioregional plans.

7.3 Recommended Buffer Zones for Planning Purposes

7.3.1 Background to Buffer Determination

Freshwater resources are coming under increasing pressure due to development and an expanding population. It is imperative that appropriate avoidance and mitigation measures are implemented to prevent further degradation of freshwater resources. In response to this, Macfarlane *et al*. (2016) developed the protocol for the development of geographical buffer zones around freshwater resources in an attempt to protect the resource itself and the goods and services that they provide. A buffer zone refers to a strip of land with a use, function or zoning specifically designed to protect one area of land against the impacts from another (Macfarlane *et al*, 2014). However, buffer zones are limited in their ability to protect freshwater resources from impacts such as hydrological changes caused by stream flow activities as well as point-source discharges. Nonetheless, buffer zones provides several important functions such as:

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

It is therefore in this regard that a suitable buffer zone has been determined using the wetland buffer zone tool developed by Macfarlane *et al* (2016).

7.3.2 Site Specific Buffers

Following the application of the wetland buffer zone tool, it was determined that a 40 m buffer zone be implemented during the construction phase of the proposed development (Figure 7-1).

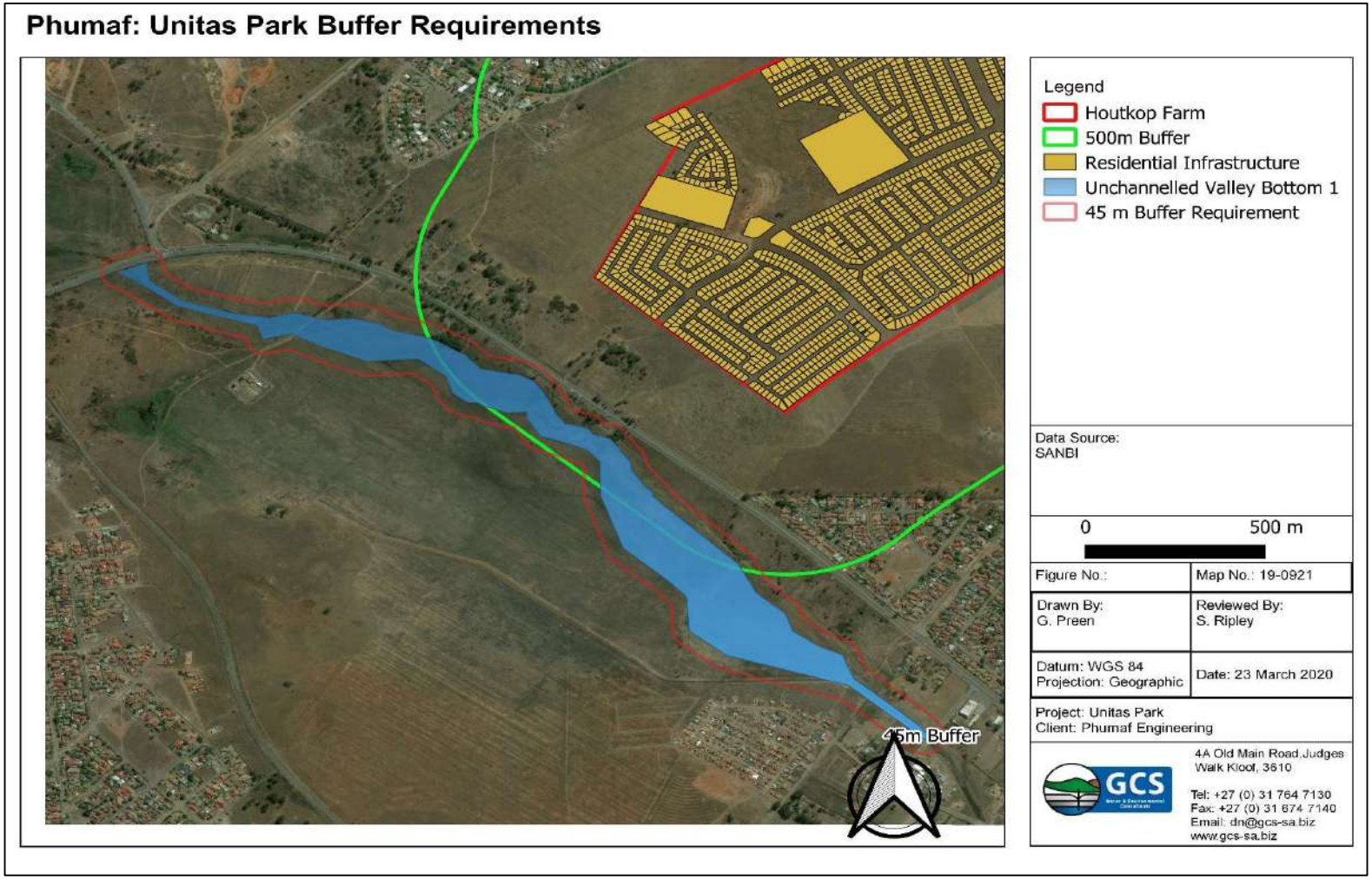

Figure 7-1: Map illustrating the buffer zone requirements

8 POTENTIAL IMPACTS AND RECOMMENDED MITIGATION MEASURES

An understanding of the relationship between the landscape and the dynamic characteristics of ecosystems is vital for the accurate assessment of ecosystem functions and values. The various ecosystems within the landscape are adjusting to disturbances occurring within them and the greater surrounding area. It was necessary to identify potential impacts which may be imparted on the various ecosystems as a result of the proposed development during the construction and operational phase.

8.1 Construction and Operational Phase

Potential impacts that may occur during the construction and operation phase of the proposed development are presented in Table 8:1 and Table 8:2 respectively.

Table 8:1: Potential environmental impacts associated with the construction phase.

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Construction Phase																	
Vegetation																	
Clearing or damage to vegetation	Proposed Development Site	• Site Clearing and the removal of indigenous vegetation • Damage to vegetation through the movement of machinery, vehicles and personnel • Dumping of material outside of designated areas • Generation of pollution and waste • Dust • Proliferation of IAPS	6	4	1	4	44	-	M	• The construction site must be clearly marked and should not exceed the boundaries of the construction site plan. • The unnecessary removal of vegetation outside of the construction site plan is not permitted. • All construction machinery, vehicles and personnel movement must be limited to the existing informal tracks around the site. • No fires are permitted on site. • An IAPS management plan must be compiled by a suitable specialist prior to the commencement of construction activities. This must be implemented throughout the construction and operational phase. This must be monitored by the Environmental Control Officer (ECO). • The open grassland identified and demarcated within this report must be avoided as far as practicable. • A waste management plan must be compiled prior to the commencement of the construction phase. • Suitable waste receptacles must be placed around the site and must be demarcated. Waste receptacles must be wind and scavenger proof. This must be addressed in waste management plan. • Dust control measures such as a water cart must be implemented throughout the construction phase.	2	2	1	3	15	-	L
Introduction of IAPS	Proposed Development Site	• Site clearing and removal of indigenous vegetation • Disturbance of natural soils	8	5	2	4	60	-	M	•The IAPS management plan must be implemented throughout the construction and operational phase and must be monitored by the ECO on a regular basis.	4	4	1	3	27	-	L
Geology & Soils																	
Soil Disturbance	Proposed Development Site	• Earthworks	6	2	1	5	45	-	M	• Soil disturbance must be limited to the construction site plan. Soil disturbance outside of this area is not permitted.	2	2	1	5	25	-	L
Soil Contamination	Proposed Development Site	• Movement of construction vehicles and machinery • Storage of hazardous waste and substances • Maintenance activities • Installation and emptying of temporary ablutions (chemical toilets) • Generation and storage of general waste • Mixing of soil layers during excavation or stockpiling	6	2	1	4	36	-	M	• Restrict movement of construction employees outside of construction areas • Restrict vehicles to travel only on designated roadways • Park construction vehicles in areas lined with concrete or fitted oil traps •Stationary construction vehicles and machinery must have drip trays placed underneath. • Ensure vehicles are in good condition and not leaking fuel or oil when entering the mining areas • Regular vehicle and equipment inspections • Use of bunds during refuelling • Maintenance to be done off site • Suitable spill prevention measures to be in place	2	2	1	2	10	-	L

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Loss of soil productivity & impact on land capability	Proposed Development Site	• Site clearing and the removal of vegetation • Establishment of construction camp & surface infrastructure • Soil and topsoil stockpiling •Dumping of material outside of designated areas • Erosion & compaction leading to loss of soil fertility • Increased stormwater runoff & leaching of soil minerals	6	5	1	4	48	-	M	• Demarcate footprint area clearly & control access • Minimise site clearance to the footprint area only • No unnecessary vegetation clearance outside go the development site plan is permitted • Separate soil layers during excavation to ensure that soil for topsoil for rehabilitation is preserved • Edge effects of construction activities need to be actively managed • Should new road development be necessary, roads should be ripped and rehabilitated at the end of construction activities • All compacted soils should be ripped and profiled at the end of the construction phase. • Implement suitable stormwater management and erosion control measures to minimise erosion • Upon completion of construction activities, no bare areas remain and that indigenous grassland species are reintroduced • Edge effect control needs to be implemented within construction areas, with specific consideration to compaction and erosion control	4	4	1	3	27	-	L
Land Use																	
Permanent change in land use from agricultural to construction	Proposed Development Site	• Construction activities •Movement of construction vehicles and machinery • Activities resulting in an increase in noise pollution • Increased human activity • Site clearing • Site camp establishment and equipment storage • Restriction of access, fencing and securing of site	8	5	2	5	75	-	H	• No mitigation measures possible • Demarcate footprint area clearly	8	5	2	5	75	-	H
Fauna																-	
Habitat Loss	Proposed Development Site	• Vegetation Clearance • Establishment of infrastructure	6	4	1	3	33	-	M	• As per vegetation mitigation measures listed above	4	2	1	2	14	-	L
Disturbance	Proposed Development Site	• Noise • Construction activities - movement of vehicles and personnel and lighting	4	2	1	4	28	-	L	• Demarcate footprint areas clearly • Restrict construction activity to the footprint area only	3	2	1	3	18	-	L
Dust	Proposed Development Site	• Vehicle Movement	4	2	2	3	24	-	L	• Consider surfacing road • Use dust-minimising procedures on access road • Restrict construction activity to the footprint area only • Control vehicle speeds	2	4	1	3	21	-	L
Road Mortalities	Proposed Development Site	• Vehicle Movement	6	2	2	3	30	-	M	• Implement speed control measures (e.g. speed limits, traffic calming measures) •Any instances of road mortalities must be recorded and reported to the ECO.	2	2	2	3	18	-	L
Alien and Invasive Plants	Proposed Development Site	• Soil disturbance during and presence of bare soil areas following construction	6	4	2	4	48	-	M	• Implement alien and invasive plant control and monitoring programme	4	1	2	2	14	-	L
Surface Water & Aquatic Ecosystems																	

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Soil excavation, blasting and earth moving (removal and storage of soil)	Proposed Development Site	• Loss of soils from stock piles • Destabilisation of soils increasing erosion • Erosion and sedimentation of the downslope aquatic systems • Loss / degradation of instream habitat and aquatic biota • Impaired water quality • Loss of ephemeral stream at open cast area	8	4	2	2	28	-	L	• Adhere to the wetland and watercourse buffers • Keep impact footprint as small as possible • Implement the SWMP • Construct cut-off berms downslope of working areas, demarcate footprint areas to be excavated to avoid unnecessary digging • Exposed areas must be ripped and vegetated to increase surface roughness • Create energy dissipation at discharge areas to prevent scouring • Temporary and permanent erosion control methods may include silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching • Compacted areas must be ripped (perpendicularly) to a depth of 300 mm • A seed mix must be applied to rehabilitated and bare areas • Any gullies or dongas must also be backfilled •Soil management plans should be in place which will include the use of correct stockpiling methods • Berms should be placed around soil stockpiles to secure them •Stockpiles must not exceed 5 m in height.	6	3	1	1	10	-	L
Infrastructure development	Proposed Development Site	• Increased runoff, erosion and sedimentation of the aquatic systems • Change in hydrodynamics of the project area • Loss / degradation of instream habitat and aquatic biota • Impaired water quality • Solid waste production • Loss of ephemeral streams	8	5	2	3	45	-	M	• Adhere to the wetland and watercourse buffers • The proposed infrastructure should be relocated outside of the proposed buffers described in this assessment • Keep impact footprint as small as possible • Implement SWMP • Construct cut-off berms downslope of working areas, demarcate footprint areas to be cleared to avoid unnecessary clearing • Exposed areas must be ripped and vegetated to increase surface roughness • Temporary and permanent erosion control methods may include , gabion walls, mattresses and bars, silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching	4	5	1	2	20	-	L
Contamination through the storage and handling of chemicals, fuels & other hazardous materials	Proposed Development Site	• Contamination risk if spills occur • Impaired water quality • Change in aquatic fauna communities • Change/deterioration of the ecological status of rivers/streams	6	2	2	3	30	-	M	• No cleaning of vehicles, machines and equipment on site • All hazardous substances to be stored separately in appropriately bunded and demarcated facilities • No servicing of machines, vehicles and equipment on site • Storage of potential contaminants in bunded areas • All contractors must have spill kits available and be trained in the correct use thereof	6	2	1	1	9	-	L
Contamination through inadequate waste management (including ablutions)	Proposed Development Site	• Indiscriminate dumping in aquatic areas • Contaminated stormwater runoff entering aquatic habitats • Impaired water quality. • Change in aquatic fauna communities. Change/deterioration of the ecological status of rivers/streams	6	2	2	3	30	-	M	•Ablution facilities may not be placed within 50 m or the 1:50 year floodline. Whichever is furthest will apply. • Implement a waste management plan • Implement the SWMP • Appropriate sanitary facilities must be provided and all waste to be removed to an appropriate waste facility	6	2	1	2	18	-	L

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Contamination through inadequate stormwater management	Proposed Development Site	• Increased runoff, erosion and sedimentation of the aquatic systems • Change in hydrodynamics of the project area and aquatic systems • Change in aquatic fauna communities. Change/deterioration of the ecological status of rivers/streams	6	4	2	4	48	-	M	• Implement the SWMP	4	4	1	3	27	-	L
Groundwater																	
Poor quality seepage from temporary stockpiles	Proposed Development Site	• Excavation and stockpiling of materials • Runoff from stockpile areas	4	2	2	4	32	-	M	• Cover stockpiles with geomembrane to reduce rainfall infiltration and hence, poor quality percolation into groundwater •Stockpiles should be placed on impermeable surfaces. • Reduce footprint areas to minimise the reaction flow path of rainfall water	4	2	2	3	24	-	L
Contamination through the storage and handling of chemicals, fuels & other hazardous materials	Proposed Development Site	• Contamination risk if spills occur • Impaired water quality	2	2	1	4	20	-	L	• Park construction vehicles in areas lined with concrete or fitted oil traps • Ensure vehicles are in good condition and not leaking fuel or oil when entering the mining areas	2	2	1	2	10	-	L

Table 8:2: Potential environmental impacts associated with the operational phase.

POTENTIAL ENVIRONMENTAL IMPACT	APPLICABLE AREA	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Operational Phase																	
Vegetation																	
Proliferation of IAPS	Proposed Development Area	• Operation of the proposed development	6	5	2	4	52	-	M	• The IAPS management plan must make provision for the operational phase and must be implemented. The ECO should monitor the site for 6 months following the completion of the proposed development.	4	2	2	2	16	-	L
Geology & Soils																	
Soil contamination	Proposed Development Area	• Oil and hydrocarbon spills from vehicular movement. • Storm water management • Waste management	10	2	2	4	56	-	M	• Implement suitable storm water management measures in the design of the proposed development.	8	1	1	2	20	-	L
Land Use																	
Change in land use from agricultural to residential	Proposed Development Area	• Operation of proposed development.	8	5	2	5	75	-	H	• Unavoidable impact of the proposed development. • Demarcate footprint area clearly	8	5	2	5	75	-	H
Surface Water & Aquatic																	
Increased runoff or stormflow from the site could lead to river bank erosion as well as pollution of downstream water bodies	Receiving surface water bodies	• Increasing impervious areas at the mine site	2	5	2	3	27	-	L	• Implement stormwater management plan	2	5	1	1	8	-	L
Visual																	
Visual impact on surrounding area	Proposed Development Area	• Proposed development infrastructure	8	4	2	4	56	-	M	• Unavoidable impact of the proposed development • Utilise existing vegetation and the natural landscape to naturally screen activities • Alternatively utilise shade cloth to create an artificial buffer • Utilise natural earth colours to best blend in • Detailed lighting plan to minimise light pollution • Highly reflective metals should be avoided to limit reflection and glaze of such structures	8	4	2	2	28	-	L

9 RISK ASSESSMENT MATRIX

The DWS has published General Notice (GN) 509 in Government Gazette no. 40229 under Section 39 of the NWA. The purpose was to streamline the application for and granting of a water use license in terms of Section 21 (c) and (i) water uses. The primary objective of GN 509 was to allow water users to apply for a water use license for Section 21 (c) and (i) under a General Authorisation as opposed to a full water use license.

A risk assessment matrix is used to determine the risk of the proposed activity to the receiving aquatic ecosystem in a post-mitigation state. The three risk categories are low, moderate and high. If the water use is determined to be of a low risk to the aquatic ecosystem, then it may fall under the ambit of a general authorisation subject to consultation with the DWS. However, it is determined to fall within a moderate or high-risk category, a full water use license application will need to be undertaken.

Following the undertaking of the risk assessment matrix, it was determined that in a post-mitigation scenario, the proposed development will have a low risk of impacting the wetland system. As such, it is the opinion of the specialist that the proposed development be granted a general authorisation under GN 509.

The proposed activities include:

- The establishment of residential infrastructure outside of the boundary and recommended buffer of the unchannelled valley bottom wetland;
- The establishment of road infrastructure outside of the boundary and recommended buffer of the unchannelled valley bottom wetland;
- The establishment of stormwater infrastructure outside of the boundary and recommended buffer of the unchannelled valley bottom wetland; and
- The establishment of wastewater infrastructure outside of the boundary and recommended buffer of the unchannelled valley bottom wetland.

The RAM identified that the most significant risk is the compaction of soil resulting in the increase in runoff and associated sedimentation. However, it was determined that this poses low risk due to the distance of the wetland system to the proposed development site. The proliferation of IAPS was also highlighted as being of some concern. However, given the distance of the wetland system to the proposed development and the implementation of an IAPS management plan, this is also expected to pose low risk. The RAM pertaining to the construction phase and operational phase can be found under appendices 7 and 8 respectively.

10 CONCLUSION AND RECOMMENDATIONS

GCS Water and Environmental Consultants (Pty) Ltd (GCS) have been appointed by Phumaf Engineering (Phumaf) to undertake the Environmental Impact Assessment (EIA) process for the proposed development of residential and mixed land uses as part of the Gauteng Rapid Land Release Programme (GRLRP) hereafter referred to as the 'proposed development'. As part of the EIA process, Phumaf require terrestrial ecological and wetland assessments of portion 222 of the farm Houtkop 594 otherwise known as Unitas Park Extension 16 and will hereafter be referred to as the 'proposed development area'.

10.1 Wetland Assessment

The wetland assessment identified one unchanneled valley bottom wetland within the 500 m regulated area. It was determined that this system may be impacted upon by the proposed development which necessitated further assessment of its ecological state and functional importance.

The PES of the system was determined to be 'moderately modifed' due to serious alterations to the hydrology of the system through canalization and stream channel modifications. The vegetation and geomorphology of the system was determined to be largely natural only being impacted by commercial agriculture in the surrounding area. The functional assessment determined that the system provides good erosion control as well as phosphate trapping.

Based on the findings of the wetland assessment, the following recommendations have been highlighted for consideration

- The wetland system must be demarcated as a no-go zone and
- A 45 m buffer must be established and maintained during the construction phase of the proposed development. This must be monitored by the ECO.

10.2 Biodiversity Assessment

The biodiversity assessment identified 3 habitat types as follows:

- Open grassland;
- Degraded grassland; and
- Freshwater hydrophytes.

The open and degraded grassland were determined to have low to very low naturalness due to the extensive commercial agriculture taking place within the study area. During the infield assessment, no species of conservation concern were observed.

Although the area has the potential to provide habitat for a diverse range of fauna species in a natural state, the degraded nature resulted in very few fauna species being observed. 1 mammal species, namely the *Lepus saxtilis* (Scrub Hare) was observed. Additionally, large flocks of *Streptopelia decipiens* (African Dove) were observed.

Based on the findings of the biodiversity assessment, the following recommendations have been highlighted for consideration:

- The open grassland must be avoided as far as reasonably practicable;
- Vegetation clearing must be limited to the site plan only. No unnecessary vegetation clearing is permitted;
- An IAPS management plan must be compiled prior to the commencement of the construction phase. This plan must be implemented throughout the construction and operational phase and must be monitored by the ECO;
- Soil disturbance must be limited to the site plan only. Construction machinery may only use the existing pathways. Suitable drip trays must be placed beneath stationary construction machinery;
- No fires are permitted on site;
- Dust control measures must be implemented;
- Erosion control measures must be implemented throughout the site. Stockpiles may not exceed 5 m in heights and must be covered using an impermeable material;
- Suitable waste receptacles must be placed around the site which are both scavenger and wind proof.

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APPENDIX 1 AMPHIBIAN SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Amietia delalandii	Delalande's River Frog	Least Concern	1	28 November 1998
Amietia fuscigula	Cape River Frog	Least Concern	1	26 February 1981
Amietia poyntoni	Poynton's River Frog	Least Concern		
Breviceps adspersus	Common Rain Frog	Least Concern		
Cacosternum boettgeri	Common Caco	Least Concern	4	10 November 2014
Chiromantis xerampelina	Southern Foam Nest Frog	Least Concern	1	28 September 2017
Kassina senegalensis	Bubbling Kassina	Least Concern	2	13 January 2000
Phrynobatrachus natalensis	Natal Dwarf Puddle Frog	Least Concern		
Pyxicephalus adspersus	Giant Bull Frog	Near Threatened	5	24 January 2017
Schismaderma carens	Red Toad	Least Concern	1	28 November 1998
Sclerophrys capensis	Raucous Toad	Least Concern	2	09 January 2014
Sclerophrys garmani	Olive Toad	Least Concern	1	24 December 2001
Sclerophrys gutturalis	Guttural Toad	Least Concern	6	24 December 2001
Sclerophrys poweri	Power's Toad	Least Concern		
Semnodactylus wealii	Weale's Running Frog	Least Concern		
Strongylopus fasciatus	Striped Stream Frog	Least Concern		
Tomopterna cryptotis	Tremelo Sand Frog	Least Concern	1	26 February 1981
Tomopterna natalensis	Natal Sand Frog	Least Concern	1	28 November 1998
Tomopterna tandyi	Tandy's Sand Frog	Least Concern		
Xenopus laevis	Common Platanna	Least Concern	4	28 November 1998

APPENDIX 2 AVIFAUNA SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Actizera lucida	Rayed blue	Least Concern (SABCA 2013)	2	22 February 2009
Afrogegenes hottentota	Marsh hottentot skipper	Least Concern (SABCA 2013)	1	01 March 2008
Afrogegenes sp.	Hottentots		1	01 March 2008
Azanus jesous	Topaz babul blue	Least Concern (SABCA 2013)	2	27 January 2019
Azanus moriqua	Black-bordered babul blue	Least Concern (SABCA 2013)	1	01 March 2008
Belenois aurota	Brown-veined white	Least Concern (SABCA 2013)	3	22 February 2009
Byblia ilithyia	Spotted joker	Least Concern (SABCA 2013)	1	01 March 2008
Cacyreus marshalli	Common geranium bronze	Least Concern (SABCA 2013)	1	30 January 2016
Catopsilia florella	African migrant	Least Concern (SABCA 2013)	4	22 February 2009
Chilades trochylus	Grass jewel	Least Concern (SABCA 2013)	2	29 January 2017
Coeliades forestan forestan	Striped policeman	Least Concern (SABCA 2013)	2	01 March 2008
Colias electo electo	African clouded yellow	Least Concern (SABCA 2013)	1	01 March 2008
Danaus chrysippus orientis	African monarch, Plain tiger	Least Concern (SABCA 2013)	5	22 February 2009
Daphnis nerii	Oleander Hawk-Moth	Not listed	1	02 April 2014
Eicochrysops messapus mahallakoaena	Cupreous blue	Least Concern (SABCA 2013)	1	01 March 2008
Eretis umbra umbra	Small marbled elf	Least Concern (SABCA 2013)	3	22 February 2009
Eurema brigitta brigitta	Broad-bordered grass yellow	Least Concern (SABCA 2013)	5	29 January 2017
Gomalia elma elma	Green-marbled skipper	Least Concern (SABCA 2013)	1	01 March 2008
Hypolimnas misippus	Common diadem	Least Concern (SABCA 2013)	4	22 February 2009
Junonia hierta cebrene	Yellow pansy	Least Concern (SABCA 2013)	3	22 February 2009
Junonia oenone oenone	Blue pansy	Least Concern (SABCA 2013)	1	01 March 2008
Junonia orithya madagascariensis	Eyed pansy	Least Concern (SABCA 2013)	6	28 April 2019
Lepidochrysops ortygia	Koppie blue	Least Concern (SABCA 2013)	4	14 January 1993
Lepidochrysops patricia	Patricia blue	Least Concern (SABCA 2013)	2	08 January 2009
Leptotes pirithous pirithous	Common zebra blue	Least Concern (SABCA 2013)	1	01 March 2008
Metisella meninx	Marsh sylph	Least Concern (SABCA 2013)	4	04 March 2009
Papilio demodocus demodocus	Citrus swallowtail	Least Concern (SABCA 2013)	1	01 March 2008
Pontia helice helice	Common meadow white	Least Concern (SABCA 2013)	1	08 January 2009
Pseudolarentia megalaria		Not Threatened (NT) [not an IUCN category]	1	28 April 2019

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Rhodometra sacraria		Not Threatened (NT) [not an IUCN category]	1	17 March 2017
Spialia asterodia	Star sandman	Least Concern (SABCA 2013)	4	22 February 2009
Spialia dromus	Forest sandman	Least Concern (SABCA 2013)	4	01 March 2008
Spialia mafa mafa	Mafa sandman	Least Concern (SABCA 2013)	4	22 February 2009
Stygionympha wichgrafi wichgrafi	Wichgraf's hillside brown	Least Concern (SABCA 2013)	2	01 March 2008
Tarucus sybaris sybaris	Dotted blue	Least Concern (SABCA 2013)	1	01 March 2008
Telchinia rahira rahira	Marsh acraea	Least Concern (SABCA 2013)	5	01 January 2018
Utetheisa pulchella	Crimson-Speckled Moth	Not listed	1	19 March 2017
Vanessa cardui	Painted lady	Least Concern (SABCA 2013)	3	08 January 2009
Zizeeria knysna knysna	African grass blue	Least Concern (SABCA 2013)	3	27 January 2019
Zizula hylax	Tiny grass blue	Least Concern (SABCA 2013)	2	22 February 2009

APPENDIX 3 ARAGONFLIES AND DAMSELFLIES

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Anax imperator	Blue Emperor	LC	3	10 November 2019
Pinheyschna subpupillata	Stream Hawker	LC	1	15 December 2005
Africallagma sp.	African bluets		1	01 January 2018
Africallagma glaucum	Swamp Bluet	LC	6	10 November 2019
Azuragrion nigridorsum	Sailing Bluet	LC	1	10 January 2016
Ischnura senegalensis	Tropical Bluetail	LC	5	10 November 2019
Proischnura rotundipennis	Round-winged Bluet	LC	1	15 December 2005
Pseudagrion massaicum	Masai Sprite	LC	2	10 November 2019
Pseudagrion salisburyense	Slate Sprite	LC	2	26 February 2017
Crocothemis erythraea	Broad Scarlet	LC	5	10 November 2019
Diplacodes lefebvrii	Black Percher	LC	6	28 April 2019
Diplacodes luminans	Barbet Percher	LC	2	14 January 2018
Pantala flavescens	Wandering Glider	LC	1	27 January 2019
Rhyothemis semihyalina	Phantom Flutterer	LC	3	18 February 2018
Sympetrum fonscolombii	Red-veined Darter or Nomad	LC	3	10 November 2019
Tholymis tillarga	Twister	LC	1	12 March 2016
Trithemis sp.			1	14 January 2018
Trithemis furva	Navy Dropwing	LC	1	14 January 2018

APPENDIX 4 MAMMAL SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Aethomys ineptus	Tete Veld Rat	Least Concern		
Alcelaphus buselaphus	Hartbesst Antelope	Least Concern		
Antidorcas marsupialis	Springbok	Least Concern		
Aonyx capensis	African Clawless Otter	Near Threatened		
Atelerix frontalis	South African Hedgehog	Least Concern		
Atilax paludinosus	Marsh Mongoose	Least Concern		
Canis mesomelas	Black-backed Jackal	Least Concern	1	16 April 2019
Caracal caracal	Caracal	Least Concern		
Ceratotherium simum	White Rhinoceros	Near Threatened		
Chaerephon pumilus	Little Free-tailed Bat	Least Concern	2	
Connochaetes gnou	Black Wildebeest	Least Concern		
Connochaetes taurinus	Blue Wildebeest	Least Concern		
Crocidura cyanea	Reddish-Gray Musk Shrew	Least Concern		
Crocidura maquassiensis	Makwassie Musk Shrew	Least Concern		
Cynictis penicillata	Yellow Mongoose	Least Concern	1	16 December 2011
Damaliscus pygargus	Bontebok	Least Concern	1	16 April 2019
Desmodillus auricularis	Cape Short-Eared Gerbil	Least Concern		
Diceros bicornis	Black Rhinocerus	Critically Endangered		
Eidolon helvum	Straw-Coloured Fruit Bat	Near Threatened		
Elephantulus brachyrhynchus	Short-Snouted Elephant Shrew	Least Concern		
Elephantulus myurus	Eastern Rock Elephant Shrew	Least Concern		
Eptesicus hottentotus	Long-Tailed House Bat	Least Concern		
Equus quagga	Plains Zebra	Least Concern	2	16 October 2014
Felis nigripes	Black-Footed Cat	Vulnerable		
Felis silvestris	Wildcat	Least Concern		
Genetta genetta	Common Genet	Least Concern		
Gerbilliscus brantsii	Highveld Gerbil	Least Concern		
Gerbilliscus leucogaster	Bushveld Gerbil	Least Concern		
Herpestes sanguineus	Slender Mongoose	Least Concern		

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Hydrictis maculicollis	Spotted-Necked Otter	Near Threatened		
Hystrix africaeaustralis	Cape Porcupine	Least Concern		
Ichneumia albicauda	White-Tailed Mongoose	Least Concern		
Ictonyx striatus	Striped Polecat	Least Concern		
Kobus ellipsiprymnus	Waterbuck	Least Concern	1	16 April 2019
Leptailurus serval	Serval	Least Concern		
Lepus victoriae	African Savanna Hare	Least Concern		
Mastomys coucha	Southern Multimammate Mouse	Least Concern		
Mellivora capensis	Honey Badger	Least Concern		
Micaelamys namaquensis	Namaqua Rock Rat	Least Concern		
Mungos mungo	Banded Mongoose	Least Concern		
Mus musculus	House Mouse	Least Concern		
Myotis tricolor	Cape Hairy Bat	Least Concern		
Myotis welwitschii	Welwitsch's Bat	Least Concern		
Mystromys albicaudatus	White-Tailed Rat	Vulnerable		
Neoromicia capensis	Cape Serotine	Least Concern		
Neoromicia zuluensis	Zulu Serotine	Least Concern		
Nycteris thebaica	Egyptian Slit-Faced Bat	Least Concern		
Orycteropus afer	Aardvark	Least Concern		
Otomys angoniensis	Angoni Vlei Rat	Least Concern		
Otomys auratus	Vlei Rat	Near Threatened		
Ourebia ourebi	Oribi Antelope	Least Concern		
Panthera pardus	Leopard	Vulnerable		
Papio ursinus	Chacma Baboon	Least Concern		
Parahyaena brunnea	Brown Hyena	Near Threatened		
Pedetes capensis	South African Springhare	Least Concern		
Pelea capreolus	Grey Rhebok	Near Threatened		
Phacochoerus africanus	Common Warthog	Least Concern		
Poecilogale albinucha	African Striped Weasel	Least Concern		
Procavia capensis	Rock Hyrax	Least Concern		

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE LAST RECORDED
Proteles cristata	Aardwolf	Least Concern		
Raphicerus campestris	Steenbok	Least Concern		
Rattus rattus	Roof Rat	Least Concern	1	06 May 1994
Rhabdomys dilectus	Mesic Four Striped Grass Rat	Least Concern		
Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern	1	07 May 2019
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Least Concern		
Rhinolophus darlingi	Darling's Horseshoe Bat	Least Concern		
Saccostomus campestris	South African Pouched Mouse	Least Concern		
Sauromys petrophilus	Robert's Flat-Headed Bat	Least Concern		
Scotophilus dinganii	African Yellow Bat	Least Concern		
Steatomys krebsii	Kreb's Fat Mouse	Least Concern		
Steatomys pratensis	Fat Mouse	Least Concern		
Suncus varilla	Lesser Dwarf Shrew	Least Concern		
Suricata suricatta	Meerkat	Least Concern		
Sylvicapra grimmia	Common Duiker	Least Concern		
Syncerus caffer	African Buffalo	Least Concern	1	16 April 2019
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Least Concern	1	01 July 1989
Taurotragus oryx	Common Eland	Least Concern	1	16 April 2019
Tragelaphus angasii	Nyala	Least Concern	2	11 May 2014
Tragelaphus oryx	Common Eland	Least Concern		
Vulpes chama	Cape Fox	Least Concern		
Xerus inauris	South African Ground Squirrel	Least Concern	1	03 November 2014

APPENDIX 5 REPTILE SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE OF LAST RECORD
Acontias gracilicauda	Thin-tailed Legless Skink	Least Concern		
Afrotyphlops bibronii	Bibron's Blind Snake	Least Concern		
Agama atra	Southern Rock Agama	Least Concern		
Aparallactus capensis	Black-headed Centipede-eater	Least Concern	1	28 July 2019
Boaedon capensis	Brown House Snake	Least Concern	1	28 January 2011
Causus rhombeatus	Rhombic Night Adder	Least Concern		
Chamaeleo dilepis	Common Flap-neck Chameleon	Least Concern		
Chamaesaura aenea	Transvaal Grass Lizard	Least Concern		
Cordylus vittifer	Common Girdled Lizard	Least Concern	3	14 August 2014
Crotaphopeltis hotamboeia	Red-lipped Snake	Least Concern		
Dasypeltis scabra	Common Egg Eater	Least Concern	1	26 February 1981
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	Least Concern		
Hemachatus haemachatus	Rinkhals	Least Concern	2	18 January 2015
Hemidactylus mabouia	Common Tropical House Gecko	Least Concern		
Homoroselaps dorsalis	Striped Harlequin Snake	Least Concern		
Homoroselaps lacteus	Spotted Harlequin Snake	Least Concern		
Lamprophis aurora	Aurora House Snake	Least Concern	4	18 January 2015
Pachydactylus capensis	Cape Gecko	Least Concern	1	14 August 2014
Panaspis wahlbergi	Wahlberg's Snake-eyed Skink	Least Concern		
Pelomedusa galeata	South African Marsh Terrapin	Not evaluated	1	03 October 2012
Philothamnus semivariegatus	Spotted Bush Snake	Least Concern		
Prosymna ambigua	East African Shovelsnout Snake	Least Concern		
Prosymna sundevallii	Sundevall's Shovel Snout	Least Concern		
Psammophis crucifer	Cross-Marked Grass Snake	Least Concern		
Psammophis subtaeniatus	Western Yellow-Bellied Sand Snake	Least Concern	2	07 May 2019
Psammophylax rhombeatus	Spotted Grass Snake	Least Concern		
Psammophylax tritaeniatus	Striped Skaapsteker	Least Concern		
Pseudocordylus melanotus	Common Crag Lizard	Least Concern	3	26 February 1981
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	Least Concern	2	10 November 2014

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS	NUMBER OF RECORDS	DATE OF LAST RECORD
Trachylepis capensis	Cape Skink	Least Concern		
Trachylepis punctatissima	Speckled Rock Skink	Least Concern	1	26 February 1981
Trachylepis varia sensu lato	Common Variable Skink Complex	Least Concern		

APPENDIX 6 FLORA SPECIES

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS
Aristida congesta	Tassel Three-Awn	Least Concern
Chloris virgata	Feather Fingergrass	Least Concern
Cymbopogan validus	Giant Turpentine Grass	Least Concern
Cynodon dactylon	Bermuda Grass	Least Concern
Digitaria longiflora	False Couch Grass	Least Concern
Elionurus muticus	Wire Grass	Least Concern
Eragrostis lehmanniana	Lehmann Lovegrass	Least Concern
Eragrostis plana	Fan Love Grass	Least Concern
Eragrostis Rigidior	Curly Leaf Grass	Least Concern
Heteropogon Contortis	Spear Grass	Least Concern
Melinis repens	Rose Natal Grass	Least Concern
Panicum natalense	Natal Buffalo Grass	Least Concern
Setaria sphacelate	South African Pigeon Grass	Least Concern
Sporobolus centrifugus	Spike Dropseed Grass	Least Concern
Sporobolus fimbriatus	Perennial Dropseed	Least Concern
Themeda triandra	Red Grass	Least Concern
Trachypogan Spicatus	Giant Spear Grass	Least Concern
Typha capensis	Bulrush	Least Concern
Invasive Alien Species		
Cirsium vulgare	Spear Thistle	Category 1b
Eucalyptus globulus	Blue Gum	Category 1b
Ipomoea indica	Blue Morning Glory	Category 1b
Melia Azedarach	Syringa Tree	Category 1b
Nerium oleander	Oleander	Category 1b
Pinus sp	Pine Species	Category 3
Verbena Opuntia	Prickly Pear	Category 1b

ANNEXURE 7 WETLAND RISK ASSESSMENT MATRIX CONSTRUCTION PHASE

No.	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
1	Clearing of vegetation within the proposed development site	Creating residential and road infrastructure	Increase surface runoff and sedimentaition of the water resource. Introduction and spread of Invasive Alien Species.	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**5**	**1**	**1**	**5**	**1**	**8**	**40**	**L**	**60**	Ensuring that construction remains within the construction plans
		Creating Site camp		1	1	1	1	1	1	2	4	1	1	5	1	**8**	**32**	**L**	60	Ensuring that the site camp remains within the construction plans
2	Proliferaiton of Alien Invasive Species.	Bare soil	Loss of natural vegetation	1	2	2	1	**1.5**	2	2	**5.5**	1	1	5	1	**8**	**44**	L		No vegetation may be cleared outside of the construction site plan
3	Construction Vehicle Activty	Dust and soil agrevation	Erosion and sedimentation Water quality deteriation	2	2	2	2	**2**	2	2	**6**	1	1	5	1	**8**	**48**	L		Existing roads must be utilised where possible.
		Spillage from construction vehicles leading to contaminaion of wetland feature soils		1	2	2	2	**1.75**	2	1	**4.75**	2	2	5	2	**11**	**52.25**	L		

ANNEXURE 8 WETLAND RISK ASSESSMENT MATRIX OPERATIONAL PHASE

No.	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
1	Increased runoff and sedimentation	Creating residential and road infrastructure. Creation of drainage channels.	Increase surface runoff and sedimentation of the water resource. Altered hydrological flow patterns	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**5**	**1**	**1**	**5**	**1**	**8**	**40**	**L**	**60**	using the Eskom Veg Standard (TGL ….). Using approved method statemnet and EMP. Rehabilitation Plan and Monitoring programme. Eskom Procedure, EMPr. SANS 1200,Design Drawings
		Disturbed soils may form erosional gullies .		3	2	3	2	2.5	2	2	6.5	1	1	5	1	**8**	**52**	**L**	60	
2	Proliferaiton of Alien Invasive Species.	Poor implementation of the IAPS management plan.	Spread of IAPS	1	2	3	2	**2**	1	2	**5**	2	2	5	1	**10**	**50**	**L**		

APPENDIX C2

Bulk Services Availability Report

GCS

Water & Environmental Consultants

GAUTENG PROVINCE
HUMAN SETTLEMENTS
REPUBLIC OF SOUTH AFRICA

GAUTENG RAPID LAND RELEASE

BULK SERVICES AVAILABILITY REPORT

UNITAS PARK EXTENSION 16

PROJECT No.: G18110017/1

17 OCTOBER 2019

PHUMAF
ENGINEERING SOLUTIONS THAT TOUCH PEOPLE'S LIVES

PHUMAF HOLDINGS
P.O. BOX 4049, RANDBURG, 2125
VVM SENTRUM BUILDING
356 PRETORIA AVENUE
RANDBURG, 2194

DOCUMENT CONTROL

Job Title	Gauteng Rapid Land Release		Job Number: 7001
Document Title	**BULK SERVICES AVAILABILITY REPORT** **Unitas Park Extension 16**		File Ref: 7001 Gauteng Rapid Land Release Programme\03 CIVIL\11 Progress reports\Report\BULK INVESTIGATION REPORTS
Document Revision	**Revised/ Issued By**		**Date**
A	Sikelela Mnguni (Pr.Tech.Eng)		17 OCTOBER 2019
Compiled By:	Rofhiwa Maboho		17 OCT 2019
	Name & Surname	*Signature*	*Date*
Reviewed & Checked By:	Sikelela Mnguni (Pr.Tech.Eng)		17 OCT 2019
	Name & Surname	*Signature*	*Date*
Client Approval:			
	Name & Surname	*Signature*	*Date*

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Annexure A: Water Supply Master Planning Volume 1

Annexure B: Sewage Disposal Master Planning Volume 2

VOLUMES:

Volume A1: Approval Authorities Correspondences

Volume A2: Book of Drawings

- Locality Map
- Layout indicating dolomitic hazard zonation
- Emfuleni Water Master Plan Layout
- Emfuleni Sewer Master Plan Layout
- SMN/2012/01
- SMN/2012/02
- SMN/2012/03
- SMN/2012/04
- SMN/2012/05
- FIGURE 7 3.1
- FIGURE 7 3.2
- FIGURE 8.1

Volume A3: Photographic Report

1 INTRODUCTION

The purpose of this Bulk Services Availability Report is to determine the availability and capacity of existing bulk services with a view of servicing the proposed development. This report presents the findings of a preliminary site investigation relating to civil engineering bulk services, civil engineering internal services, road, traffic/transportation engineering, public transport and non-motorised Transport (NMT), storm water management and domestic solid waste management.

This Bulk Services Availability Report addressed the following:

- Bulk Potable Water and Internal reticulation
- Bulk Potable Sanitation and Internal reticulation
- Roads, Traffic and Transportation Engineering
- Public Transport and Non-Motorised Transport (NMT)
- Storm water Management
- Domestic Solid Waste Management
- Conclusion and Recommendation

This investigation will be based on available, local knowledge and discussions with the relevant officials as in **Volume A1: Approval Authorities Correspondences**.

2 SITE INFORMATION

The proposed residential development of Unitas Park Extension 16 is in the Sedibeng District Municipality under the Emfuleni Local Municipality. The Project involves Farm Portions within the Unitas Park eastern Suburbs in the Emfuleni Local Municipality's eastern suburbs. The proposed site is located adjacent the existing Houtkop Rd (R54) on the western side, this route is located where the future K180 will be positioned. Houtkop AH farm is on the eastern side, Unitas Park AH on the southern side and Unitas Park farm on the western side. Future K55 route also bounds the site to the south.

The property size is listed below:

- portion 222 (a portion of portion 221) of the farm Houtkop IQ 594 IQ 151 0900m²

The locality plan is attached as in **Volume A2: Book of Drawings**. and indicates these areas.

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3 TOPOGRAPHY AND VEGETATION

Unitas Park Extension 16 site is predominantly flat. The lowest point on the site is recorded as being approximately 1470 metres above sea level, while the highest point is outside the site to the west and is recorded at 1481 metres above sea level. The gentleness of the terrain presents a positive attribute of the site as reduces the likelihood of intensive earthworks during construction within the area. A detailed topographical survey of the area to be developed is not available at present.

Unitas Park Extension 16 is in Vereeniging. The Vereeniging area normally receives about 559mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (0mm) in July and the highest (108mm) in January. The average midday temperatures for Vereeniging range from 17°C in June to 27.6°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

4 GEOLOGICAL AND GEOTECHNICAL ASPECTS

The only source of geo-technical information that is available at present is Engeodata Request (attached as **Volume A2: Book of Drawings**) geological survey mapping which shows that the proposed Unitas Park Ext.16 development is underlain by dolomite.

A detailed geotechnical investigation will be performed to determine the founding conditions for roads and housing developments especially if NHBRC approvals are required. Detailed investigations will also be required for structures such as double storey housing units or group housing. These investigations will also indicate whether excavated material may be used for other purposes (such as road building materials etc.).

5 ECOLOGY/ENVIRONMENTAL INFORMATION

A detailed investigation is being executed by Public Process Consultants and a report for an Environmental Impact Assessment is being prepared. Environmental and ecological details will be available in this investigation report.

6 WATER SUPPLY

6.1 Authority and Provider Arrangements

The proposed development area falls within the Emfuleni Local Municipality Metsi-A-Lekoa Water jurisdiction and the Municipality serves as both the Water Service Authority as well as the Water Service Provider.

The content of this section is based on information obtained from Emfuleni Spatial Development Framework 2017-2025, Compiled on Behalf of the Emfuleni Local Municipality by: Urban Dynamics Gauteng, dated September 2017 and Project 14/2006 Civil Engineering Services Master Planning Volume 1 Water Supply, Draft report compiled in April 2009 and updated in April 2013.

6.2 Description of Existing Water Infrastructure

The content on this section below is based on the information extracted from Emfuleni Spatial Development Framework 2017-2025 report under Municipal Services section. This section gives an insight on the conditions and status of the existing Bulk water infrastructure in Emfuleni, and the plans that Emfuleni Local Municipality have with regards to solving the problems they are currently facing with their old overworked bulk water infrastructure which does not have sufficient capacity to supply the current demand and also to accommodate future demand from future developments.

MUNICIPAL SERVICES

WATER SUPPLY

According to the **Figure 6.1** below, the majority of households that reside in Emfuleni have access to piped water. A relatively small number of households acquire water from other sources, such as such as boreholes.

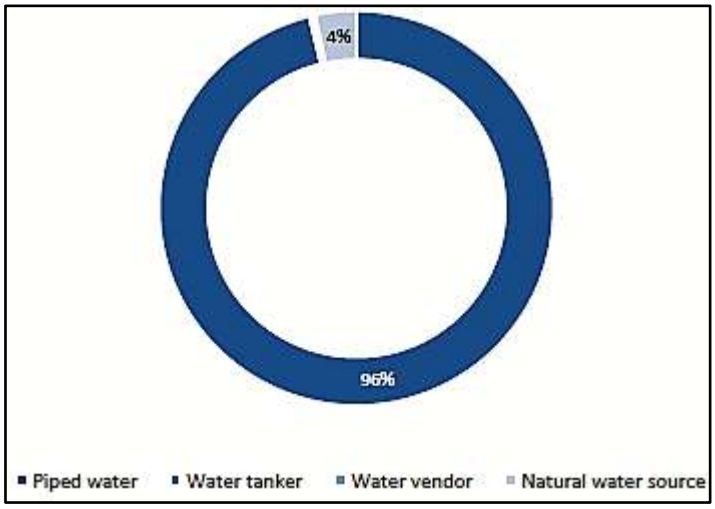

FIGURE 6.1: WATER SUPPLY

(CENSUNS 2011)

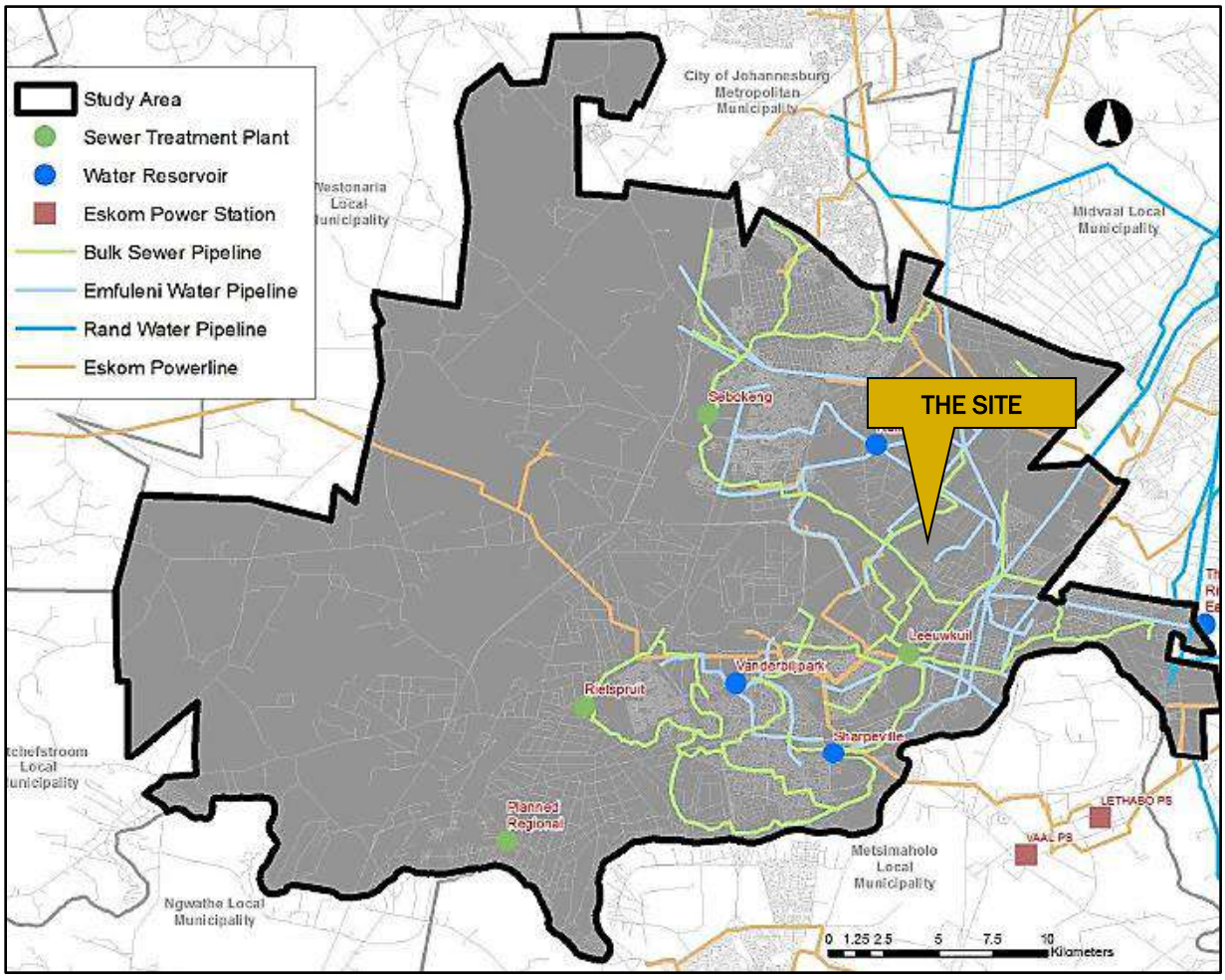

FIGURE 6. 2: BULK SERVICES

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

The water system consists of pipe networks, 9 reservoirs, and a small potable water treatment plant. Emfuleni borders the Vaal River and therefore extracts water from the river for consumption within Emfuleni. However, only a small amount of the required quantity is extracted from the Vaal River and purified at 0.2 Ml/day. Most potable water required by Emfuleni is supplied by Rand Water (205 Ml/day). The bulk water network is illustrated on **Figure 6.2**.

The bulk water network is old, and it is overworked due to the demand for potable water. The age of the networks varies between 60 -70 years across the municipal area. There are no backlogs in the supply of water connections. Additional water connections have largely been provided to informal settlement households to cope with growth of those settlements. In addition, water connections are continuously being provided to new housing development within Emfuleni.

EXISTING INFRASTRUCTURE

This information below was obtained from the Civil Engineering Services Master Planning Volume 1 Water Supply, Draft report

BULK WATER SUPPLY

Emfuleni, except for Vaaloewer, receives its bulk water supply from Rand Water. Various Rand Water pipelines traverse the municipal area from either Vereeniging or Suikerbosch. The Rand Water supply systems deliver either to Daleside Reservoirs (TWL 1528 m) or Eikenhof (TWL 1580 m). From the Daleside reservoirs the water gravitates to Swartkoppies from where it is pumped further.

STORAGE

- Vanderbijlpark reservoirs have some spare capacity, but the Rand Water connection and supply pipes are restrictive based on summer flow (PF) conditions.

- Sharpeville reservoirs are not utilized presently as the pump station feeding the water tower is out of operation. The supply line from Rand Water feeds directly into the Sharpeville Water Tower with top water level 1504,8m. As indicated above the Rand Water connection and supply pipe to Sharpeville is restrictive. Sharpville water supply system was provided during the separate development policy period. Sharpeville falls within the Vanderbijlpark reservoir supply zone and should be incorporated in the Vanderbijlpark system.

- Langerand Reservoir belongs to Rand Water. Rand Water policy dictates that consumers, Emfuleni Municipality in this case, provide their own storage facilities. This requirement was waived to an extent because Langerand reservoir is located at the end of the Rand Water system and dedicated to the Sebokeng / Evaton / Orange Farm area. The reservoir is, however, over extended and need to be augmented. The supply level of the Langerand reservoir is too high to supply the area within the 90 m maximum pressure criterium. Additional reservoir capacity at a lower top water level is required.

DISTRIBUTION

The different distribution systems are discussed briefly separately.

a. Vanderbijlpark

The distribution system is conventional with a bulk supply point, bulk supply pipe to the reservoirs and a distribution network. The networks are supplied from the reservoirs with TWL 1528,5 m and the water towers with TWL 1548,8 m. The supply area includes Vanderbijlpark, Bophelong, Boipatong, Tshepiso, Zuurfontein, Bonane, Agricultural Holdings and a feed to Iscor.

The capacities of the distribution networks are within the design norms. The only area where supply is under limited stress is a small area in Bophelong. The lower laying areas along the Vaal River are fed via pressure reducing valves to stay within the 90 m maximum pressure limit. Matters of concern with regard to the Vanderbijlpark Park system are that it is only supplied from one source, Rand Water connection, and that the supply area is spread out.

This issue is being addressed by the installation of a 500 mm steel / mPVC pipeline from downstream side of the Langerand reservoir past Unitaspark, Solandpark and Tshepiso X4 up to the existing 300 mm Vanderbijlpark supply pipe to Tshepiso X3. This pipeline provides an additional supply to the Vanderbijlpark system. A 15 Mℓ reservoir with similar TWL as the existing Vanderbijlpark reservoirs is also provided along this new supply pipe.

b. Vereeniging Town

These areas are also supplied directly from the Rand Water pipelines without any balancing or storage. The capacities of these connections are sufficient for the foreseeable future. It is

anticipated that these connections and supply directly from the Rand Water lines will remain for the planning period of this report. The supply areas include Vereeniging Town, Leeuhof, Leeuwkuil, Peacehaven, Powerville, Duncanville, Arconpark, Dickensonville.

c. **Solandpark / Dadaville, Roshnee and Rust-de-Vaal / Steelpark**

These areas are supplied from the high-pressure Rand Water pipelines i.e. delivering to Eikenhof. Operating pressure in these pipelines is ± 1610 m. The areas are supplied via pressure reducing valves. The existing Rand Water connections and distribution networks have sufficient spare capacity for the short term. As for the other Vereeniging supply systems no balancing or storage are provided.

d. **Unitaspark, Waldrif, Agricultural Holdings**

These areas are supplied from the Helenasrust Rand Water connection. The pressures in the Rand Water pipes are limited (± 1550 m), The Rand Water connection is sufficient, but the network pipes must be augmented. No balancing and storage facilities are provided for.

6.3 Level of Service & Design Norms

The design norms and standards that have been utilized for this report are the:

- "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book).
- Any relevant published SANS documents.

The design parameters utilised to calculate the demand and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must therefore be confirmed through a preliminary and final design process.

6.4 Unitas Park Extension 16: Water Demand (Annual Average Daily Demand)

The following are assumed:

1. Demand rates are according to the Guidelines for Human Settlement.
2. Reticulation losses assumed at 15%
3. Emfuleni Local Municipality Metsi-A-Lekoa Design Criteria and Internal Services Standards

Table 6.1: Water Demand (Annual Average Daily Demand)

Zoning	No of Stands	No of Dwellings	Area (ha)	AADD per Unit (l/day)	Unit	Average Water Demand (l/day)	Average Water Demand (l/s)	Peak Factor	Peak Demand (l/s)
High Density Mixed Use	1	7250	151	400	Dwelling per 100m² of Gross Floor Area	6040000	69,91	4	279,630
TOTAL			151			6040000	69,91		279,630
SUB-TOTAL									279629,630kl/day
PLUS, UAW (20% OF TOTAL AADD)									69907,407 kl/day
TOTAL AVERAGE DEMAND (AADD)									349537,037 kl/day
PEAK DEMAND (exc. Fire flow) PF = 4									4045,568 l/s
FIRE FLOW PER HYDRANT (X4) - High risk									25 l/s

Limited calculations to determine the demand for the various services were prepared to obtain an indication of the size of the services. The actual sizes of the services will have to be determined through a final design process after the relevant details (final site layout plan, number of units, size and coverage of the various land uses etc.) have been finalised.

6.5 Proposed Internal Water Supply

All pipes used must conform to SANS 1200 L and all other standards referred to in SANS 1200 L. This will include the use of uPVC, mPVC, steel and HDPE pipes.

The following is a summary of the design criteria, elements and standards that will be used:

WATER RETICULATION

Criteria:

A full water network, with individual connections to all erven.

Elements:

- Class 12 uPVC piping with a minimum size of 75mm dia
- Cast Iron waterworks anticlockwise closing type valves
- Underground Byonette type hydrant valves
- Erf connections using HDPE class 12 piping

Standards:

• Average Daily Demand	400 litres/100m2/day of gross floor area
• Instantaneous demand peak factor	4
• Peak flow residual head	24m
• Fire demand	High risk 15m
• Pipe material	uPVC class 9 / 12 SABS 966 approved No solvent welding will be allowed
• Pipe size	75mm dia. Minimum
• Pipe cover	1.0m minimum
• Valves	AVK Waterworks type, Cast Iron, anticlockwise closing, opposite splay pegs, Aqua-loc mono box type – blue lid colour
• Hydrants	Underground Byonette type opposite splay pegs, Aqua-loc mono box type – red lid colour
• Residential connections	HDPE class 12 50mm single connections – small stands 100mm single connections – larger stands Connection installed & tested up 1m outside erf boundary
• Hydrant spacing	120m on 75mm dia. Minimum – high risk

6.6 Standard Details

SANS 1200 (together with other applicable details) details will be used to prepare project-specific details and be submitted to Emfuleni Local Municipality Metsi-A-Lekoa for their approval.

The provision of SANS 1936 is also applicable to this project.

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7 SANITATION

7.1 Authority and Provider Arrangements

The proposed development area falls within the Emfuleni Local Municipality Metsi-A-Lekoa Water jurisdiction and the Municipality serves as both the Water Service Authority as well as the Water Service Provider.

The content of this section is based on information obtained from Emfuleni Spatial Development Framework 2017-2025 (ESDF), Compiled on Behalf of the Emfuleni Local Municipality by: Urban Dynamics Gauteng, dated September 2017, Project SNM/2012 Civil Engineering Services Master Planning Volume 2 Sewage Disposal, first edition dated August 2013 and Southern Corridor Regional Implementation Plan.

7.2 Description of Existing Sewer Infrastructure

The content on this section below is based on the information extracted from Emfuleni Spatial Development Framework 2017-2025 report under Municipal Services section.

MUNICIPAL SERVICES

SANITATION SUPPLY

As depicted by the **Figure 7.1** below, flush toilets are the most common form of sanitation provision within Emfuleni. The only other significantly used sanitation system in use in Emfuleni is pit latrines, which is most probably used in the informal settlement of Emfuleni.

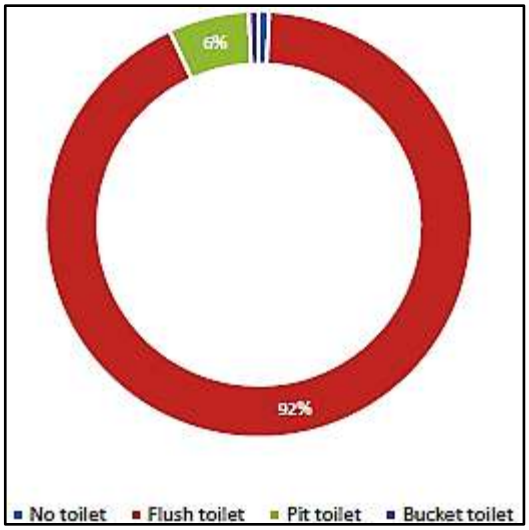

FIGURE 7.1: SANITATION SUPPLY

(CENSUNS 2011)

The bulk sanitation network is illustrated on **Figure 6.2**. The sanitation system consists of gravity pipelines and, due to the flat terrain; it also consists of 49 sewage pump stations. The wastewater system consists of 3 wastewater treatment works. The Sebokeng wastewater treatment works, located in Sebokeng next to the Rietspruit, is the largest wastewater treatment works within Emfuleni.

This wastewater treatment facility has a capacity of 119 Ml/day. Significant parts of the sanitation system infrastructure, including the Rietspruit and Leeuwkuil wastewater treatment works, need to be upgraded and rehabilitated.

The bulk sanitation network is old, and it is overworked due to the demand for sanitation services. The age of the networks varies between 60 -70 years across the Municipal area. The short-term sanitation infrastructure plans involve the rehabilitation of existing infrastructure, including sewer pump stations to minimize sewer spills. While this will give a significant improvement to overall performance, problems which could result in raw sewage spillage cannot be ruled out. Existing sanitation infrastructure has reached the end of its lifespan and can only be kept operational with a high risk of sewer spills. New infrastructure needs to be constructed in order to prevent future sewer spills.

The long-term solution for the aging sewer network problem includes the elimination of sewer pump stations and the construction of a new gravity pipe next to the Klip and Vaal Rivers. The replacement of the 3 Emfuleni wastewater treatment plants (Sebokeng, Leeuwkuil and Rietspruit), as well as Midvaal's wastewater treatment plants that serves Roshnee, are also included in the long-term sanitation infrastructure plans. The long-term plans aim to reduce sewer spillages and reduce the high

bulk infrastructure costs associated with urban development in Emfuleni. The long-term solution is estimated to take at least 8-10 years to implement.

EXISTING INFRASTRUCTURE

The information below is obtained from Civil Engineering Services Master Planning Volume 2 Sewage Disposal report.

The different elements of the sewage disposal scheme will be addressed separately:

DRAINAGE AREAS

The Emfuleni Local Municipality sewage drain to four (4) wastewater treatment works, viz. Leeuwkuil WWTW`s, Rietspruit WWTW`s, Sebokeng WWTW`s and the Midvaal WWTW`s. The Leeuwkuil WWTW`s drainage area has 34 sub-drainage areas, the Rietspruit WWTW`s has 3 sub-drainage areas, the Sebokeng WWTW`s has 6 sub-drainage areas and the Midvaal WWTW`s drainage area has 1 sub-drainage area inside the Emfuleni Local Municipality area, which either drain to a pump station or to the water treatment works directly. Risiville, a portion of Duncanville and Lakeside Estates, which is located inside the Midvaal Municipal Area, Lenasia, Orange Farm and Savanna City, located in the Johannesburg Municipal area, also drain to the Emfuleni sewer system.

Drawing number **SMN/2012/01** and Figure 7.1.1 (attached as **Volume A2: Book of Drawings**) give an overall indication of the Northern Drainage Area serviced by the Sebokeng WWTW`s. Drawing number **SMN/2012/02** and Figure 7.1.2 (attached as **Volume A2: Book of Drawings** ) give an overall indication of the Southern Drainage Area serviced by the Leeuwkuil WWTW`s in Vereeniging and the Rietspruit WWTW`s in Vanderbijlpark.

RETICULATION NETWORKS

The sewer network is conventional for the whole Emfuleni Local Municipality and was divided into 3 areas, the Southern Drainage area as per drawing number **SMN/2012/03** Southern Drainage Area, the Northern Drainage area as per drawing number **SMN/2012/04** Northern Drainage Area and Vaaloewer (attached as **Volume A2: Book of Drawings)**. The Northern and Southern areas drain to the four-wastewater treatment works while no sewer system for Vaaloewer exist.

- **Southern Drainage Area**

  The Southern drainage area as indicated on Figure 7.2.1 on **Annexure B** drain to two WWTW`s namely the Leeuwkuil WWTW in Vereeniging and the Rietspruit WWTW in Vanderbijlpark, this

figure 7.2.1 also show the existing pipe sizes of the network. The Southern drainage area was analysed using the Sewsan hydraulic model and the following links where less than 30 % spare capacity is available were identified. Drawing number **SMN/2012/05**, and Figure 8.1 on **Volume A2: Book of Drawings** shows the theoretical flows as per the hydraulic model done in April 2013.

SEDIBENG REGIONAL SANITATION SCHEME (SRSS)

The information in the section below was extracted from Southern Corridor Regional Implementation Plan.

A key requirement for the implementation of the majority of development proposals in the Sedibeng District, is the upgrade and implementation of the Sedibeng Sanitation Scheme.
A feasibility report has been prepared by GIBB SS&G Consortium dated 19 October 2016 which aimed to provide the planning of a detailed design and implementation plan of new infrastructure related to the sanitation scheme. The report has reviewed and assessed previous reports relating to the SRSS, and it recommends that it is necessary to expand on the previously proposed scheme of 2009, specifically with regard to the site selection and the need for a new wastewater treatment works (WWTW).

The feasibility report recommends that the Sebokeng and Meyerton WWTWs be retained to treat sewage generated in their respective catchments. Also, the Sebokeng WWTW must be upgraded to 200 Mℓ/d to accommodate flows from the northern part of Emfuleni. This WWTW will be upgraded in two phases, divided into Module 6 and 7 and are to be constructed using multiple contractors. Similarly, the Meyerton WWTW (which is currently being upgraded to a capacity of 25 Mℓ/d), should be kept operational to allow for the development along the R59 corridor.
The report also highlighted the urgent upgrade of Leeuwkuil WWTW (Emfuleni) with an additional 20Mℓ/d to accommodate flows from the planned university housing developments and other scheduled developments in Vereeniging.

Furthermore, the Rietspruit WWTW should ultimately be converted into a regional works with a 55 Mℓ/d expansion by 2035. This will accommodate sewerage flows from the south Sebokeng catchment, Vereeniging catchment and Vanderbijlpark catchment. The construction of pumping mains along the R59 into a bulk outfall sewer between Leeuwkuil WWTW and the Rietspruit WWTW should be carried out to transfer excess flows from Leeuwkuil WWTW to the Rietspruit WWTW.

7.3 Level of Service & Design Norms

The design norms and standards that have been utilized for this report are the:

- "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book).
- Any relevant published SANS documents.

The design parameters utilised to calculate the demand and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must therefore be confirmed through a preliminary and final design process.

7.4 Unitas Park Extension 16: Sanitation Demand Calculations

The following are assumed:

1. Demand rates are according to the Guidelines for Human Settlement.
2. Emfuleni Local Municipality Metsi-A-Lekoa Design Criteria and Internal Services Standards

Table 7.1: Sewer Flow (Annual Average Daily Flow)

Zoning	No of Stands	No of Dwellings	Area (ha)	ADWF per Unit (l/day)	Unit	Average Sewage Outflow (l/day)	Average Sewage Outflow (ADWF)(l/s)	Peak Factor	PWWF (l/s)
High Density Mixed Use	1	7250	151	300	Dwelling per 100m² of Gross Floor Area	4530000	52,43	2,5	131,076
TOTAL			151			4530000	52,431		131,076
						Total incl.15% Extraneous flow			150,738

Limited calculations to determine the demand for the various services were prepared to obtain an indication of the size of the services. The actual sizes of the services will have to be determined through

a final design process after the relevant details (final site layout plan, number of units, size and coverage of the various land uses etc.) have been finalized.

7.5 Proposed Internal Sanitation Drainage

All pipes used must conform to SANS 1200 L and all other standards referred to in SANS 1200 L. This will include the use of uPVC, mPVC, steel and HDPE pipes.

Below is a summary of the design criteria, elements and standards that will be used for new sewer reticulation networks:

SEWER NETWORK

Criteria:

A full waterborne sewerage system is proposed, with individual connections to all erven.

Elements:

- SABS approved piping with minimum size 160mm diameter.
- Concrete manholes with spacing of not more than 80mm, installed at all direction changes and mains intersections
- 160mm dia. connection to all erven with a depth to ensure drainage of 100% of the stand.
- Erf connections end 1m inside the erf

Standards

• Daily flow	300 litres/100m2/day of gross floor area
• Peak factor	Sliding scale as per Red Book – 2.5 maximum
• Pipe material	Any SABS approved piping
• Pipe size	160mm minimum at head, 1.0m generally 1.4 under streets
• Pipe slopes	1:80 at head 1:200 minimum for 160mm dia pipes 1:300 minimum for 200mm dia pipes 1:400 minimum for 250mm dia pipes 1:500 minimum for 300mm dia pipes

• Minimum flow velocity	0.7 m/s at half full
• Manholes	Concrete pre heavy-duty cast-in-situ, with step Irons and heavy-duty type concrete cover Piping inside manhole Clay/Fibre Concrete
• Manhole spacing	80m maximum
• Manhole sizes	0m to 1.2m deep: 0.9m inside diameter chamber, no shaft; 1.21m to 3.5m deep: 1.25 inside dia. chamber, no shaft; deeper than 3,5m: 1,5m inside dia chamber, no shaft Erf connections 160mm dia minimum, SABS approved piping
• Erf connections slope	1.60 minimum
• Erf connections depths	500mm minimum cover at buildings

7.6 Standard Details

SANS 1200 (together with other applicable details) details will be used to prepare project-specific details and be submitted to Emfuleni Local Municipality Metsi-A–Lekoa for their approval.

The provision of SANS 1936 is also applicable to this project.

8 ROADS

8.1 Authority and Provider Arrangements

The Emfuleni Local Municipality is responsible for the provision and maintenance of roads and stormwater infrastructure in its area of jurisdiction.

8.2 Traffic Impact Study

A traffic impact assessment will be conducted. The existing 2019 scenario, the future 2024 scenario on the existing geometry and the 2024 future scenario on the upgraded geometry will be analysed.

8.3 Access

The existing road network in close proximity of the project is summarized in Table 8.1 below.

Table 8.1: Existing Access		
Road Name	**Class**	**Description**
Existing Houtkop Road (R54)	4	Local Distributor (Main Road) to the West of the proposed Site.
Future K180 Route	3	Minor arterial road which will bound the site on its western side and will be located where existing Houtkop Road (R54) currently running.
Future K55 Route	3	Minor arterial road which will bound the site on its southern side.

Unitas Park Extension 16 development will gain access to west from the existing Houtkop Road (R54) which will also be the future K180 Route. Future K55 route will be located on the southern side forming the southern boundary to the development. These access routes will serve as the main accesses to the site. The collector streets from the proposed development will connect to the future K-routes as in **Volume A3: Photographic Report**.

8.4 Road Networks

8.4.1 Existing Road Networks

Figure 8.1 depicts the road network serving Emfuleni area. The N1 freeway passes through the centre of Emfuleni, linking Emfuleni to Johannesburg and Soweto. The primary role of this freeway is link Gauteng Province to the Free State Province and the Western Province and therefore fulfills a through-traffic function, rather than serving Emfuleni specifically. The P156 freeway, on the other hand, primarily serves Emfuleni, linking Vanderbijlpark and Vereeniging to Ekurhuleni and the OR Tambo International Airport. Due to its function, corridor development is increasingly occurring along

the P156 freeway, especially in the Vereeniging and Meyerton areas. The P156 freeway is located on the eastern boundary of Emfuleni.

Most of Emfuleni's planned K-route network has been developed, although not all the K-routes have been developed to a dual carriageway level. Many of the K-routes are also in need of rehabilitation, especially K-routes such as the K174 (Barrage Road). Despite this, the complete K-route network allows urban infill and expansion to take place in almost any part of Emfuleni, providing the access infrastructure needed for urban development.

There are four K-routes that can be highlighted as prominent K-routes serving Emfuleni. The first is the K53 (Moshoeshoe Road that become the Golden Highway), which runs between Vanderbijlpark and Sebokeng. This is an important commuter spine serving Emfuleni. The second K-route worth mentioning is the K174 (Barrage Road), linking Vanderbijlpark to Vereeniging.

This road is a gateway route into Emfuleni and the Municipality is thus concerned over the type of development that take place along this route. The K178 links Sebokeng to Vereeniging and the shopping and employment opportunities found within Vereeniging. This K-route is expected to become a major commuter spine, as urban development intensifies along this route. The fourth K-route is the K164, which links Evaton to Meyerton. Savanna City (a 14000-residential unit development) will be situated on and have access from the K164, which will increase the prominence of this K-route.

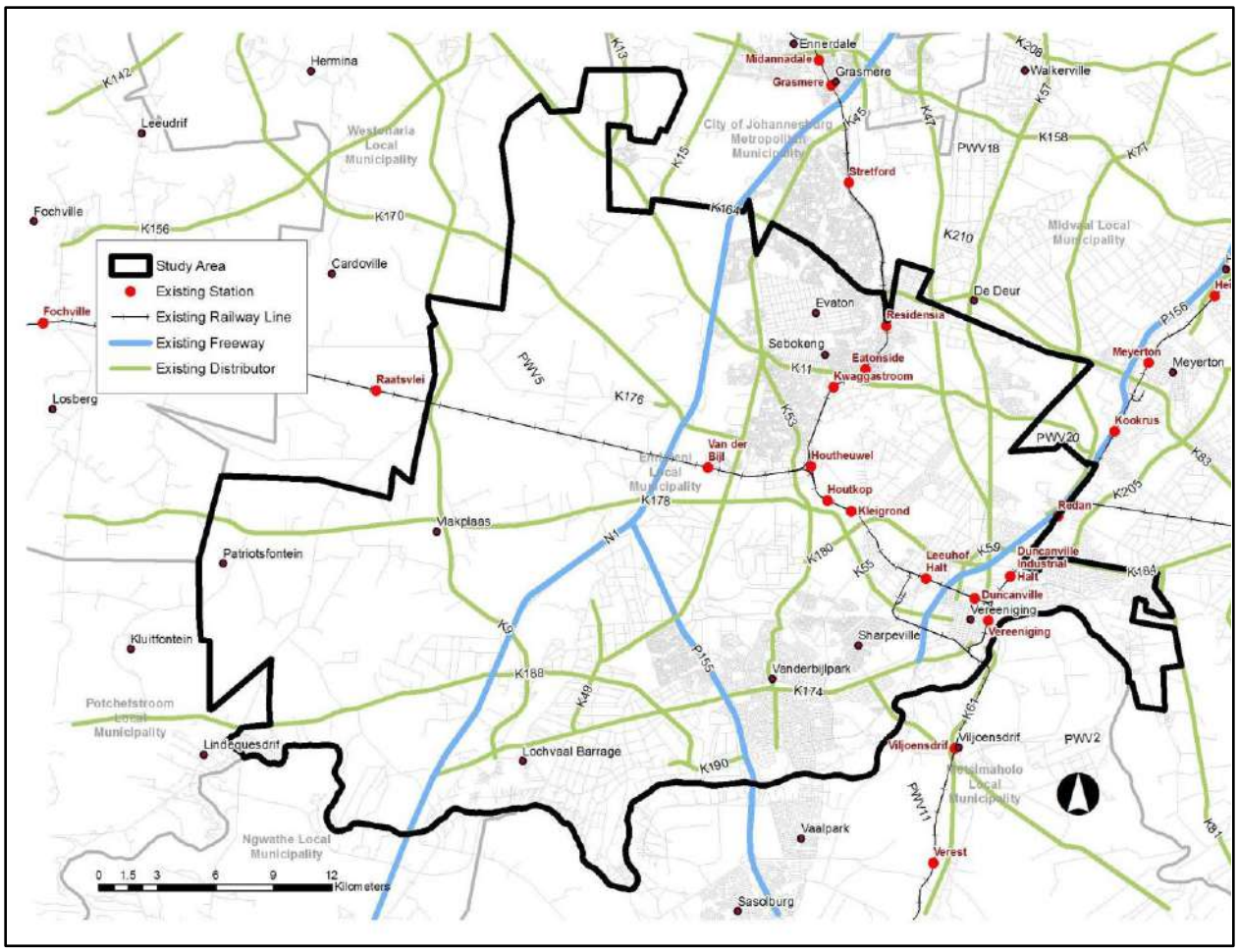

FIGURE 8.1: TRANSPORT NETWORK

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

8.4.2 Proposed Road Network Development

Most of the arterial network planned for Emfuleni has been developed. Of greater concern is the fact that much of this arterial network is in need of repair and even upgrading to modern K-route design standards. Barrage Road is one such a road that needs to be upgraded, especially if it is to fulfill a public transport function, as proposed in this Emfuleni SDF. The construction of the K55 arterial is of particular importance and should be given priority within Emfuleni.

The K55 will provide a needed north-south linkage between the Vaal University of Technology, Sharpeville, Boipatong, and Sonlandpark. The construction of this road will enable the northward expansion of the urbanised area into the Sonlandpark region, north of the Vereeniging-Johannesburg commuter railway line, as proposed in this Emfuleni SDF. This road will also intersect within the K180, providing the access needed to develop the proposed Sonlandpark Region Node on this intersection.

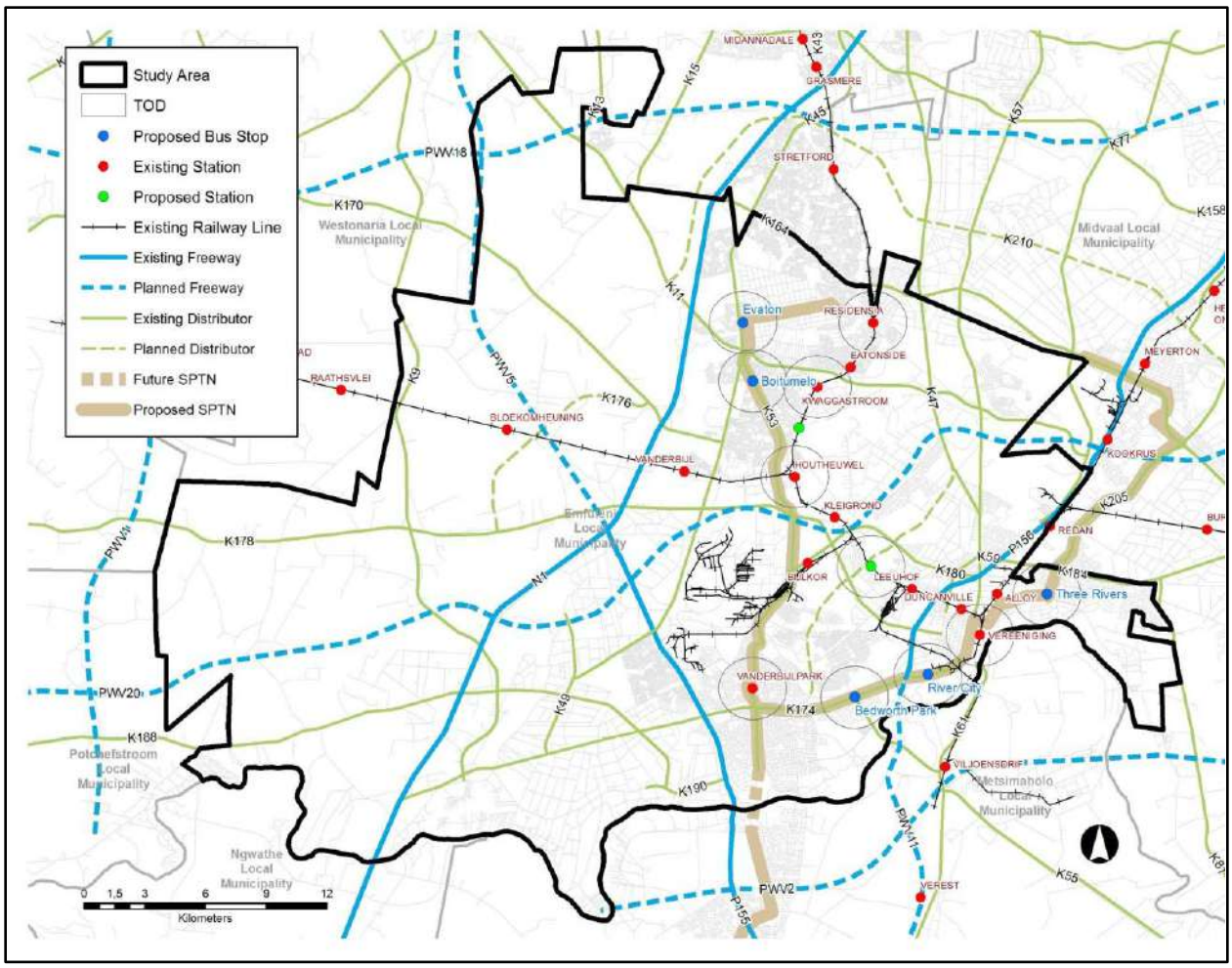

FIGURE 8.2: PROPOSED TRANSPORT NETWORK

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

8.5 Design Standards

The design norms and standards that have been utilized for this report are the:

1. "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book).
2. Any relevant published SANS documents.

9 Public Transport & Non-Motorised Transport (NMT)

9.1 Existing Public Transport and NMT Facilities

There is 1 formal taxi rank in Vereeniging which is 6.3km away from Unitas Park Extension 16. There are no Public transport lay-bys are located on Houtkop Road (R54). There are no formal pedestrian sidewalks located along the development boundary.

One is mindful of the following:

- The likelihood exists that residents and workers of the proposed development would be making use of public transport for recreational, business or employment purposes.
- According to the NHTS, 1.5km is the ideal limit that one should expect a pedestrian to walk to a public transport facility.

The information below was obtained from Emfuleni Spatial Development Framework 2017-2025.

Emfuleni is served by a rail network that connects Emfuleni to neighboring areas in Gauteng and the Free State. As depicted by **Figure 9.1**, this rail network consists of 3 lines. The first rail line stretches along the P156 (R59) freeway and links Sasolburg to Vereeniging, Meyerton and Germiston. This rail line is primarily a freight line but does contain commuter railway stations along the line. The second railway line stretches from Sasolburg, via Vereeniging towards Sebokeng, Orange Farm and Johannesburg.

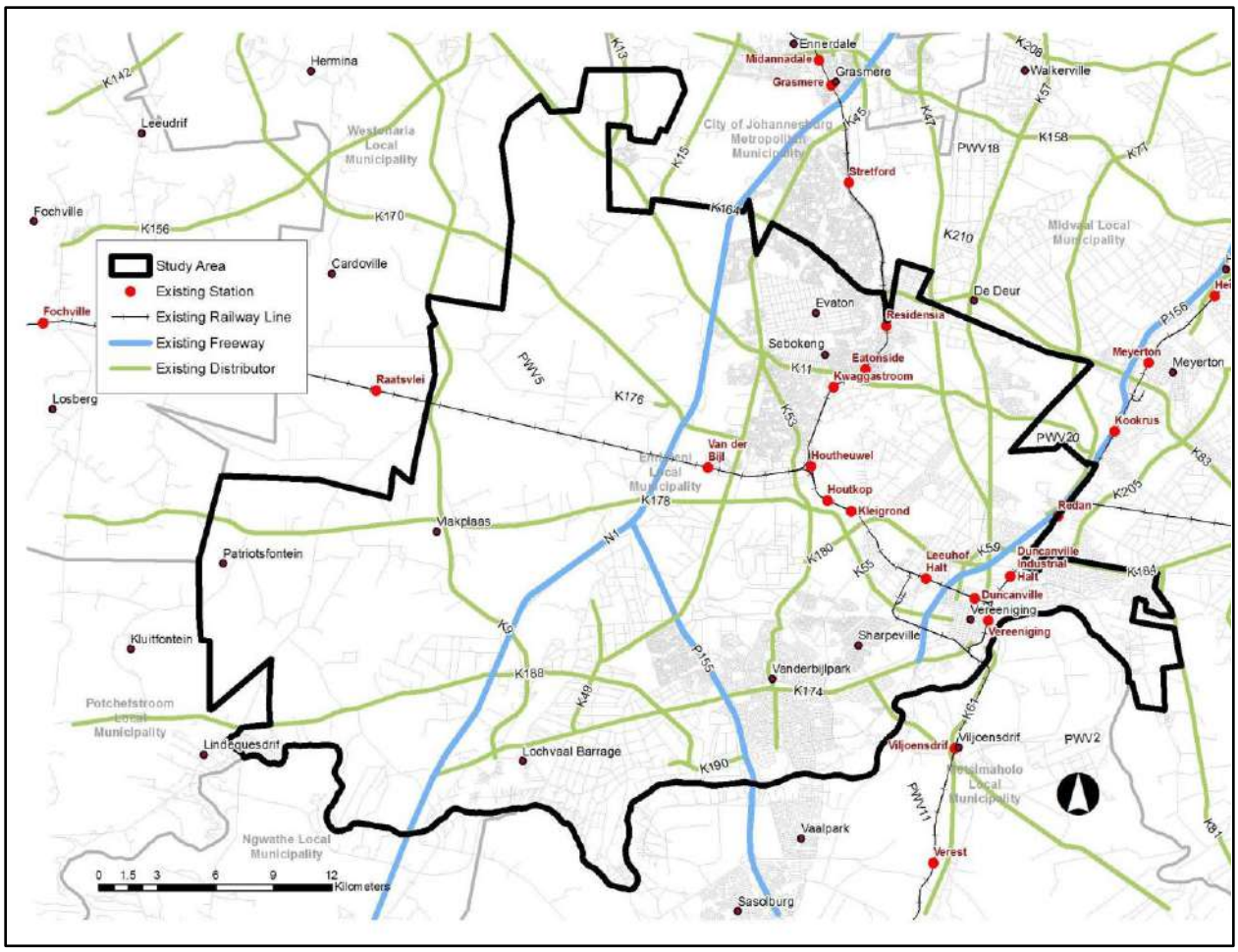

FIGURE 9.1: TRANSPORT NETWORK

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

METRORAIL

Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. This commuter rail network consists of 2 lines. The first rail line stretches from Vereeniging to Meyerton towards Germiston. This commuter railway line contains commuter railway stations, with prominent stations being the Vereeniging Station, the Duncanville Industrial Halt Station and the Meyerton Station.

The use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. The second commuter railway line stretches from Vereeniging towards Sebokeng, Orange Farm and Johannesburg. Prominent stations along this line are Houtheuwel Station, Residentia Station and Stredford Station. This railway line traverses densely built-up urban areas, as is found in Sebokeng and Orange Farm, and it therefore fulfills a significant commuter railway line function.

However, the full potential of this railway line to function as a commuter railway line is impeded by the following factors:

- Large undeveloped areas between Vereeniging and Sebokeng, with low residential densities to support commuter rail.
- The lack of urban development on both sides of the railway line, in particular in the Sebokeng and Evaton region.
- Gaps in the spacing of commuter railway stations, in particular on the stretches of railway line between the Leeuhof Halt and Kleigrond Stations and between the Houtheuwel and Kwaggastroom Stations.

BUS NETWORK

Emfuleni comprises an extensive bus network that serves the municipal area. A prominent bus route is the bus route linking Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway). This bus route links Evaton and Sebokeng to the Vereeniging CBD and the industrial areas located within Vereeniging. Other bus routes worth mentioning are the bus route linking Vereeniging to Meyerton, the bus route linking Vereeniging to Residentia Station, and the Bus route linking Evaton to Meyerton. Linking the bus network to the commuter rail network will enable the bus network to act as a feeder system to the commuter rail network. This will give Emfuleni access to an integrated hierarchy of public transport modes servicing different parts of the municipal are and it will greatly improve the current public transport network serving Emfuleni.

MINI-BUS TAXI NETWORK

Emfuleni comprises an extensive minibus taxi network. This network largely uses the same routes and serves the same areas within the municipal area that the bus network does. The only significant exception is that a minibus taxi route links the Vanderbijlpark CBD to Sebokeng via Mittal Steel; a route which the bus network does not serve. A disadvantage of the minibus taxi network is that the routes of this network are not fixed and can therefore change in future. Therefore, minibus taxi route does not indicate fixed locations where Emfuleni can develop. Bus routes and in particular commuter railway lines provide much better indication of where to densify Emfuleni.

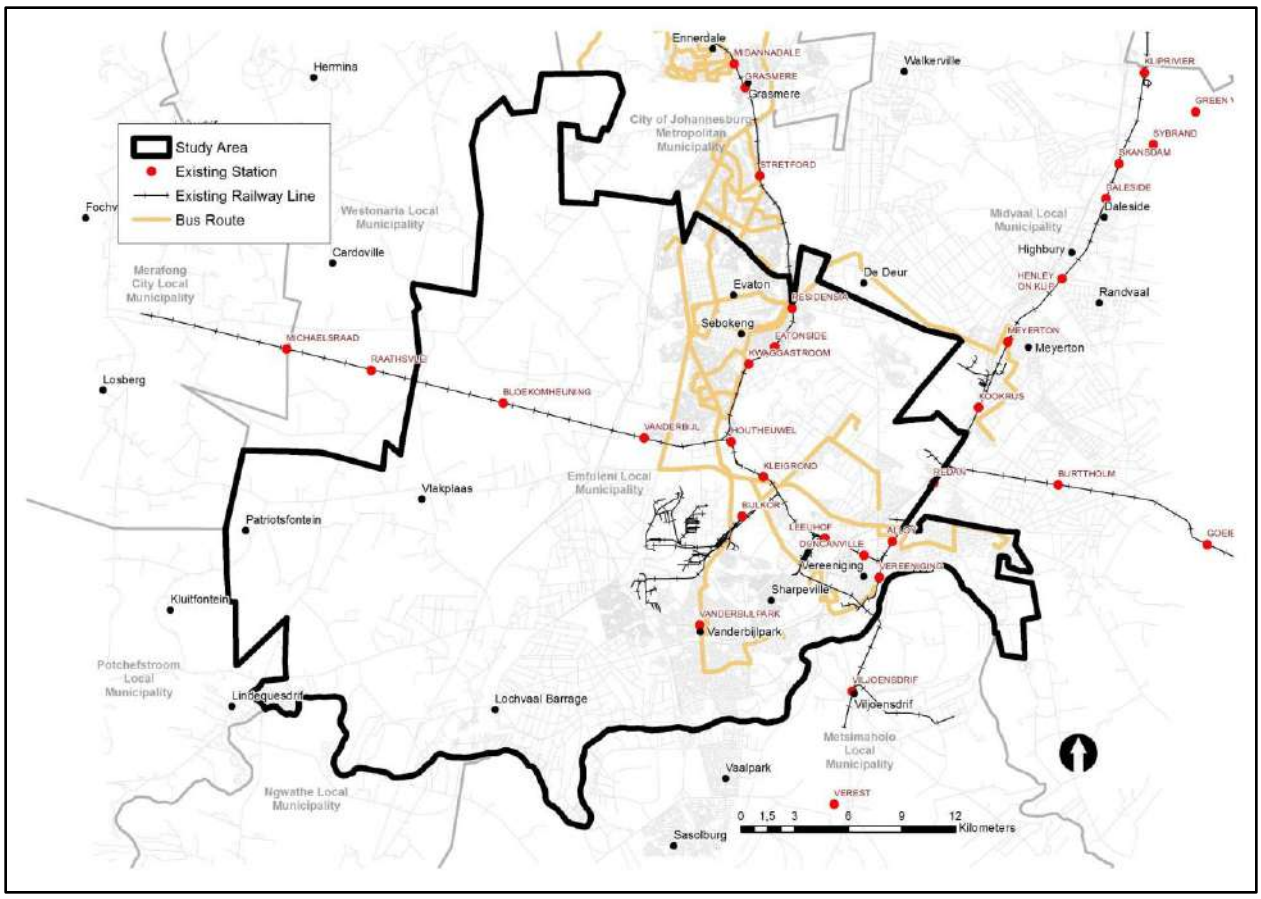

FIGURE 9.2: PUBLIC TRANSPORT

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

9.2 Public Transport Development

As was mentioned in the status quo section of this report, Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. Prominent station along this line is Houtheuwel Station, Residentia Station and Stredford Station. Currently, the use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. Urban development along the Vereeniging-Sebokeng-Orange Farm commuter railway line will provide the necessary commuter thresholds needed to ensure the viable operation and expansion of this commuter railway line.

With regard to further developing the Vereeniging-Johannesburg commuter railway line, it is proposed the 2 new stations are developed along this line to better serve envisaged urban expansion areas within Emfuleni. The first proposed station is located at the proposed Sonlandpark Regional Node and

will serve the Sonlandpark and Boipatong areas. The second proposed station is located north of Houtheuwel Station and will better serve the envisaged Lethabong extensions. The additional stations along this commuter rail line will provide opportunities for Transit Oriented Development (TOD). This will involve focusing new higher density, mixed-use development around these commuter rail stations. The layout of the land uses in relation to the stations are of critical importance, because it will determine the level of access that commuters will have to these stations. It should be noted that the station proposals above area Emfuleni SDF proposals and not PRASA proposals at this stage.

In addition to the above, a Strategic Public Transport Network (SPTN) is proposed by the Emfuleni SDF that will serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line. Two SPTN routes have been identified. The first route links Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway), and then turns eastward at Evaton towards Residentia Station. This SPTN route links Evaton and the Sebokeng CBD to the Vereeniging CBD. This route can be extended southwards across the Vaal River up to Sasolburg. The second SPTN route utilizes Barrage Road (K147) and links the Vanderbijlpark CBD, the Bedworthpark Regional Node, the proposed River City Node, the Vereeniging CBD, and the Three Rivers Node. This route can be extended northeastwards up to Meyerton.

A Strategic Public Transport Network (SPTN) is proposed by the Emfuleni SDF that will serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line. Two SPTN routes have been identified. The first route links Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway), and then turns eastward at Evaton towards Residentia Station. This SPTN route links Evaton and the Sebokeng CBD to the Vereeniging CBD. This route can be extended southwards across the Vaal River up to Sasolburg. The second SPTN route utilizes Barrage Road (K147) and links the Vanderbijlpark CBD, the Bedworthpark Regional Node, the proposed River City Node, the Vereeniging CBD, and the Three Rivers Node. This route can be extended northeastwards up to Meyerton.

Having a longer-term view of public transport network development will enable municipal planners to develop a land use structure that can support the envisaged public transport network in future. Municipal planners can promote the development of activity nodes at commuter railway stations and envisaged SPTN/BRT stations that would (a) apply higher land use densities, (b) a greater land use mix, and (c) a pedestrian-oriented structure.

These are all critical elements needed to support the viable operation of a public transport system and station.

SPTN Route/ railway line	Nodal Area	Station or Rank or Stop	Integration Principles
Vereeniging-Johannesburg commuter railway line	Vereeniging CBD	Existing Vereeniging commuter railway station Proposed bus station and minibus taxi rank at commuter railway station	Design and locate mixed land use at commuter railway station Design and construct pedestrian walkways to facilitate access to a commuter railway station
Vereeniging-Johannesburg commuter railway line	Sonlandpark Regional Node	Proposed Sonlandpark commuter railway station Proposed bus station and minibus taxi rank at commuter railway station	Design and locate mixed land use at proposed commuter railway station Design and construct pedestrian walkways to facilitate access to the proposed commuter railway station

Table 9.1: PROPOSED PUBLIC TRANSPORT ROUTES, STATIONS AND LAND USE INTEGRATION

(Source: Urban Dynamics Gauteng, 2017)

10 Stormwater Management

10.1 Natural River System and Flood lines

There are several natural low points (drainage areas) dividing the development in Unitas Park into different natural drainage areas. Natural drainage flow directions will be retained in the preliminary design of the stormwater infrastructure.

10.2 Design Norms and Standards

The design criteria are derived from the Guidelines for Human Settlement Planning and Design (Red Book) and the SANRAL Drainage Manual 5th Edition.

The Rational Method will be used to calculate the stormwater runoff for this site. The stormwater will be drained along the road reserve, mainly in open, unlined V-drain channels, with underground / piped systems only where surface drainage is not possible or deemed to be impractical.

Designs will be such that the canals can accommodate the 1:2-year minor storm and the 1:25 year major storm is accommodated in the road structure without overtopping.

10.3 Existing Stormwater Drainage Zones

There is currently no information available regarding existing stormwater infrastructure on existing areas adjacent to the planned developments. In order to tie into these existing systems, the positions, levels of these existing systems need to be confirmed in order to confirm functional designs.

11 Domestic Solid Waste

Domestic solid waste will be collected by the Municipality which will be established as part of this project. It is further envisaged that this will be an on-street collection system operating once a week using a Municipal Waste collection truck.

Disposal of collected waste will be via Emfuleni Local Municipality Waste Disposal who collect generated waste at pre-determined locations on the site and disposes it at their Landfill / Waste Disposal facility on a weekly basis.

Waste reduction through recycling at source will be encouraged to reduce the waste pile (e.g. bottles, tins and paper and cardboard) however given the nature of the development, it is not expected that there will be a huge reduction in volume.

12 Conclusions and Recommendations

The development of this site i.e. Unitas Park Extension 16 appear to be a viable proposition based on initial studies and investigations.

The following conclusions and recommendations are drawn:

- There is currently insufficient capacity in the existing reservoirs to accommodate the proposed development and densities. Additional studies will be required to determine a suitable reservoir to supply the proposed development or whether a new reservoir is needed.

- There is currently insufficient capacity in the wastewater treatment works to accommodate the proposed development and densities.
- There are no records of any service installed to accommodate this development and new water and sewer pipes will need to be installed to provide connections.
- Additional capacity analysis of the network pipes will be required with a GLS report to determine if and any upgrades that are required on the network pipes for both the water and sewer pipes.at the time of this report, the time and budget did not allow for this level of investigation.
- Additional services (roads, stormwater, water and Sewer) would need to be installed to accommodate the proposed development.
- A traffic impact assessment is required to determine any additional capacity required on the roads.
- No formal storm water exists, a masterplan and new infrastructure is required to support the development.

ANNEXURE A

WATER SUPPLY MASTER PLANNING VOLUME 1

ANNEXURE B

SEWER DISPOSAL MASTER PLANNING VOLUME 2

PHUMAF HOLDINGS
P.O. BOX 4049, RANDBURG, 2125
VVM SENTRUM BUILDING
356 PRETORIA AVENUE
RANDBURG, 2194

APPENDIX C3

Bulk Electrical Services Report

GCS

Water & Environmental Consultants

GAUTENG PROVINCE
HUMAN SETTLEMENTS
REPUBLIC OF SOUTH AFRICA

BULK ELECTRICAL SERVICES REPORT

BULK ELECTRICAL SERVICES REPORT

UNITAS PARK EXTENSION 16

PROJECT No.: G18110017/1

25 SEPTEMBER 2019

PHUMAF
ENGINEERING SOLUTIONS THAT TOUCH PEOPLE'S LIVES

PHUMAF HOLDINGS
P.O. BOX 4049, RANDBURG, 2125
VVM SENTRUM BUILDING
356 PRETORIA AVENUE
RANDBURG, 2194

DOCUMENT CONTROL

Job Title	Gauteng Rapid Land Release		Job Number: 7001
Document Title	**Unitas Park Extension 16 Bulk Electrical Services Report**		File Ref: 7001 Gauteng Rapid Land Release Programme\02 PROJ\09 Documents\Internal Documents
Document Revision	**Revised/ Issued By**		**Date**
A	KENNETH CHITENHE		25 SEPTEMBER 2019
Compiled By:	*KENNETH CHITENHE*		*25/09/2019*
	Name & Surname	*Signature*	*Date*
Reviewed & Checked By:	*KENNETH CHITENHE*		*25/09/2019*
	Name & Surname	*Signature*	*Date*
Client Approval:			
	Name & Surname	*Signature*	*Date*

CONTENTS

LIST OF ABBREVIATIONS

A	Ampere
ADMD	After Diversity Maximum Demand
IDP	Integrated Development Plan
kV	Kilo Volt
kVA	Kilo Volt Ampere
LPU	Large Power User
LSM	Living Standards Measure
LV	Low voltage
MV	Medium voltage
MVA	Mega Volt Ampere
m^2	Square metre
mm^2	Square millimetre
NRS	National Rationalised Standard
OHL	Overhead Line
PILC	Paper Insulated Lead Covered
PVC	Polyvinyl Chloride
RMU	Ring Main Unit
SANS	South African National Standard
SPU	Small Power User
SWA	Steel Wire Armoured
VA	Volt Ampere
XLPE	Cross Linked Polyethylene

1 PROJECT INFORMATION

1.1. Background to the Gauteng Rapid Land Release Programme

In an effort to expedite the release and allocation of serviced stands to qualifying beneficiaries, the Gauteng Provincial Government approved the Gauteng Rapid Land Release Programme. The programme's main objective is to utilize state owned land as an initial quick win to make land immediately available to beneficiaries who are willing to put up top structures for themselves as opposed to receiving a house constructed by government. In addition to availing land for housing, the programme also seeks to make available land for other commercial uses including urban agriculture.

Against this background, a panel of Built Environment Service Providers was appointed to assist the Gauteng Department of Human Settlements with all pre-planning, planning, design and construction management associated with the release of housing opportunities on land so identified and to qualifying beneficiaries. Phumaf Holdings forms a part of the panel so appointed to undertake some of the projects under this programme.

1.2. Purpose of the Gauteng Rapid Land Release Programme

The programme is divided into three phases/Stages viz;

- **Stage 1 – Feasibility & Scoping**; whose main objective was to analyze the feasibility and readiness of various land parcels to commence with the installation of engineering services and propose the planning activities required to prepare the land for the installation of services.
- **Stage 2 – Planning & Design**; whose main objective is to undertake the planning and engineering activities to make the various land parcels ready for the installation of services and, in some cases, construction of walk-up units/flats.
- **Stage 3 – Construction Management**; whose main objective is to direct, manage, and coordinate the installation of services and, in some cases, construction of walk-ups/flats on chosen sites

1.3. Client Brief

One of the land parcels identified for the Gauteng Rapid Land Release Programme is Unitas Park Extension 16 in Vereeniging. The site is located on Portion 222 of Farm Houtkop 594 IQ in Emfuleni Local Municipality. The project is expected to yield approximately **7250** housing opportunities.

1.4. Project Site

The project is on Portion 222 of Farm Houtkop 594 IQ in Emfuleni Local Municipality, a land parcel which is 151.09 hectares in extent and is located in Vereeniging. The site has a pending township application with the Emfuleni Local Municipality for 2,679 stands. This however is being withdrawn and will be replaced by a development yielding 7,250 units. The portion of land is owned by the Gauteng Provincial Government and is currently vacant whilst being utilized for farming on an informal basis.

Fig 1.1 – Project Site

It is noted that the project site has a pending township application for 2,679 residential stands. However this will be changed to yield 7,250 dwelling units according to the Client Brief.

1.5. Existing Infrastructure

The project site is part of an existing township which falls under the jurisdiction of the Emfuleni Local Municipality. In terms of electricity supply the proposed development will be supplied directly by the Emfuleni Local Municipality. There is an existing municipal substation as shown below:

Fig 1.2 – Existing Sonland Milan 88/11kV Substation, Vereeniging

Fig 1.3 – Existing 88kV Incomer to Sonland Milan Substation

a. The existing Sonland Milan 88kV Substation is operated by the Emfuleni Local Municipality and is situated about 1 kilometre from the proposed Unitas Park Extension 16 development.
b. The Municipality advised that the substation has been recently upgraded from 5MVA to 10MVA to cater for the proposed Unitas Park Extension 16 development. However this will not be adequate and a further upgrade will be required.
c. There is no MV reticulation to the proposed development and this will have to be installed from the substation to the new township. This will entail crossing the existing Houtkop Road via underground cable.

2 ELECTRICITY BULK SUPPLY DETERMINATION

2.1 Demand Calculation

The land use budget for the Project is primarily residential and is as indicated below. The electrical demand was estimated as per SANS 204: 2011 – Energy Efficiency in Buildings and the National Rationalized Specifications (NRS) 034-1:2007 Table 2 (Refer to Annexure A)

Individual dwelling units have been allocated an average load based on Urban Residential II Consumer Class (LSM 7 and 8), with a load of 3.54kVA ADMD. Because this is an Eskom area of supply the relevant tariff will be the Homelight 80, with a provision of an 80A supply circuit breaker for each dwelling unit.

The average 3.7kVA per housing unit is the 7-year projected load ADMD and this is in line with the National Rationalized Specifications (NRS) 034-1:2007 Table 2 (Refer to Annexure A) assuming that the development will consists of LSM 7 and 8 consumer classes.

In order to estimate the total load requirements for other consumers which are not housing unit stands, the following kVA/m2 figures were adapted based on load densities in volt-ampere per meter square as stipulated by the NRS 069:2004 guidelines with specific reference to Annex B subsection B2 (refer to Annexure B);

- Business or office equivalent 0.08kVA/m²
- Light industrial or equivalent 0.04kVA/m²
- Industrial or equivalent 0.10kVA/m²

Demand Calculations

The estimated total electricity supply bulk requirement is given below:

Item	Description	Quantity / Area	Total Load (KVA)
1	Dwelling Units (@ 3.54kVA ADMD)	7,250	25,665
2	Streetlights (LED High masts 5kVA each)	60	300
3	Business / retail nodes	0	0
4	Institutional	0	0
5	Educational	0	0
	TOTAL		**25,965**

The total bulk electricity requirements for the project is **25,965 kVA.** The required bulk capacity is currently not available for the development. Major capital works will have to be undertaken which will include the following:

a. Substation upgrade on the Eskom-side of Sonland Milan substation to ensure a secure supply of 30MVA to the development. This might include strengthening of the 88kV incomer as well as upstream substations. Such works will have to be phased to ensure alignment with development project timelines.
b. Substation upgrade by the Municipality on the 11-KV side of the substation to cater for the new development. Such works will have to be phased in line with the development project timelines.
c. A new 11kV switching station may be required within the development area to enable efficient MV reticulation.
d. New MV reticulation within the development consisting of 11kV underground cables, RMUs, minisubstations, and associated accessories.
, installation and commissioning of 2 (two) 1,000kVA 11/0.4kV minisubstations, including associated RMUs and underground 11kV XLPE cable. The extra capacity in the minisubstations will cater for limited future expansion of the project.
e. All other works that may be deemed necessary when tying into the Eskom 88kV network in Vereeniging West.

The installation of street and area lighting will be done as part of the LV reticulation work package to the housing units. This will be carried out in line with Emfuleni Local Municipality specifications and standards.

2.2 Cost Estimate

All electricity customers (generators and loads) are required to make a contribution towards the utility for the provision of new or additional capacity or for direct services rendered to a customer such as, the provision of service mains, the installation of equipment in the customer's substation, for the taking of any special meter readings, for reconnection of the supply after disconnection (i) either at the request of the customer or (ii) caused by the customer in failure to carry out its obligations, and for special/additional work done for the customer by the utility. These charges are referred to as “standard charges/fees” and are raised in addition to the standard tariff prices. The charges and tariffs levied are dependent on whether the customer is an LPU or SPU.

The work required to provide bulk electricity supply to the development will involve both Eskom as well as Emfuleni Local Municipality. An accurate cost of such works will be determined at the detailed design stage or via a direct quotation from the supplier (Eskom or the Municipality). The following costs are therefore only a high-level budget estimate at this stage:

Total Electricity Bulk Supply Required (Firm)	**: 30MVA @ 11kV**
Substation HV-side Upgrade	: R50,000,000
Substation LV-side Upgrade (Emfuleni)	: R20,000,000
New Switching Station (Emfuleni)	: R10,000,000
MV Reticulation	: R15,000,000
Professional Fees	: R7,500,000
TOTAL COST ESTIMATE	**: R102,500,000**

The connection fees for the high mast lighting will be based on the actual cost incurred by Eskom, a quote of which will be given on request.

Depending on the specific arrangements and agreements the Department may enter into with the following charges may also be payable:

I. Bulk Contribution @ R2,000 per kVA : R60,000,000
II. Eskom Cost Estimate Fee (Annexure C) : R77,040

It is also noted that the estimated bulk contribution payable will be much less than the actual cost of the bulk infrastructure. The Municipality will however be able to recover a substantial portion of these costs from the Department of Energy as per the following Department of Energy policies:

- Bulk Infrastructure Guidelines for Integrated National Electrification Programme (Annexure D)
- Mixed Developments and Developer Projects Policy Guidelines for Integrated National Electrification Programme (Annexure E)

3 CONCLUSION & RECOMMENDATION

The project site is located in Evaton West in the Emfuleni Local Municipality and falls under the Eskom area of supply. The following items are noted in conclusion:

a. The total electricity supply bulk requirement for the project is **25,965 kVA.**
b. The existing Sonland Milan 88/11kV substation does not have enough capacity to supply the proposed development and will require major upgrade works.
c. It will be necessary to construct a new MV network to supply the proposed development.
d. The total cost estimate for supplying the required bulk capacity for the development is **R102,500,000**, to be borne by both Eskom and Emfuleni Local Municipality.
e. The estimated bulk contribution payable by the Department to the Municipality is **R60,000,000.**
f. Application for connection will be made once final approval for the development has been granted by the Client. It should be noted that any variations to the development which will result in changes to the application will result in extra charges being levied by Eskom.
g. It is envisaged that on completion of the project each beneficiary will open an individual electricity account with the Municipality. The Municipality will therefore have to apply for bulk metering for the Eskom supply.
h. The Municipality is eligible to apply to the Department of Energy for funding of the required bulk infrastructure in line with current policies. It will be a requirement that this project and related bulk infrastructure be included in the Municipality's IDP.
i. Further design work will be dependent the approved township layout of site development plan, as well as overall project constraints.

4 ANNEXURES

- Annexure A - NRS Classification of Domestic Consumers
- Annexure B - NRS 069:2004 Annex – Network Standards
- Annexure C - Eskom Schedule of Standard Fees 2018/19
- Annexure D - Bulk Infrastructure Guidelines for Integrated National Electrification Programme
- Annexure E - Mixed Developments and Developer Projects Policy Guidelines for Integrated National Electrification Programme

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APPENDIX C4
Outline Scheme Report

GAUTENG PROVINCE
HUMAN SETTLEMENTS
REPUBLIC OF SOUTH AFRICA

OUTLINE SCHEME REPORT

ELECTRICAL ENGINEERING SERVICES

UNITAS PARK EXTENSION 16

PROJECT No.: G18110017/1

22 MAY 2020

PHUMAF
ENGINEERING SOLUTIONS THAT TOUCH PEOPLE'S LIVES

PHUMAF HOLDINGS
P.O. BOX 4049, RANDBURG, 2125
VVM SENTRUM BUILDING
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RANDBURG, 2194

DOCUMENT CONTROL

Job Title	Gauteng Rapid Land Release		Job Number: 7001
Document Title	**Unitas Park Extension 16 Outline Scheme Report: Electrical Engineering Services**		File Ref: 7001 Gauteng Rapid Land Release Programme\02 PROJ\09 Documents\Internal Documents
Document Revision	**Revised/ Issued By**		**Date**
A	KENNETH CHITENHE		22 MAY 2020
Compiled By:	*KENNETH CHITENHE*		*22/05/2020*
	Name & Surname	*Signature*	*Date*
Reviewed & Checked By:	*KENNETH CHITENHE*		*22/05/2020*
	Name & Surname	*Signature*	*Date*
Client Approval:	S Manyon		25/5/20
	Name & Surname	*Signature*	*Date*

CONTENTS

LIST OF ABBREVIATIONS

A	Ampere
ADMD	After Diversity Maximum Demand
IDP	Integrated Development Plan
kV	Kilo Volt
kVA	Kilo Volt Ampere
LPU	Large Power User
LSM	Living Standards Measure
LV	Low voltage
MV	Medium voltage
MVA	Mega Volt Ampere
m^2	Square metre
mm^2	Square millimetre
NRS	National Rationalised Standard
OHL	Overhead Line
PILC	Paper Insulated Lead Covered
PVC	Polyvinyl Chloride
RMU	Ring Main Unit
SANS	South African National Standard
SPU	Small Power User
SWA	Steel Wire Armoured
VA	Volt Ampere
XLPE	Cross Linked Polyethylene

1 PROJECT INFORMATION

1.1. Background to the Gauteng Rapid Land Release Programme

In an effort to expedite the release and allocation of serviced stands to qualifying beneficiaries, the Gauteng Provincial Government approved the Gauteng Rapid Land Release Programme. The programme's main objective is to utilize state owned land as an initial quick win to make land immediately available to beneficiaries who are willing to put up top structures for themselves as opposed to receiving a house constructed by government. In addition to availing land for housing, the programme also seeks to make available land for other commercial uses including urban agriculture.

Against this background, a panel of Built Environment Service Providers was appointed to assist the Gauteng Department of Human Settlements with all pre-planning, planning, design and construction management associated with the release of housing opportunities on land so identified and to qualifying beneficiaries. Phumaf Holdings forms a part of the panel so appointed to undertake some of the projects under this programme.

1.2. Purpose of the Gauteng Rapid Land Release Programme

The programme is divided into three phases/Stages viz;

- **Stage 1 – Feasibility & Scoping**; whose main objective was to analyze the feasibility and readiness of various land parcels to commence with the installation of engineering services and propose the planning activities required to prepare the land for the installation of services.
- **Stage 2 – Planning & Design**; whose main objective is to undertake the planning and engineering activities to make the various land parcels ready for the installation of services and, in some cases, construction of walk-up units/flats.
- **Stage 3 – Construction Management**; whose main objective is to direct, manage, and coordinate the installation of services and, in some cases, construction of walk-ups/flats on chosen sites

1.3. Client Brief

One of the land parcels identified for the Gauteng Rapid Land Release Programme is Unitas Park Extension 16 in Vereeniging. The site is located on Portion 222 of Farm Houtkop 594 IQ in Emfuleni Local Municipality. The project is expected to yield approximately **7250** housing opportunities.

1.4. Project Site

The project is on Portion 222 of Farm Houtkop 594 IQ in Emfuleni Local Municipality, a land parcel which is 151.09 hectares in extent and is located in Vereeniging. The site has a pending township application with the Emfuleni Local Municipality for 2,679 stands. This however is being withdrawn and will be replaced by a development yielding 7,250 units. The portion of land is owned by the Gauteng Provincial Government and is currently vacant whilst being utilized for farming on an informal basis.

Fig 1.1 – Project Site

It is noted that the project site has a pending township application for 2,679 residential stands. However this will be changed to yield 7,250 dwelling units according to the Client Brief.

1.5. Existing Infrastructure

The project site is part of an existing township which falls under the jurisdiction of the Emfuleni Local Municipality. In terms of electricity supply the proposed development will be supplied directly by the Emfuleni Local Municipality. There is an existing municipal substation as shown below:

Fig 1.2 – Existing Sonland Milan 88/11kV Substation, Vereeniging

Fig 1.3 – Existing 88kV Incomer to Sonland Milan Substation

a. The existing Sonland Milan 88kV Substation is operated by the Emfuleni Local Municipality and is situated about 1 kilometre from the proposed Unitas Park Extension 16 development.
b. The Municipality advised that the substation has been recently upgraded from 5MVA to 10MVA to cater for the proposed Unitas Park Extension 16 development. However this will not be adequate and a further upgrade will be required.
c. There is no MV reticulation to the proposed development and this will have to be installed from the substation to the new township. This will entail crossing the existing Houtkop Road via underground cable.

2 ELECTRICITY POWER REQUIREMENTS

2.1 Demand Calculation

The land use budget for the Project is primarily residential and is as indicated below. The electrical demand was estimated as per SANS 204: 2011 – Energy Efficiency in Buildings and the National Rationalized Specifications (NRS) 034-1:2007 Table 2 (Refer to Annexure A)

Individual dwelling units have been allocated an average load based on Urban Residential II Consumer Class (LSM 7 and 8), with a load of 3.54kVA ADMD. Because this is an Eskom area of supply the relevant tariff will be the Homelight 80, with a provision of an 80A supply circuit breaker for each dwelling unit. In order to estimate the total load requirements for other consumers which are not housing unit stands, the following kVA/m2 figures were adapted based on load densities in volt-ampere per meter square as stipulated by the NRS 069:2004 guidelines with specific reference to Annex B subsection B2 (refer to Annexure B);

- Business or office equivalent 0.08kVA/m²
- Light industrial or equivalent 0.04kVA/m²
- Industrial or equivalent 0.10kVA/m²

Demand Calculations

T1he estimated total electricity supply bulk requirement is given below:

Item	Description	Quantity / Area	Total Load (KVA)
1	Low Density Residential (@ 3.54kVA ADMD)	1727	6,113.58
2	Medium Density Residential (@ 2.5kVA ADMD)	1111	2,777.5
3	High Density Residential (@ 2.37kVA ADMD)	603	1,429.11
4	Mixed Use (@ 0.04kVA/m2)	77,000 (m²)	3,080
5	Student Village (@ 2.37kVA ADMD)	1110	2,630.7
6	Social (@ 0.02kVA/m2)	26,000 (m²)	520
7	Educational (@ 0.02kVA/m2)	73,000 (m²)	1,460
8	Streetlights (LED High Masts @ 5kVA each	60	300
	TOTAL		**18,310.89**

The total bulk electricity requirements for the project is **18,310.89 kVA.** The required bulk capacity is currently not available for the development. Major capital works will have to be undertaken for a total estimated firm capacity of **20 MVA.**

3 DESIGN METHODOLOGY

3.1 Standards

The most up to date versions of the following standards shall be used in the design and specification of all electrical services for the project:

- SANS 1019, Standard voltages, currents and insulation levels for electricity supply
- SANS 10142, The wiring of premises – LV installations
- SANS 1339, Electric cables – XLPE insulated cables for voltages from 3.8/6.6kV up to 19/33kV
- IEC 60287:2020 Series, Electric cables
- Eskom suite of distribution standards
- NRS standards
- SANS 60529, Degrees of protection provided by enclosures
- Occupational Health & Safety Act No. 85, 1993

3.2 Design Considerations

The following considerations will be taken into account for the design of the electrical services in the development:

i. **Medium Voltage Network**

The MV network will follow the approved road network in the development and will be by 11kV underground cable feeding a network of minisubstations ranging in size between 500kVA and 1,000 kVA. As much as possible the minisubstations and kiosks will be installed within the road reserve to minimize extra servitude requirements. The MV network will be designed according to Eskom standards.

ii. **Low Voltage Reticulation**

Low voltage reticulation to each site will be either directly from the minisubstation or from a kiosk and will be via underground PVC/SWA cable. The network will be designed according to Eskom and Emfuleni Local Municipality requirements. Prepaid and/or smart metering will be allowed for at each site or building unit.

iii. **Electrical Building Services**

Electrical buildings services will be designed to ensure that each building site and/or unit can be electrically isolated without affecting the rest of the installation. Building services will be designed in line with SANS and NHBRC regulations.

iv. **Street and Area Lighting**

Street and area lighting will be designed in line with Eskom and SANS requirements, with high mast lights used wherever possible. For energy efficiency purposes only LED lighting will be considered supported by PV solar wherever possible.

v. **Constructability, Reliability, and Maintainability**

The design of all electrical services will follow current best practice to ensure ease of construction and maintenance, as well as providing optimal reliability during the development life span.

3.3 Energy Efficiency

The design of all electrical services will be premised on the need to minimize the total electrical demand of the development. Energy saving measures (electrical and non-electrical) will be recommended for the development. Active and passive measures will include

- Use of solar heating and lighting wherever possible
- Energy efficient lighting – e.g. LED lamps
- Proper thermal insulation as required
- Optimal alignment of building structures.

4 PROJECT COST ESTIMATE

The project cost estimate is a first order estimate based on the available information and excludes all costs associated with internal building services. The cost estimate is made up as follows:

Bulk contribution (@ R2,000/kVA)	= R40,000,000
New switching station	= R10,000,000
MV Reticulation	= R15,000,000
LV Reticulation	= R25,000,000
Street and Area Lighting	= R5,000,000
Metering	= R15,000,000
Professional Fees	= R8,000,000
Total Project Cost Estimate	**= R118,000,000**

The estimate excludes VAT.

5 CONCLUSION & RECOMMENDATION

The project site is located in Evaton West in the Emfuleni Local Municipality and falls under the Eskom area of supply. The following items are noted in conclusion:

a. The total electricity supply bulk requirement for the project is approximately **20,000 kVA.**
b. The existing Sonland Milan 88/11kV substation does not have enough capacity to supply the proposed development and will require major upgrade works.
c. It will be necessary to construct a new MV network to supply the proposed development.
d. The total cost estimate for supplying the required bulk capacity as well as the related MV, LV, and metering infrastructure for the development is **R118,000,000**.
e. Application for connection will be made once final approval for the development has been granted by the Client. It should be noted that any variations to the development which will result in changes to the application will result in extra charges being levied by Eskom.
f. It is envisaged that on completion of the project each beneficiary will open an individual electricity account with the Municipality. The Municipality will therefore have to apply for bulk metering for the Eskom supply.
g. The Municipality is eligible to apply to the Department of Energy for funding of the required bulk infrastructure in line with current policies. It will be a requirement that this project and related bulk infrastructure be included in the Municipality's IDP.
h. Further design work will be dependent the approved township layout of site development plan, as well as overall project constraints.

6 ANNEXURES

- Annexure A - NRS Classification of Domestic Consumers
- Annexure B - NRS 069:2004 Annex – Network Standards
- Annexure C - Eskom Schedule of Standard Fees 2018/19
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PROPOSED DRAFT LAYOUT

APPENDIX C5

Traffic Impact and Access Study Report

GCS

Water & Environmental Consultants

TRAFFIC IMPACT & ACCESS STUDY REPORT
UNITAS PARK EXTENSION 16- FINAL REPORT

PREPARED BY

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CONFIGURATION CONTROL

Project: Proposed Mixed Use Unitas Park Extension 16

Title: Traffic Impact & Access Study for Proposed Mixed Use Residential development Unitas Park Extension 16 Situated on Portion 222 of the farm Houtkop 594-IQ (SG Diagram 7423/2008). Portion 222 of the farm Houtkop 594-IQ is in the process of subdivision and will be known as Portion 225 (a portion of 222) of the farm Houtkop 594-IQ (Subdivision Diagram 4362/2009) in the Emfuleni Local Municipality.

Created by: Sikelela Mnguni *(Pr.Tech.Eng)*

REVISION RECORD

Revision	Date	Compiled	Saved as	Project Minutes
A0	07 July 2020	Sikelela Mnguni *(Pr.Tech.Eng)*	Proposed Unitas Park Extension 16 *TIA RT. A1*	None
A1	02 November 2020	Sikelela Mnguni *(Pr.Tech.Eng)*	Proposed Unitas Park Extension 16 *TIA RT. A1*	None

---

DECLARATION

It is herewith certified that this Traffic Impact & Access Study for Proposed Mixed Use Residential development Unitas Park Extension 16 Situated on Portion 222 of the farm Houtkop 594-IQ (SG Diagram 7423/2008). Portion 222 of the farm Houtkop 594-IQ is in the process of subdivision and will be known as Portion 225 (a portion of 222) of the farm Houtkop 594-IQ (Subdivision Diagram 4362/2009) in the Emfuleni Local Municipality has been prepared according to requirements of the South African Traffic Impact and Site Traffic Assessment Manual.

Prepared : Sikelela. Mnguni (*Pr.Tech. Eng-201170212*)

Signed: 

Date: 02 November 2020

Clients Approval :

Signed:

Date:

TRAFFIC IMPACT & ACCESS STUDY FOR PROPOSED MIXED USE RESIDENTIAL DEVELOPMENT UNITAS PARK EXTENSION 16 SITUATED ON PORTION 222 OF THE FARM HOUTKOP 594-IQ (SG DIAGRAM 7423/2008). PORTION 222 OF THE FARM HOUTKOP 594-IQ IS IN THE PROCESS OF SUBDIVISION AND WILL BE KNOWN AS PORTION 225 (A PORTION OF 222) OF THE FARM HOUTKOP 594-IQ (SUBDIVISION DIAGRAM 4362/2009) IN THE EMFULENI LOCAL MUNICIPALITY

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1 INTRODUCTION

1.1 Background

Phumaf Holdings (Pty) Ltd has been appointed by Gauteng Province Human Settlement to complete the Traffic Impact & Access Study for Proposed Mixed Use Residential development Unitas Park Extension 16 Situated on Portion 222 of the farm Houtkop 594-IQ (SG Diagram 7423/2008). Portion 222 of the farm Houtkop 594-IQ is in the process of subdivision and will be known as Portion 225 (a portion of 222) of the farm Houtkop 594-IQ (Subdivision Diagram 4362/2009) in the Emfuleni Local Municipality.

The site is well-connected on a regional scale. To the south is Houtkop Road (R54), to the south-west is the R28 and to the east is the R59 (Old Johannesburg Road). The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary.

On a more local level, the extension of Houtkop Road, Skippie Botha Road, and Langrand Road provides connectivity to the north, east, and west. As shown in the locality plan indicated in Figure PH_001 as shown in the book of drawings.

The development consists of the following land use:

- Proposed Mixed Use Residential Development

The purpose of this report is to assess the traffic impact at surrounding intersections, due to the additional traffic that the development will generate together with measures to mitigate the impact.

1.2 Approval of Submission

This report will be subject to approval from the relevant roads authorities. This report will be submitted to the following roads authorities for approval:

- Emfuleni Local Municipality (ELM)
- Gauteng Department of Roads and Transport (GDRT)

2 DEVELOPMENT DETAILS

2.1 Locality

The site is well-connected on a regional scale. To the south is Houtkop Road (R54), to the south-west is the R28 and to the east is the R59 (Old Johannesburg Road). The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary.

On a more local level, the extension of Houtkop Road, Skippie Botha Road, and Langrand Road provides connectivity to the north, east, and west. As shown in the locality plan indicated in Figure PH_001 as shown in the book of drawings.

2.2 Development and Property Particulars

The development particulars of the Proposed Mixed Use Residential Development Unitas Park Ext. 16 are summarized in Table 1.

TABLE 1: PROPOSED MIXED USE RESIDENTIAL DEVELOPMENT UNITAS PARK EXTENSION 16 SITUATED ON PORTION 222 OF THE FARM HOUTKOP 594-IQ (SG DIAGRAM 7423/2008). PORTION 222 OF THE FARM HOUTKOP 594-IQ IS IN THE PROCESS OF SUBDIVISION AND WILL BE KNOWN AS PORTION 225 (A PORTION OF 222) OF THE FARM HOUTKOP 594-IQ (SUBDIVISION DIAGRAM 4362/2009) IN THE EMFULENI LOCAL MUNICIPALITY	
Name of the Applicant	GAUTENG PROVINCE HUMAN SETTLEMENT 37 Sauer Street Marshalltown JOHANNESBURG 2001 Tel: +27 (0)11 355 6000 Fax: +27 (0)11 355 6211
Name of the Development	Proposed Mixed Use Residential development Unitas Park Extension 16 Situated on Portion 222 of the farm Houtkop 594-IQ (SG Diagram 7423/2008). Portion 222 of the farm Houtkop 594-IQ is in the process of subdivision and will be known as Portion 225 (a portion of 222) of the farm Houtkop 594-IQ (Subdivision Diagram 4362/2009) in the Emfuleni Local Municipality

The proposed layout of the development for Proposed Mixed Uses Residential Development Unitas Park Ext. 16 is shown in (Figure PH_002 as shown in the book of drawings).

3 STUDY AREA

3.1 The extent of the Study Area

The extent of the study area is determined by the extent of the expected additional traffic that may be generated by the proposed development.

The guideline document **"Manual for Traffic Impact Studies"** of the **Department of Transport** was used to determine the different scenarios and the extent of the study area.

The site is well-connected on a regional scale. To the south is **Houtkop Road (R54),** to the south-west is the **R28** and to the east is the **R59 (Old Johannesburg Road).** The proposed **PWV 20** runs to the west of the site and the proposed **K55** abuts the site on its eastern boundary.

On a more local level, the extension of **Houtkop Road**, **Skippie Botha Road,** and **Langrand Road** provides connectivity to the north, east, and west. As shown in the locality plan indicated in **Figure PH_001 as shown in the book of drawings**.

3.2 The planned or proposed major development

Planned or proposed major developments and land-uses in the area have been taken into consideration and these include the following:

a) Approved but not yet implemented developments;
b) Land with potential or latent lands that have been taken into account.

At the time of doing this study, no latent development rights were received from the Emfuleni Local Municipality Planning Department.

4 PLANNED FUTURE ROADS, RAIL NETWORK & PUBLIC TRANSPORT

4.1 Planned future roads

Movement patterns provide an understanding of how an area functions because it illustrates the spatial relationships between settlements and core areas (employment and shopping areas) and the linkages that exist between such spatial entities.

The Schematic PH_001 shows the movement of people within Emfuleni and between Emfuleni and the neighbouring municipal areas. Six primary core areas are located within and close to Emfuleni. Movement within Emfuleni largely occurs within a triangle, anchored by the core areas of Vanderbijlpark, Vereeniging, and Sebokeng. Movements between Emfuleni and neighbouring municipal areas occur along three axes. The first axis is located between Vereeniging and Sebokeng towards Lenasia and Johannesburg. The second axis is located between Vanderbijlpark, Vereeniging, and Meyerton towards Ekurhuleni. The third axis is located between Sebokeng, Vanderbijlpark, and Sasolburg.

Schematic PH_001 MOVEMENT AXIS

A strong movement of people occurs between Vanderbijlpark, Vereeniging, and Meyerton towards Johannesburg along the P156 freeway. A strong movement also occurs between Sebokeng and Johannesburg, especially during morning and afternoon peak hours, as commuter access employment opportunities in Johannesburg and surrounding areas. A strengthening of movement in the future can be expected between Vereeniging and Sebokeng, as urban development and densification occur along this corridor. Movement along the corridor between Vereeniging, Sebokeng, and Johannesburg is supported by the existing commuter railway line

The South African Road Classification and Access Management Manual is an official road planning document supported by SANRAL and the National Department of Transport (NDOT). According to the South African Road Classification and Access Management Manual, the road hierarchy within South Africa functions on 5 levels. The first level contains freeways, consisting of national freeways and provincial PWV roads and these are classified as Class 1 roads. These roads provide regional access, connecting an area to neighbouring cities and towns. The second and third levels comprise major and minor arterials (or K-routes), which aim to provide better intra-urban access between suburbs and activity areas. These are classified as Class 2 and 3 roads. The fourth level comprises collector roads, which are classified as Class 4 roads. These roads connect residential areas to the mentioned arterial network. On the fifth level, local streets provide direct access to land uses and link these land uses to the mentioned collector roads. These are classified as Class 5 roads.

In essence, freeways and arterials are highly mobile and therefore aim to connect people over large distances to activity areas and neighbouring settlements. Collector roads and local streets provide good accessibility and therefore aim to connect people and land use to more mobile roads. Road-based public transport systems (minibus taxis and busses) mostly use arterials and collector roads, because these provide an efficient balance between mobility and land use accessibility.

Figure PH_004 & 004a in the book of drawings depicts the road network serving Emfuleni area. The N1 freeway passes through the centre of Emfuleni, linking Emfuleni to Johannesburg and Soweto. The primary role of this freeway is to link Gauteng Province to the Free State Province and the Western Province and therefore fulfills a through-traffic function, rather than serving Emfuleni specifically. The P156 freeway, on the other hand, primarily serves Emfuleni, linking Vanderbijlpark and Vereeniging to Ekurhuleni and the OR Tambo International Airport. Due to its function, corridor development is increasingly occurring along the P156 freeway, especially in the Vereeniging and Meyerton areas. The P156 freeway is located on the eastern boundary of Emfuleni.

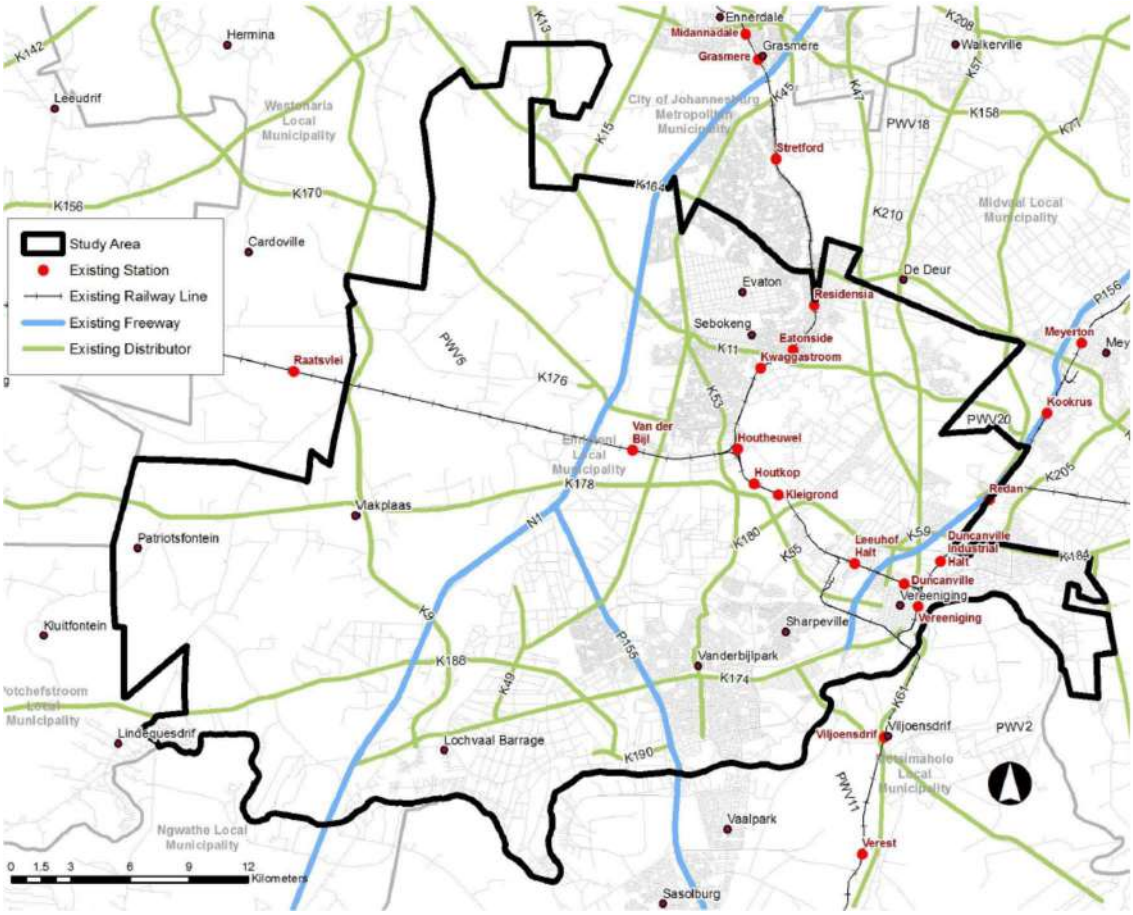
Most of Emfuleni's planned K-route network has been developed, although not all the K-routes have been developed to a dual carriageway level. Many of the K-routes are also in need of rehabilitation, especially K-routes such as the K174 (Barrage Road). Despite this, the complete K-route network allows urban infill and expansion to take place in almost any part of Emfuleni, providing the access infrastructure needed for urban development. Four K-routes can be highlighted as prominent K-routes serving Emfuleni. The first is the K53 (Moshoeshoe Road that becomes the Golden Highway), which runs between Vanderbijlpark and Sebokeng. This is an important commuter spine serving Emfuleni. The second K-route worth mentioning is the K174 (Barrage Road), linking Vanderbijlpark to Vereeniging. This road is a gateway route into Emfuleni and the Municipality is thus concerned over the type of development that take place along this route. The K178 links Sebokeng to Vereeniging and the shopping and employment opportunities found within Vereeniging. This K-route is expected to become a major commuter spine, as urban development intensifies along this route. The fourth K-route is the K164, which links Evaton to Meyerton. Savanna City (a 14000-residential unit development) will be situated on and have access from the K164, which will increase the prominence of this K-route.

Figure PH_003 in the book of drawings depicts The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary.

4.2 Rail Network

Emfuleni is served by a rail network that connects Emfuleni to neighbouring areas in Gauteng and the Free State. As depicted in Schematic PH_002, this rail network consists of 3 lines. The first rail line stretches along with the P156 (R59) freeway and links Sasolburg to Vereeniging, Meyerton, and Germiston. This rail line is primarily a freight line but does contain commuter railway stations along the line. The second railway line stretches from Sasolburg, via Vereeniging towards Sebokeng, Orange Farm, and Johannesburg.

This railway line also functions as a freight railway line, although it also
fulfills a significant commuter railway line function. The third railway line stretches from Sebokeng towards Westonaria. This railway line is exclusively used for rail freight purposes.



Schematic PH_002: RAIL NETWORK

Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. This commuter rail network consists of 2 lines. The first rail line stretches from Vereeniging to Meyerton towards Germiston. This commuter railway line contains commuter railway stations, with prominent stations being the Vereeniging Station, the Duncanville Industrial Halt Station, and the Meyerton Station. The use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. The second commuter railway line stretches from Vereeniging towards Sebokeng, Orange Farm, and Johannesburg. Prominent stations along this line are Houtheuwel Station, Residentia Station, and Stretford Station. This railway line traverses densely built-up urban areas, as is found in Sebokeng and Orange Farm, and it, therefore, fulfills a significant commuter railway line function.

4.3 Public Transportation

Emfuleni comprises an extensive bus network that serves the municipal area. A prominent bus route is the bus route linking Vereeniging to Sebokeng along with the K53 (Moshoeshoe Road) and the K45 (Golden Highway). This bus route links Evaton and Sebokeng to the Vereeniging CBD and the industrial areas located within Vereeniging. Other bus routes worth mentioning are the bus route linking Vereeniging to Meyerton, the bus route linking Vereeniging to Residentia Station, and the Bus route linking Evaton to Meyerton. Linking the bus network to the commuter rail network will enable the bus network to act as a feeder system to the commuter rail network. This will give Emfuleni access to an integrated hierarchy of public transport modes servicing different parts of the municipal are and it will greatly improve the current public transport network serving Emfuleni.

Emfuleni comprises an extensive minibus taxi network. This network largely uses the same routes and serves the same areas within the municipal area that the bus network does. The only significant exception is that a minibus taxi route links the Vanderbijlpark CBD to Sebokeng via Mittal Steel; a route that the bus network does not serve. A disadvantage of the minibus taxi network is that the routes of this network are not fixed and can, therefore, change in the future. Therefore, the minibus taxi route does not indicate fixed locations where Emfuleni can develop. Bus routes and in particular commuter railway lines provide a much better indication of where to densify Emfuleni.

Developing Emfuleni's transportation infrastructure is dealt with in terms of the road network and public transport network. Whereas the road network primarily refers to provincial and metropolitan roads, the public transport network refers to the public transport routes and stations that make up the transportation network. Figure PH_005 in the book of drawings illustrates the transportation infrastructure development proposals made for Emfuleni.

Emfuleni is a municipality with a population nearing 1 million people. In other words, Emfuleni is becoming a metropolitan area. It is, therefore, necessary that Emfuleni starts positioning itself for this responsibility. A key function of a metropolitan area is to provide public transport of a high standard to support its metropolitan population. Emfuleni thus needs to start identifying its public transport routes, so that it can start shaping its land-use structure (which takes time) to serve this public transport network. To this end, Emfuleni can proactively promote public transport by (a) engaging with PRASA to further develop the Vereeniging-Johannesburg commuter railway line (especially concerning station development) and (b) identify and develop a Strategic Public Transport Network (SPTN) to serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line.

Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. Prominent station along this line is Houtheuwel Station, Residentia Station, and Stretford Station. Currently, the use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. Urban development along the Vereeniging-Sebokeng-Orange Farm commuter railway line will provide the necessary commuter thresholds needed to ensure the viable operation and expansion of this commuter railway line.

Concerning further developing the Vereeniging-Johannesburg commuter railway line, it is proposed the 2 new stations are developed along this line to better serve envisaged urban expansion areas within Emfuleni. The first proposed station is located at the proposed Sonlandpark Regional Node and will serve the Sonlandpark and Boipatong areas. The second proposed station is located north of Houtheuwel Station and will better serve the envisaged Lethabong extensions. The additional stations along this commuter rail line will provide opportunities for Transit-Oriented Development (TOD). This will involve focusing on new higher density, mixed-use development around these commuter rail stations. The layout of the land uses concerning the stations are of critical importance, because it will determine the level of access that commuters will have to these stations. It should be noted that the station proposals above area Emfuleni SDF proposals and not PRASA proposals at this stage.

In addition to the above, a Strategic Public Transport Network (SPTN) is proposed by the Emfuleni SDF that will serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line. Two SPTN routes have been identified. The first route links Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway), and then turns eastward at Evaton towards Residentia Station. This SPTN route links Evaton and the Sebokeng CBD to the Vereeniging CBD. This route can be extended southwards across the Vaal River up to Sasolburg. The second SPTN route utilizes Barrage Road (K147) and links the Vanderbijlpark CBD, the Bedworthpark Regional Node, the proposed River City Node, the Vereeniging CBD, and the Three Rivers Node. This route can be extended northeastwards up to Meyerton.

It is important to note that where an SPTN route utilizes a K-route (arterial), flexible, public transport oriented design parameters will be required, especially where this route traverses or abut an activity node. For example, pedestrian crossing and accesses will have to be addressed differently within such sections of the SPTN route. Also, the development of the SPTN route can already at this stage be planned to accommodate higher-order road-based public transport systems in the future, such as the Bus Rapid Transit (BRT) system. The implementation of a BRT system can then be phased over time. The following phasing will most probably be logical:

- Phase 1: Design SPTN routes to allow the long-term implementation of the BRT system
- Phase 2: Start operating municipal system on SPTN route
- Phase 3: Construct major BRT stations at regional nodes
- Phase 4: Start operating BRT system
- Phase 5: Construct minor BRT stations at other locations along SPTN route
- Phase 6: Construct dedicated BRT lanes

Having a longer-term view of public transport network development will enable municipal planners to develop a land-use structure that can support the envisaged public transport network in the future. Municipal planners can promote the development of activity nodes at commuter railway stations and envisaged SPTN/BRT stations that would (a) apply higher land use densities, (b) a greater land use mix and (c) a pedestrian-oriented structure. These are all critical elements needed to support the viable operation of a public transport system and station.

TABLE 2: PROPOSED PUBLIC TRANSPORT ROUTES, STATIONS, AND LAND USE INTEGRATION

SPTN Route/ railway line	Nodal Area	Station or Rank or Stop	Integration Principles
Proposed Barrage Road SPTN route	Vanderbijlpark CBD	○ Proposed bus station and minibus taxi rank within CBD	○ Design and locate mixed land uses at commuter railway station ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank
Vereeniging-Johannesburg commuter railway line	Vereeniging CBD	○ Existing Vereeniging commuter railway station ○ Proposed bus station and minibus taxi rank at commuter railway station	○ Design and locate mixed land uses at commuter railway station ○ Design and construct pedestrian walkways to facilitate access to a commuter railway station
Proposed Barrage Road SPTN route	River City Node (part of Vanderbijlpark CBD)	○ Proposed bus station and minibus taxi rank within Node	○ Develop higher-density residential uses to support proposed bus station and minibus taxi rank ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank
Vereeniging-Johannesburg commuter railway line	Sebokeng CBD	○ Existing Houtheuwel commuter railway station ○ Existing bus station and minibus taxi rank within CBD	○ Develop higher-density residential uses to support a commuter railway station with required commuter numbers ○ Design and construct pedestrian walkways to facilitate access to commuter railway station
Proposed Barrage Road SPTN route	Bedworthpark Regional Node	○ Proposed bus station and minibus taxi rank within node	○ Design and locate mixed land uses at proposed bus station and minibus taxi rank ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank

SPTN Route/ railway line	Nodal Area	Station or Rank or Stop	Integration Principles
Proposed Golden Highway SPTN route	Evaton Regional Node	○ Proposed bus station and minibus taxi rank within node	○ Develop higher-density residential uses to support proposed bus station and minibus taxi rank ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank
Proposed Barrage Road SPTN route	Three River Regional Node	○ Proposed bus station and minibus taxi rank within node	○ Design and locate mixed land uses at proposed bus station and minibus taxi rank ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank
Vereeniging-Johannesburg commuter railway line	Sonlandpark Regional Node	○ Proposed Sonlandpark commuter railway station ○ Proposed bus station and minibus taxi rank at commuter railway station	○ Design and locate mixed land uses at proposed commuter railway station ○ Design and construct pedestrian walkways to facilitate access to the proposed commuter railway station
Proposed Golden Highway SPTN route	Boitumelo Community Node	○ Proposed bus station and minibus taxi rank within node	○ Design and locate mixed land uses at proposed bus station and minibus taxi rank ○ Design and construct pedestrian walkways to facilitate access to proposed bus station and minibus taxi rank
Vereeniging-Johannesburg commuter railway line	Kwaggastroom Community Node	○ Existing Kwaggastroom commuter railway station	○ Develop higher-density residential uses to support a commuter railway station with required commuter numbers
Vereeniging-Johannesburg commuter railway line	Residensia Community Node	○ Existing Residensia commuter railway station	○ Develop higher-density residential uses to support a commuter railway station with required commuter numbers

As alluded to above, the efficient functioning of the public transport system within Emfuleni will not only require a well-developed public transport network but will also require well-developed public transit stations and stops that are strategically located along the public transport routes. The major public transit stations and stops should preferably be located within the nodal areas. Many of the existing, planned, and proposed nodes will be served by the existing and proposed commuter railway stations of the Vereeniging-Johannesburg commuter railway line. These include, amongst others, the Residensia Station, Houtheuwel Station, Vereeniging Station, and the proposed Sonlandpark Station. Where nodal areas are served by a road-based public transport network (SPTN), such as the Vanderbijlpark CBD, the Bedworthpark Regional Node, and the Evaton Regional Node, a bus station, and minibus taxi rank should make up the public transit station serving such a node. It is proposed that major transit stations and stops within Emfuleni be located at localities set out in Table 2 above, which correspond with the Transit-Oriented Developments (TODs) proposed for Emfuleni. Pick-up and drop-off stops can be places at 400-600m intervals along the SPTN routes.

To ensure the optimal use of each public transit station and stop, it will have to be integrated through a competent design with surrounding land uses. This design will need to focus on pedestrian movement and how pedestrians exchange between the transit facility and the surrounding land uses. The competent building design is also necessary to ensure land use and transportation integration and will have to be applied to buildings (e.g. retail centers and walk-ups) bordering these transit stations.

5 EXISTING AND PROPOSED ACCESS TO THE DEVELOPMENT

5.1 Existing Major Access

Access to the site is problematic as there are currently no constructed roads linking to the site. The following are potential connections:

Schematic PH_003: MOVEMENT AXIS

- The proposed K55 has two access points that have been provided for in the erf subdivision. This road, or a portion of it, must first be constructed before access to the site can be obtained. There is no indication as to when this will be done.
- There are three access points across the adjacent unproclaimed townships (Sonlandpark Ext 4, Unitas Park Ext 4, and Unitas Park Ext 2) based on their approved layouts. These townships must first be proclaimed and developed before such access can be obtained. To get access in the interim a right-of-way servitude will have to be registered on private property and the roads constructed.
- There is a registered right of way servitude that links to Bennie Osler Street in the Unitas Park Agricultural Holdings. This road must still be constructed.
- Frederik Road in the Unitas Park Agricultural Holdings is constructed up to the north-eastern edge of the site. Thereafter it becomes a dirt road that borders a portion of the site. It continues north from the edge of the site as a dirt road that links up with Langrand Road. These roads will have to be upgraded to accommodate the increase in vehicular traffic anticipated by the development of the site.
- The currently approved layout allows for an access road to the south to connect to Houtkop Road. This connection will necessitate a right of way servitude over privately owned land and will not be allowed once the K55 is constructed due to the distance from the intersection of the K55 and Houtkop Road.

The only current feasible options to obtain access to the site is the construction of the southern portion of the K55 up to the boundary of the site. Another option will be the upgrade of Frederik Road. This in itself will not be sufficient as Frederik Road will not be able to cope with the increase in traffic.

Access to the development is also (indicated in Figure PH_005 as shown in the book of drawings).

5.2 Proposed Access

The concession to grant access to **Proposed Mixed Use Residential Development Unitas Park Ext.16** from Municipality Road is the **Emfuleni Local Municipality and Gauteng Department of Roads and Transport**.

The only current feasible options to obtain access to the site is the construction of the southern portion of the K55 up to the boundary of the site.

6 TRAFFIC FLOWS & DEVELOPMENT TRIPS

6.1 Existing Traffic Flows

Detailed traffic surveys (traffic counts) were carried out at the following intersections :

- **Houtkop Road** and **Gary Player Street** intersection;
- **Houtkop Road** and **Laurie Stevens Street** intersection;
- **Houtkop Road** and **Percy Sherwell Street** intersection;
- **Houtkop Road** and **Japie Krige Street** intersection;
- **Houtkop Road** and **Senator/Sprinkbok Street** intersection;
- **Houtkop Road** and **Leeuwkrol Drive/Van Riebeek Street** intersection;
- **Leeuwkrol Drive** and **Poole Street** intersection;
- **Leeuwkrol Drive** and **Johannesburg Road** intersection; indicated in **Figure PH_007** as shown in the book of drawings). The surveys were conducted for 13 hours (**06:00-18:30**) during the weekday on **Thursday**, **05 March 2020**.

From the traffic counts a common peak hour was determined (the busiest hour) for each counted period and was found to be as follows:

- **Morning peak 06:30-07:30**
- **Afternoon peak 16:00-17:00**

6.2 Traffic Evaluation

The traffic impact of the proposed development has been assessed by examining the intersections in the area of influence. These intersections include:

- Houtkop Road and Gary Player Street intersection;
- Houtkop Road and Laurie Stevens Street intersection;
- Houtkop Road and Percy Sherwell Street intersection;
- Houtkop Road and Japie Krige Street intersection;
- Houtkop Road and Senator/Sprinkbok Street intersection;
- Houtkop Road and Leeuwkrol Drive/Van Riebeek Street intersection;
- Leeuwkrol Drive and Poole Street intersection;
- Leeuwkrol Drive and Johannesburg Road intersection.

The performance of each of the above intersections has been assessed by comparing the traffic flows (demand) with the estimated capacity (supply) for the critical movements at each intersection to obtain a Level of Service (LOS) for each movement and delays experienced.

Sidra Intersection 8.0, simulation software was used to evaluate the intersections.

The following parameters were used to evaluate capacity analysis:

The following definitions from the 2000 Highway Capacity Manual are used in this report:

- Capacity - The maximum hourly rate at which vehicles can reasonably be expected to traverse a lane or roadway during a given period under prevailing traffic and control conditions.
- Volume - The hourly rate of vehicle arrivals at an intersection.
- Volume to capacity ratio (v/c) - Is the ratio of volume to capacity.

Level of service (LOS) - Level of service is defined in terms of delay. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The levels of service for signalized and un-signalized intersections as defined in the 2000 Highway Capacity Manual are shown in Table 3 below.

TABLE 3: LEVEL OF SERVICE DEFINITIONS

Level of Service	Signalized intersections Stopped delay (seconds)	Unsignalized intersections Total delay (seconds)
A	< 10	< 10
B	> 10 and < 20	> 10 and < 15
C	> 20 and < 35	> 15 and < 25
D	> 35 and < 55	> 25 and < 35
E	> 55 and < 80	> 35 and < 50
F	> 80	> 50

An intersection is deemed to be operating acceptably at levels of service A to D. If an intersection operates at a level of service E or F or has a volume to a capacity ratio higher than 0.95 the intersection is considered to be operating at capacity.

6.3 Development Trip Generation and Traffic Volume Scenario-Adjusted Factors

Various trip adjustment factors have been introduced into the COTO document to allow for trip reductions. These adjustment factors are discussed briefly below.

6.4 Mixed-use Developments (MUD)

According to the COTO manual "mixed-use developments are defined as developments in an area that consist of two or more single-use developments between which trips can be made utilizing non-motorized modes of transport (such as walking). This has the net effect of reducing the vehicle trip generation in the area."

Since this development will consist of mixed land use, the reduction factors which have been applied are listed in Table 4 below. Note, Pm = Reduction factor for mixed-use development.

6.5 LOW VEHICLE OWNERSHIP (LVO) & VERY LOW VEHICLE OWNERSHIP (VLVO)

According to COTO "the vehicle ownership in areas with high levels of vehicle ownership varies between one or two per household. In areas with a low level of vehicle ownership, the majority of households (more than 50%) do not own a vehicle and rely on public transport for transportation.

In areas with a very low level of vehicle ownership, nearly all households (more than 90%) do not own a vehicle and rely on public transportation."

This study considered low to very low vehicle ownership and the reduction factors which have been applied are listed in Table 4 below. Note, Pv = Reduction factor for vehicle ownership.

6.6 TRANSIT NODE OR CORRIDORS

According to COTO "the transit reduction factors apply to developments that are located within a reasonable walking distance from a major transit node or stops on a major transit corridor."

This study considered transit nodes and a 15% reduction factor has been applied for all land uses as recommended in the COTO manual. See Table 4 below. Note, Pt = Reduction factor for transit nodes or corridors.

Table 4: Adjustment Factors Applied for Trip Reductions			
Trip Code	Pm	Pv	Pt
Single Dwelling Units	30%	80%	15%
Townhouses (Simplexes and Duplexes)	30%	80%	15%
Apartments and Flats	30%	80%	15%

6.7 TRIP SUMMARY

The detailed trip generation calculations are included in Annexure A. Using the COTO document the expected peak hour trip generation for the proposed development was calculated and indicated in Table 5 below.

Table 5: EXPECTED PEAK HOUR TRIP GENERATION (veh/h)					
WEEKDAY AM			WEEKDAY PM		
IN	OUT	TOTAL	IN	OUT	TOTAL
141	424	**566**	396	170	**566**

Table 5 shows that the proposed development will generate **566** trips during the weekday AM and weekday PM peak periods, respectively.

From Table 5 it can be seen that the development will generate a maximum of 566 trips during the weekday PM peak period. The Manual for Traffic Impact Studies requires that a traffic impact statement be done for developments that generate more than 50 but less than 150 peak hour trips as indicated in Table 6 below.

Table 6: Assessment Years for Traffic Studies (from Manual for Traffic Impact Studies)	
Type of Study	Assessment years to consider
Traffic Impact Statement (50-150 peak hour trips)	• Base year; • Any other year at the discretion of responsible road authority.
Traffic Impact Study (150-2000 peak hour trips)	• Base year; • Five years after the base year; • Any other year at the discretion of responsible road authority.
Traffic Impact Study (> 2000 peak hour trips)	• Base year; • Ten years after the base year; • Any other year at the discretion of responsible road authority.
Multiphase developments	• Base year; • Five years after the base year for developments < 2000 peak hour trips; • Ten years after the base year for developments > 2000 peak hour trips; • Any other year at the discretion of responsible road authority.

6.8 GROWTH RATE

TMH 16 South African Traffic Impact and Site Traffic Assessment Manual Volume 1 requires that a five-year horizon be considered for developments that generate more than 50 trips. TMH 17 South African Trip Data Manual recommends growth rates for developments as shown in Table 7.

Table 7: Typical Traffic Growth Rates	
Development Area	Growth Rates
Low Growth Area	• 0-3%
Average Growth Area	• 3-4%
Above-average growth areas	• 4-6%
Fast-growing areas	• 6-8%
Exceptionally high growth areas	• >8%

A growth rate of 3% was considered appropriate for this study

6.9 Total Future Traffic Flows with Development

The existing 2020 peak hour traffic volumes (see Figure PH_006 as shown in the book of drawings) were thus subjected to a 3% growth rate over five years; this is in line with an above-average growth rate as given in Table 7 above. The 2025 background plus development peak hour traffic volumes are presented in Figure PH_007 as shown in the book of drawings.

6.10 Trip Distribution and Assignment

Assumptions concerning the expected trip distribution were based on the location of the site access about the surrounding road network; the existing traffic volumes, travel patterns as well as the land use nature of the proposed development.

The expected trip distribution and development generated traffic of the proposed development can be seen in Figure PH_007 as shown in the book of drawings.

7 TRAFFIC IMPACT AND CAPACITY ANALYSIS

7.1 General

The AM and PM peak hour trip generation of the development was analysed. The critical peak hour analysis was considered for the following scenarios:

- 2020 without development scenario;
- 2025 with a development scenario.

2020 without development scenario demonstrates the existing intersection's operation. 2025 with a development scenario is the worst-case scenario and would indicate all the intersection upgrading the developer would be responsible for.

This analysis aims to ensure that the intersection of:

- Houtkop Road and Gary Player Street intersection;
- Houtkop Road and Laurie Stevens Street intersection;
- Houtkop Road and Percy Sherwell Street intersection;
- Houtkop Road and Japie Krige Street intersection;
- Houtkop Road and Senator/Sprinkbok Street intersection;
- Houtkop Road and Leeuwkrol Drive/Van Riebeek Street intersection;
- Leeuwkrol Drive and Poole Street intersection;
- Leeuwkrol Drive and Johannesburg Road intersection.

This analysis aims to ensure that the intersections and proposed accesses operate at an acceptable level of service. If the intersection should operate poorly the aim will be to at least improve the overall performance of the intersection.

7.2 2020 Background Scenario Without Development

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Gary Player Street** are shown in **Table 8 & Table 9** for 2020 without development scenario.

Site: 1 [GARY PLAYER STR & HOUTKOP RD AM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	467	0,0	0,126	0,2	LOS A	0,2	1,1	0,03	0,01	0,03	59,6
12	R2	7	0,0	0,126	10,9	LOS B	0,2	1,1	0,07	0,02	0,07	57,4
Approach		475	0,0	0,126	0,4	NA	0,2	1,1	0,03	0,01	0,03	59,6
North: Gary Player St												
1	L2	51	0,0	0,236	9,6	LOS A	0,8	5,7	0,59	0,91	0,60	45,9
3	R2	25	0,0	0,236	35,6	LOS E	0,8	5,7	0,59	0,91	0,60	45,7
Approach		76	0,0	0,236	18,3	LOS C	0,8	5,7	0,59	0,91	0,60	45,8
West: Houtkop Road												
4	L2	136	0,0	0,206	5,6	LOS A	0,0	0,0	0,00	0,20	0,00	56,6
5	T1	660	0,0	0,206	0,0	LOS A	0,0	0,0	0,00	0,08	0,00	59,2
Approach		796	0,0	0,206	1,0	NA	0,0	0,0	0,00	0,10	0,00	58,8
All Vehicles		1346	0,0	0,236	1,7	NA	0,8	5,7	0,05	0,11	0,05	58,1

Table 8 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS *WITHOUT DEVELOPMENT*

Site: 1 [GARY PLAYER STR & HOUTKOP RD PM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	801	0,0	0,230	0,4	LOS A	0,6	4,4	0,08	0,03	0,08	59,3
12	R2	38	0,0	0,230	9,5	LOS A	0,6	4,4	0,17	0,07	0,17	56,6
Approach		839	0,0	0,230	0,8	NA	0,6	4,4	0,08	0,03	0,08	59,2
North: Gary Player St												
1	L2	14	0,0	0,480	22,4	LOS C	1,8	12,4	0,88	1,05	1,19	31,8
3	R2	41	0,0	0,480	64,6	LOS F	1,8	12,4	0,88	1,05	1,19	31,7
Approach		55	0,0	0,480	54,1	LOS F	1,8	12,4	0,88	1,05	1,19	31,7
West: Houtkop Road												
4	L2	34	0,0	0,156	5,6	LOS A	0,0	0,0	0,00	0,07	0,00	57,8
5	T1	574	0,0	0,156	0,0	LOS A	0,0	0,0	0,00	0,03	0,00	59,7
Approach		607	0,0	0,156	0,3	NA	0,0	0,0	0,00	0,03	0,00	59,6
All Vehicles		1501	0,0	0,480	2,5	NA	1,8	12,4	0,08	0,07	0,09	57,5

Table 9 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS *WITHOUT DEVELOPMENT*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Gary Player Street** currently operates at **LOS F on the North** approach during **the PM peak**, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Laurie Stevens Street** are shown in **Table 10 & Table 11** for 2020 without development scenario.

Site: 2 [LAURIE STEVENS & HOUTKOP RD AM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	554	0,0	0,144	0,0	LOS A	0,1	0,4	0,01	0,00	0,01	59,9
12	R2	3	0,0	0,144	9,0	LOS A	0,1	0,4	0,02	0,01	0,02	57,9
Approach		557	0,0	0,144	0,1	NA	0,1	0,4	0,01	0,00	0,01	59,9
North: Laurie Stevens												
1	L2	5	0,0	0,025	9,5	LOS A	0,1	0,6	0,57	0,87	0,57	46,8
3	R2	3	0,0	0,025	28,4	LOS D	0,1	0,6	0,57	0,87	0,57	46,7
Approach		8	0,0	0,025	16,6	LOS C	0,1	0,6	0,57	0,87	0,57	46,8
West: Houtkop Road												
4	L2	1	0,0	0,151	5,6	LOS A	0,0	0,0	0,00	0,00	0,00	58,3
5	T1	588	0,0	0,151	0,0	LOS A	0,0	0,0	0,00	0,00	0,00	60,0
Approach		589	0,0	0,151	0,0	NA	0,0	0,0	0,00	0,00	0,00	60,0
All Vehicles		1155	0,0	0,151	0,2	NA	0,1	0,6	0,01	0,01	0,01	59,8

Table 10 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS *WITHOUT DEVELOPMENT*

Site: 2 [LAURIE STEVENS & HOUTKOP RD PM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	1031	0,0	0,273	0,1	LOS A	0,3	1,8	0,02	0,01	0,03	59,7
12	R2	12	0,0	0,273	10,6	LOS B	0,3	1,8	0,05	0,01	0,06	57,6
Approach		1042	0,0	0,273	0,3	NA	0,3	1,8	0,02	0,01	0,03	59,7
North: Laurie Stevens												
1	L2	6	0,0	0,125	9,8	LOS A	0,3	2,4	0,84	0,91	0,84	34,7
3	R2	5	0,0	0,125	85,8	LOS F	0,3	2,4	0,84	0,91	0,84	34,6
Approach		12	0,0	0,125	44,3	LOS E	0,3	2,4	0,84	0,91	0,84	34,7
West: Houtkop Road												
4	L2	2	0,0	0,172	5,6	LOS A	0,0	0,0	0,00	0,00	0,00	58,3
5	T1	669	0,0	0,172	0,0	LOS A	0,0	0,0	0,00	0,00	0,00	59,9
Approach		672	0,0	0,172	0,0	NA	0,0	0,0	0,00	0,00	0,00	59,9
All Vehicles		1725	0,0	0,273	0,5	NA	0,3	2,4	0,02	0,01	0,02	59,5

Table 11 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS *WITHOUT DEVELOPMENT*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Laurie Stevens Street** currently operates at **LOS E on the North** approach during **the PM peak**, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Percy Sherwell Street** are shown in **Table 12 & Table 13** for 2020 without development scenario.

Site: 3 [HOUTKOP RD & PERCY SHERWELL ST AM 2020]

New Site
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Percy sherwell St												
1	L2	84	0,0	0,731	25,9	LOS D	5,5	38,5	0,89	1,24	1,69	36,0
2	T1	58	0,0	0,731	46,0	LOS E	5,5	38,5	0,89	1,24	1,69	36,0
3	R2	53	0,0	0,731	57,1	LOS F	5,5	38,5	0,89	1,24	1,69	35,9
Approach		195	0,0	0,731	40,3	LOS E	5,5	38,5	0,89	1,24	1,69	36,0
East: Houtkop Road												
4	L2	11	0,0	0,099	5,5	LOS A	0,0	0,0	0,00	0,03	0,00	58,1
5	T1	368	0,0	0,099	0,1	LOS A	0,0	0,3	0,01	0,02	0,01	59,7
6	R2	3	0,0	0,099	8,8	LOS A	0,0	0,3	0,03	0,01	0,03	57,8
Approach		382	0,0	0,099	0,3	NA	0,0	0,3	0,01	0,02	0,01	59,7
North: Percy sherwell St												
7	L2	61	0,0	0,494	16,0	LOS C	2,5	17,7	0,70	1,08	1,11	41,5
8	T1	58	0,0	0,494	32,7	LOS D	2,5	17,7	0,70	1,08	1,11	41,5
9	R2	21	0,0	0,494	45,7	LOS E	2,5	17,7	0,70	1,08	1,11	41,3
Approach		140	0,0	0,494	26,9	LOS D	2,5	17,7	0,70	1,08	1,11	41,5
West: Houtkop Road												
10	L2	31	0,0	0,152	5,6	LOS A	0,0	0,0	0,00	0,05	0,00	57,8
11	T1	560	0,0	0,152	0,0	LOS A	0,0	0,1	0,00	0,03	0,00	59,7
12	R2	1	0,0	0,152	7,4	LOS A	0,0	0,1	0,00	0,00	0,00	58,0
Approach		592	0,0	0,152	0,3	NA	0,0	0,1	0,00	0,03	0,00	59,6
All Vehicles		1308	0,0	0,731	9,1	NA	5,5	38,5	0,18	0,32	0,38	52,1

Table 12 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 3 [HOUTKOP RD & PERCY SHERWELL ST PM 2020]

New Site
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Percy sherwell St												
1	L2	83	0,0	0,921	66,7	LOS F	9,6	67,3	0,85	1,75	3,30	24,8
2	T1	1	0,0	0,921	86,3	LOS F	9,6	67,3	0,85	1,75	3,30	24,8
3	R2	93	0,0	0,921	104,5	LOS F	9,6	67,3	0,85	1,75	3,30	24,7
Approach		177	0,0	0,921	86,6	LOS F	9,6	67,3	0,85	1,75	3,30	24,7
East: Houtkop Road												
4	L2	6	0,0	0,161	5,6	LOS A	0,0	0,0	0,00	0,01	0,00	58,2
5	T1	614	0,0	0,161	0,0	LOS A	0,0	0,3	0,01	0,01	0,01	59,9
6	R2	3	0,0	0,161	7,3	LOS A	0,0	0,3	0,01	0,01	0,01	58,0
Approach		623	0,0	0,161	0,1	NA	0,0	0,3	0,01	0,01	0,01	59,9
North: Percy sherwell St												
7	L2	43	0,0	0,754	26,4	LOS D	5,5	38,3	0,79	1,27	1,87	35,3
8	T1	143	0,0	0,754	47,1	LOS E	5,5	38,3	0,79	1,27	1,87	35,3
9	R2	4	0,0	0,754	57,4	LOS F	5,5	38,3	0,79	1,27	1,87	35,2
Approach		191	0,0	0,754	42,6	LOS E	5,5	38,3	0,79	1,27	1,87	35,3
West: Houtkop Road												
10	L2	17	0,0	0,094	5,5	LOS A	0,0	0,0	0,00	0,05	0,00	57,9
11	T1	342	0,0	0,094	0,1	LOS A	0,1	0,4	0,02	0,03	0,02	59,6
12	R2	3	0,0	0,094	9,0	LOS A	0,1	0,4	0,03	0,01	0,03	57,8
Approach		362	0,0	0,094	0,4	NA	0,1	0,4	0,02	0,03	0,02	59,5
All Vehicles		1353	0,0	0,921	17,5	NA	9,6	67,3	0,23	0,42	0,70	46,5

Table 13 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of **Houtkop Road** and **Percy Sherwell Street** currently operates at **LOS F on the South** approach during **the PM peak**, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Japie Krige Street** are shown in **Table 14 & Table 15** for 2020 without development scenario.

Site: 4 [HOUTKOP RD & JAPIE KRINGE ST AM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	294	0,0	0,150	0,0	LOS A	0,6	4,1	0,00	0,00	0,00	59,9
12	R2	84	0,0	0,150	11,4	LOS B	0,6	4,1	0,67	0,85	0,67	49,2
Approach		378	0,0	0,150	2,6	NA	0,6	4,1	0,15	0,19	0,15	57,2
North: Japie Krige St												
1	L2	268	0,0	1,952	875,8	LOS F	172,4	1206,7	1,00	7,11	19,94	3,8
3	R2	256	0,0	1,952	895,5	LOS F	172,4	1206,7	1,00	7,11	19,94	3,8
Approach		524	0,0	1,952	885,4	LOS F	172,4	1206,7	1,00	7,11	19,94	3,8
West: Houtkop Road												
4	L2	186	0,0	0,226	5,6	LOS A	0,0	0,0	0,00	0,26	0,00	56,2
5	T1	686	0,0	0,226	0,0	LOS A	0,0	0,0	0,00	0,09	0,00	59,1
Approach		873	0,0	0,226	1,2	NA	0,0	0,0	0,00	0,13	0,00	58,5
All Vehicles		1775	0,0	1,952	262,7	NA	172,4	1206,7	0,33	2,20	5,92	11,2

Table 14 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 4 [HOUTKOP RD & JAPIE KRINGE ST PM 2020]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	316	0,0	0,109	0,4	LOS A	0,5	3,4	0,11	0,08	0,11	58,9
12	R2	56	0,0	0,109	7,3	LOS A	0,5	3,4	0,33	0,23	0,33	56,1
Approach		372	0,0	0,109	1,4	NA	0,5	3,4	0,14	0,10	0,14	58,3
North: Japie Krige St												
1	L2	382	0,0	1,185	191,8	LOS F	88,4	618,5	1,00	3,55	8,64	13,9
3	R2	276	0,0	1,185	213,9	LOS F	88,4	618,5	1,00	3,55	8,64	13,8
Approach		658	0,0	1,185	201,0	LOS F	88,4	618,5	1,00	3,55	8,64	13,8
West: Houtkop Road												
4	L2	19	0,0	0,096	5,5	LOS A	0,0	0,0	0,00	0,06	0,00	57,8
5	T1	356	0,0	0,096	0,0	LOS A	0,0	0,0	0,00	0,03	0,00	59,7
Approach		375	0,0	0,096	0,3	NA	0,0	0,0	0,00	0,03	0,00	59,6
All Vehicles		1404	0,0	1,185	94,6	NA	88,4	618,5	0,51	1,70	4,09	23,3

Table 15 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of **Houtkop Road** and **Japie Krige Street** currently operates at **LOS F on the North** approach during **the AM & PM peak**, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Senator/Sprinkbok Street** are shown in **Table 16 & Table 17** for 2020 without development scenario.

Site: 5 [HOUTKOP RD & SENATOR RD AM 2020]

New Site
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Springbok St												
1	L2	20	0,0	1,113	197,9	LOS F	13,8	96,3	1,00	1,96	4,65	12,0
2	T1	57	0,0	1,113	228,8	LOS F	13,8	96,3	1,00	1,96	4,65	12,0
3	R2	28	0,0	1,113	282,8	LOS F	13,8	96,3	1,00	1,96	4,65	12,0
Approach		105	0,0	1,113	237,5	LOS F	13,8	96,3	1,00	1,96	4,65	12,0
East: Houtkop Road												
4	L2	75	0,0	0,166	5,6	LOS A	0,0	0,0	0,00	0,14	0,00	57,2
5	T1	339	0,0	0,166	0,8	LOS A	0,9	6,2	0,14	0,21	0,14	57,6
6	R2	92	0,0	0,166	8,9	LOS A	0,9	6,2	0,52	0,38	0,52	53,4
Approach		505	0,0	0,166	3,0	NA	0,9	6,2	0,19	0,23	0,19	56,7
North: Senator Road												
7	L2	169	0,0	0,230	11,0	LOS B	0,9	6,3	0,51	0,97	0,51	50,4
8	T1	133	0,0	3,130	1952,5	LOS F	130,4	913,1	1,00	4,36	15,14	1,8
9	R2	149	0,0	3,130	1955,9	LOS F	130,4	913,1	1,00	4,36	15,14	1,8
Approach		452	0,0	3,130	1225,0	LOS F	130,4	913,1	0,82	3,08	9,65	2,8
West: Houtkop Road												
10	L2	74	0,0	0,272	6,2	LOS A	0,6	4,0	0,10	0,08	0,10	58,0
11	T1	579	0,0	0,272	0,6	LOS A	1,5	10,5	0,20	0,17	0,20	57,8
12	R2	183	0,0	0,272	7,9	LOS A	1,5	10,5	0,49	0,40	0,49	53,6
Approach		836	0,0	0,272	2,7	NA	1,5	10,5	0,25	0,21	0,25	56,8
All Vehicles		1898	0,0	3,130	306,6	NA	130,4	913,1	0,41	1,00	2,72	9,8

Table 16 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 5 [HOUTKOP RD & SENATOR RD PM 2020]

New Site
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Springbok St												
1	L2	191	0,0	1,677	631,5	LOS F	110,3	772,1	1,00	6,11	16,32	5,1
2	T1	100	0,0	1,677	650,7	LOS F	110,3	772,1	1,00	6,11	16,32	5,1
3	R2	103	0,0	1,677	661,0	LOS F	110,3	772,1	1,00	6,11	16,32	5,1
Approach		394	0,0	1,677	644,1	LOS F	110,3	772,1	1,00	6,11	16,32	5,1
East: Houtkop Road												
4	L2	7	0,0	0,145	5,6	LOS A	0,0	0,0	0,00	0,02	0,00	58,2
5	T1	535	0,0	0,145	0,1	LOS A	0,1	0,9	0,03	0,02	0,03	59,7
6	R2	9	0,0	0,145	8,2	LOS A	0,1	0,9	0,05	0,02	0,05	57,9
Approach		552	0,0	0,145	0,3	NA	0,1	0,9	0,03	0,02	0,03	59,6
North: Senator Road												
7	L2	25	0,0	0,027	9,3	LOS A	0,1	0,7	0,34	0,87	0,34	51,4
8	T1	56	0,0	1,597	587,4	LOS F	49,0	343,1	1,00	3,38	10,74	5,5
9	R2	125	0,0	1,597	596,6	LOS F	49,0	343,1	1,00	3,38	10,74	5,5
Approach		206	0,0	1,597	522,2	LOS F	49,0	343,1	0,92	3,07	9,47	6,1
West: Houtkop Road												
10	L2	77	0,0	0,183	6,0	LOS A	0,5	3,5	0,11	0,13	0,11	57,5
11	T1	491	0,0	0,183	0,6	LOS A	0,7	4,8	0,18	0,13	0,18	58,0
12	R2	51	0,0	0,183	8,7	LOS A	0,7	4,8	0,26	0,12	0,26	55,9
Approach		618	0,0	0,183	1,9	NA	0,7	4,8	0,18	0,13	0,18	57,8
All Vehicles		1769	0,0	1,677	205,0	NA	110,3	772,1	0,40	1,77	4,81	13,5

Table 17 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of **Houtkop Road** and **Senator/Sprinkbok Street** currently operates at **LOS F on the South & North** approach during **the AM & PM peak**, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Leeuwkrol Drive/Van Riebeek Street** are shown in **Table 18 & Table 19** for 2020 without development scenario.

Site: 6 [HOUTKOP RD & LEEUWKROL DR AM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Van Riebeeck St												
1	L2	547	0,0	1,720	686,8	LOS F	225,6	1578,9	1,00	2,86	4,90	4,8
2	T1	514	0,0	1,720	681,2	LOS F	225,6	1578,9	1,00	2,86	4,90	4,8
3	R2	368	0,0	1,911	871,0	LOS F	93,3	653,1	1,00	2,70	5,48	3,8
Approach		1429	0,0	1,911	732,3	LOS F	225,6	1578,9	1,00	2,82	5,05	4,5
East: Houtkop Road												
4	L2	247	0,0	0,917	58,8	LOS E	28,3	198,1	1,00	1,12	1,54	31,1
5	T1	489	0,0	0,917	51,4	LOS D	36,1	253,0	1,00	1,10	1,42	31,7
6	R2	363	0,0	0,917	55,1	LOS E	36,1	253,0	1,00	1,07	1,30	31,7
Approach		1100	0,0	0,917	54,3	LOS D	36,1	253,0	1,00	1,09	1,41	31,6
North: Leeuwkrol Drive												
7	L2	244	0,0	0,615	30,6	LOS C	18,5	129,2	0,85	0,79	0,85	40,4
8	T1	466	0,0	0,615	28,1	LOS C	18,5	129,2	0,87	0,79	0,87	40,1
9	R2	91	0,0	0,615	36,9	LOS D	13,4	93,9	0,90	0,79	0,90	38,3
Approach		801	0,0	0,615	29,9	LOS C	18,5	129,2	0,87	0,79	0,87	40,0
West: Houtkop Road												
10	L2	484	0,0	1,637	616,4	LOS F	161,0	1127,3	1,00	2,81	4,67	5,3
11	T1	300	0,0	1,637	610,8	LOS F	161,0	1127,3	1,00	2,81	4,67	5,3
12	R2	537	0,0	1,871	832,2	LOS F	132,7	928,6	1,00	2,66	5,35	4,0
Approach		1321	0,0	1,871	702,8	LOS F	161,0	1127,3	1,00	2,75	4,95	4,7
All Vehicles		4652	0,0	1,911	442,6	LOS F	225,6	1578,9	0,98	2,04	3,44	7,1

Table 18 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 6 [HOUTKOP RD & LEEUWKROL DR PM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Van Riebeeck St												
1	L2	294	0,0	0,869	42,7	LOS D	31,4	219,5	0,98	1,03	1,33	36,1
2	T1	485	0,0	0,869	39,3	LOS D	31,4	219,5	0,98	1,03	1,30	35,5
3	R2	259	0,0	0,869	49,6	LOS D	22,9	160,4	0,99	1,03	1,24	33,2
Approach		1038	0,0	0,869	42,8	LOS D	31,4	219,5	0,98	1,03	1,29	35,1
East: Houtkop Road												
4	L2	263	0,0	0,708	27,5	LOS C	13,2	92,2	0,94	0,84	0,95	41,8
5	T1	321	0,0	0,708	26,7	LOS C	17,4	122,0	0,92	0,84	0,93	40,3
6	R2	209	0,0	0,708	35,1	LOS D	17,4	122,0	0,91	0,83	0,92	38,5
Approach		794	0,0	0,708	29,2	LOS C	17,4	122,0	0,93	0,84	0,94	40,3
North: Leeuwkrol Drive												
7	L2	143	0,0	0,264	23,9	LOS C	6,8	47,5	0,66	0,69	0,66	43,3
8	T1	311	0,0	0,264	18,3	LOS B	6,9	48,5	0,66	0,59	0,66	45,6
9	R2	1	0,0	0,264	23,8	LOS C	6,9	48,5	0,66	0,56	0,66	45,2
Approach		455	0,0	0,264	20,1	LOS C	6,9	48,5	0,66	0,62	0,66	44,8
West: Houtkop Road												
10	L2	268	0,0	0,802	36,8	LOS D	20,5	143,2	0,96	0,95	1,20	38,1
11	T1	263	0,0	0,802	33,3	LOS C	20,5	143,2	0,96	0,95	1,18	37,5
12	R2	267	0,0	0,802	46,4	LOS D	16,3	114,1	0,98	0,93	1,14	33,8
Approach		799	0,0	0,802	38,9	LOS D	20,5	143,2	0,97	0,94	1,17	36,4
All Vehicles		3085	0,0	0,869	34,9	LOS C	31,4	219,5	0,92	0,90	1,08	37,9

Table 19 SUMMARY OF 2020 PM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of Houtkop Road and Leeuwkrol Drive/Van Riebeek Street currently operates at LOS F on the South & West approach during the AM peak, an intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of Leeuwkrol Drive and Poole Street are shown in Table 20 & Table 21 for 2020 without development scenario

Site: 7 [LEEUWKUIL DR & POOLE ST AM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Poole St												
1	L2	41	0,0	0,309	16,7	LOS B	1,6	11,1	0,86	0,73	0,86	47,4
2	T1	48	0,0	0,309	11,1	LOS B	1,6	11,1	0,86	0,73	0,86	48,5
3	R2	32	0,0	0,309	16,6	LOS B	1,6	11,1	0,86	0,73	0,86	47,3
Approach		121	0,0	0,309	14,4	LOS B	1,6	11,1	0,86	0,73	0,86	47,8
East: Leeuwkuil Dr												
4	L2	94	0,0	0,314	13,2	LOS B	2,4	17,0	0,75	0,68	0,75	50,3
5	T1	333	0,0	0,314	7,7	LOS A	2,4	17,0	0,75	0,65	0,75	52,4
6	R2	9	0,0	0,314	13,2	LOS B	2,4	16,7	0,75	0,62	0,75	51,5
Approach		436	0,0	0,314	9,0	LOS A	2,4	17,0	0,75	0,65	0,75	51,9
North: Poole St												
7	L2	19	0,0	0,289	16,5	LOS B	1,6	11,3	0,86	0,70	0,86	48,8
8	T1	95	0,0	0,289	11,0	LOS B	1,6	11,3	0,86	0,70	0,86	49,9
9	R2	11	0,0	0,289	16,5	LOS B	1,6	11,3	0,86	0,70	0,86	48,6
Approach		124	0,0	0,289	12,3	LOS B	1,6	11,3	0,86	0,70	0,86	49,6
West: Leeuwkuil Dr												
10	L2	56	0,0	0,285	13,1	LOS B	2,2	15,3	0,74	0,65	0,74	50,9
11	T1	332	0,0	0,285	7,6	LOS A	2,2	15,3	0,74	0,63	0,74	52,7
12	R2	8	0,0	0,285	13,1	LOS B	2,1	14,9	0,74	0,61	0,74	51,6
Approach		396	0,0	0,285	8,5	LOS A	2,2	15,3	0,74	0,63	0,74	52,4
All Vehicles		1077	0,0	0,314	9,8	LOS A	2,4	17,0	0,78	0,66	0,78	51,3

Table 20 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 7 [LEEUWKUIL DR & POOLE ST PM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Poole St												
1	L2	47	0,0	0,335	16,7	LOS B	1,8	12,3	0,87	0,73	0,87	47,4
2	T1	54	0,0	0,335	11,2	LOS B	1,8	12,3	0,87	0,73	0,87	48,5
3	R2	32	0,0	0,335	16,7	LOS B	1,8	12,3	0,87	0,73	0,87	47,2
Approach		133	0,0	0,335	14,5	LOS B	1,8	12,3	0,87	0,73	0,87	47,8
East: Leeuwkuil Dr												
4	L2	94	0,0	0,374	13,5	LOS B	3,0	20,9	0,78	0,69	0,78	50,4
5	T1	418	0,0	0,374	7,9	LOS A	3,0	20,9	0,78	0,66	0,78	52,4
6	R2	11	0,0	0,374	13,4	LOS B	2,9	20,6	0,78	0,65	0,78	51,4
Approach		522	0,0	0,374	9,0	LOS A	3,0	20,9	0,78	0,67	0,78	52,0
North: Poole St												
7	L2	22	0,0	0,275	16,5	LOS B	1,5	10,7	0,86	0,69	0,86	48,7
8	T1	86	0,0	0,275	10,9	LOS B	1,5	10,7	0,86	0,69	0,86	49,8
9	R2	9	0,0	0,275	16,4	LOS B	1,5	10,7	0,86	0,69	0,86	48,5
Approach		118	0,0	0,275	12,4	LOS B	1,5	10,7	0,86	0,69	0,86	49,5
West: Leeuwkuil Dr												
10	L2	48	0,0	0,190	12,8	LOS B	1,4	9,8	0,71	0,63	0,71	50,8
11	T1	219	0,0	0,190	7,3	LOS A	1,4	9,8	0,71	0,59	0,71	52,9
12	R2	1	0,0	0,190	12,8	LOS B	1,4	9,8	0,71	0,57	0,71	52,0
Approach		268	0,0	0,190	8,3	LOS A	1,4	9,8	0,71	0,60	0,71	52,5
All Vehicles		1041	0,0	0,374	9,9	LOS A	3,0	20,9	0,78	0,66	0,78	51,3

Table 21 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of Leeuwkrol Drive and Poole Street currently operates at LOS A during both the AM & PM peak, an NO intersection upgrade required.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Leeuwkrol Drive** and **Johannesburg Road** are shown in **Table 22 & Table 23** for 2020 without development scenario

Site: 8 [LEEUWKUIL DR & JOHANNESBURG RD AM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Johannesburg Road												
1	L2	55	0,0	0,775	55,9	LOS E	31,2	218,5	0,97	0,87	0,98	32,2
2	T1	416	0,0	0,775	50,4	LOS D	31,2	218,5	0,97	0,87	0,98	32,7
3	R2	267	0,0	1,376	415,8	LOS F	52,6	368,5	1,00	1,63	2,89	7,3
Approach		738	0,0	1,376	183,2	LOS F	52,6	368,5	0,98	1,14	1,67	14,5
East: Leeuwkuil Dr												
4	L2	426	0,0	0,730	27,5	LOS C	42,6	298,0	0,77	0,78	0,77	41,9
5	T1	416	0,0	0,730	21,9	LOS C	42,6	298,0	0,77	0,78	0,77	42,7
6	R2	405	0,0	1,336	382,8	LOS F	78,1	546,8	1,00	1,61	2,74	8,0
Approach		1247	0,0	1,336	141,1	LOS F	78,1	546,8	0,84	1,05	1,41	17,6
North: Johannesburg Road												
7	L2	20	0,0	0,565	51,4	LOS D	20,8	145,8	0,89	0,78	0,89	33,6
8	T1	324	0,0	0,565	45,8	LOS D	20,8	145,8	0,89	0,78	0,89	34,2
9	R2	74	0,0	0,649	81,3	LOS F	5,6	39,0	1,00	0,82	1,08	25,4
Approach		418	0,0	0,649	52,4	LOS D	20,8	145,8	0,91	0,78	0,92	32,2
West: Leeuwkuil Dr												
10	L2	108	0,0	0,349	21,0	LOS C	14,5	101,4	0,54	0,55	0,54	46,0
11	T1	309	0,0	0,349	16,5	LOS B	14,5	101,4	0,55	0,56	0,55	46,3
12	R2	59	0,0	0,349	50,4	LOS D	4,1	28,7	0,82	0,76	0,82	32,6
Approach		477	0,0	0,349	21,7	LOS C	14,5	101,4	0,58	0,58	0,58	43,9
All Vehicles		2680	0,0	1,376	119,2	LOS F	78,1	546,8	0,84	0,96	1,27	19,8

Table 22 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

Site: 8 [LEEUWKUIL DR & JOHANNESBURG RD PM 2020]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Johannesburg Road												
1	L2	182	0,0	0,680	27,4	LOS C	38,0	265,8	0,74	0,72	0,74	42,6
2	T1	596	0,0	0,680	21,9	LOS C	38,0	265,8	0,74	0,72	0,74	43,5
3	R2	431	0,0	1,961	940,7	LOS F	124,6	871,9	1,00	2,18	4,09	3,5
Approach		1208	0,0	1,961	350,1	LOS F	124,6	871,9	0,83	1,24	1,94	8,7
East: Leeuwkuil Dr												
4	L2	411	0,0	1,826	805,3	LOS F	306,1	2142,8	1,00	2,80	3,81	4,1
5	T1	854	0,0	1,826	800,1	LOS F	306,1	2142,8	1,00	2,74	3,82	4,1
6	R2	274	0,0	1,826	807,9	LOS F	105,8	740,6	1,00	2,41	3,86	4,1
Approach		1538	0,0	1,826	802,9	LOS F	306,1	2142,8	1,00	2,70	3,83	4,1
North: Johannesburg Road												
7	L2	44	0,0	0,656	26,9	LOS C	36,1	252,5	0,72	0,67	0,72	43,4
8	T1	713	0,0	0,656	21,4	LOS C	36,1	252,5	0,72	0,67	0,72	44,3
9	R2	363	0,0	1,771	770,7	LOS F	97,1	679,8	1,00	2,04	3,79	4,3
Approach		1120	0,0	1,771	264,6	LOS F	97,1	679,8	0,81	1,12	1,72	10,9
West: Leeuwkuil Dr												
10	L2	31	0,0	0,604	50,7	LOS D	23,3	163,1	0,90	0,79	0,90	33,8
11	T1	353	0,0	0,604	45,2	LOS D	23,3	163,1	0,90	0,79	0,90	34,3
12	R2	165	0,0	3,130	1955,6	LOS F	59,3	415,2	1,00	2,11	5,18	1,8
Approach		548	0,0	3,130	621,2	LOS F	59,3	415,2	0,93	1,19	2,19	5,2
All Vehicles		4415	0,0	3,130	519,8	LOS F	306,1	2142,8	0,90	1,71	2,57	6,1

Table 23 SUMMARY OF 2020 AM-PEAK CAPACITY ANALYSIS RESULTS
WITHOUT DEVELOPMENT

The capacity analysis indicates that the intersection of **Leeuwkrol Drive** and **Johannesburg Road** currently operates at **LOS F** during **the AM & PM peak**, an intersection upgrade required.

7.3 2025 With Development Scenario

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Gary Player Street** are shown in **Table 24 & Table 25** for 2025 with a development scenario.

Site: 1v [GARY PLAYER STR & HOUTKOP RD AM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	636	0,0	0,424	7,4	LOS A	3,7	25,7	0,77	0,64	0,77	53,4
12	R2	8	0,0	0,424	12,9	LOS B	3,5	24,5	0,77	0,65	0,77	51,8
Approach		644	0,0	0,424	7,4	LOS A	3,7	25,7	0,77	0,64	0,77	53,4
North: Gary Player St												
1	L2	61	0,0	0,247	17,3	LOS B	1,2	8,6	0,88	0,75	0,88	45,7
3	R2	31	0,0	0,247	17,3	LOS B	1,2	8,6	0,88	0,75	0,88	45,5
Approach		92	0,0	0,247	17,3	LOS B	1,2	8,6	0,88	0,75	0,88	45,7
West: Houtkop Road												
4	L2	163	0,0	0,760	16,7	LOS B	8,9	62,3	0,92	0,92	1,14	48,5
5	T1	1015	0,0	0,760	11,2	LOS B	9,0	63,0	0,92	0,91	1,14	50,2
Approach		1178	0,0	0,760	11,9	LOS B	9,0	63,0	0,92	0,92	1,14	50,0
All Vehicles		1914	0,0	0,760	10,7	LOS B	9,0	63,0	0,87	0,82	1,00	50,8

Table 24 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 1v [GARY PLAYER STR & HOUTKOP RD PM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	1169	0,0	0,824	14,0	LOS B	11,0	77,3	0,96	1,02	1,33	48,6
12	R2	45	0,0	0,824	19,7	LOS B	10,0	70,0	0,95	1,03	1,35	47,1
Approach		1215	0,0	0,824	14,2	LOS B	11,0	77,3	0,96	1,02	1,33	48,6
North: Gary Player St												
1	L2	17	0,0	0,179	17,1	LOS B	0,9	6,1	0,86	0,73	0,86	45,8
3	R2	49	0,0	0,179	17,1	LOS B	0,9	6,1	0,86	0,73	0,86	45,7
Approach		66	0,0	0,179	17,1	LOS B	0,9	6,1	0,86	0,73	0,86	45,7
West: Houtkop Road												
4	L2	40	0,0	0,526	13,3	LOS B	4,8	33,5	0,81	0,70	0,81	51,5
5	T1	778	0,0	0,526	7,8	LOS A	4,8	33,6	0,81	0,69	0,81	53,0
Approach		818	0,0	0,526	8,0	LOS A	4,8	33,6	0,81	0,69	0,81	52,9
All Vehicles		2099	0,0	0,824	11,9	LOS B	11,0	77,3	0,89	0,88	1,11	50,1

Table 25 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Gary Player Street** currently operates at **LOS B** for both **the AM & PM peak**, with the intersection signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Laurie Stevens Street** are shown in **Table 26 & Table 27** for 2025 with a development scenario.

Site: 2v [LAURIE STEVENS & HOUTKOP RD AM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	739	0,0	0,481	7,6	LOS A	4,3	30,1	0,79	0,67	0,79	53,3
12	R2	4	0,0	0,481	13,1	LOS B	4,2	29,5	0,79	0,67	0,79	51,8
Approach		743	0,0	0,481	7,6	LOS A	4,3	30,1	0,79	0,67	0,79	53,3
North: Laurie Stevens												
1	L2	6	0,0	0,028	16,5	LOS B	0,1	0,9	0,83	0,66	0,83	46,2
3	R2	4	0,0	0,028	16,5	LOS B	0,1	0,9	0,83	0,66	0,83	46,0
Approach		11	0,0	0,028	16,5	LOS B	0,1	0,9	0,83	0,66	0,83	46,1
West: Houtkop Road												
4	L2	1	0,0	0,597	13,7	LOS B	5,7	39,9	0,84	0,73	0,85	51,6
5	T1	929	0,0	0,597	8,1	LOS A	5,7	39,9	0,84	0,73	0,85	52,9
Approach		931	0,0	0,597	8,2	LOS A	5,7	39,9	0,84	0,73	0,85	52,9
All Vehicles		1684	0,0	0,597	8,0	LOS A	5,7	39,9	0,82	0,70	0,82	53,0

Table 26 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 2v [LAURIE STEVENS & HOUTKOP RD PM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	1445	0,0	0,884	7,8	LOS A	11,2	78,6	0,78	0,72	0,82	53,1
12	R2	14	0,0	0,884	13,4	LOS B	10,9	78,1	0,78	0,72	0,82	51,5
Approach		1459	0,0	0,884	7,9	LOS A	11,2	78,6	0,78	0,72	0,82	53,1
North: Laurie Stevens												
1	L2	7	0,0	0,049	22,1	LOS C	0,2	1,7	0,88	0,67	0,88	43,1
3	R2	6	0,0	0,049	22,1	LOS C	0,2	1,7	0,88	0,67	0,88	43,0
Approach		14	0,0	0,049	22,1	LOS C	0,2	1,7	0,88	0,67	0,88	43,1
West: Houtkop Road												
4	L2	2	0,0	0,418	11,3	LOS B	5,2	38,6	0,82	0,54	0,82	53,4
5	T1	895	0,0	0,418	5,8	LOS A	5,2	38,6	0,82	0,54	0,82	54,8
Approach		897	0,0	0,418	5,8	LOS A	5,2	38,6	0,82	0,54	0,82	54,8
All Vehicles		2369	0,0	0,884	7,2	LOS A	11,2	78,6	0,72	0,65	0,74	53,6

Table 27 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Laurie Stevens Street** currently operates at **LOS A** for both **the AM & PM peak**, with the intersection signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Percy Sherwell Street** are shown in **Table 28 & Table 29** for 2025 with a development scenario.

Site: 3v [HOUTKOP RD & PERCY SHERWELL ST AM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Percy sherwell St												
1	L2	101	0.0	0.619	18.3	LOS B	3.5	24.4	0.94	0.84	1.07	46.1
2	T1	69	0.0	0.619	12.8	LOS B	3.5	24.4	0.94	0.84	1.07	47.1
3	R2	63	0.0	0.619	18.3	LOS B	3.5	24.4	0.94	0.84	1.07	45.9
Approach		234	0.0	0.619	16.6	LOS B	3.5	24.4	0.94	0.84	1.07	46.4
East: Houtkop Road												
4	L2	13	0.0	0.379	13.5	LOS B	3.1	21.5	0.78	0.65	0.78	51.6
5	T1	517	0.0	0.379	7.9	LOS A	3.1	21.5	0.78	0.65	0.78	52.9
6	R2	4	0.0	0.379	13.4	LOS B	3.0	21.0	0.78	0.65	0.78	51.5
Approach		534	0.0	0.379	8.1	LOS A	3.1	21.5	0.78	0.65	0.78	52.9
North: Percy sherwell St												
7	L2	74	0.0	0.422	17.0	LOS B	2.3	16.0	0.89	0.75	0.89	47.3
8	T1	69	0.0	0.422	11.5	LOS B	2.3	16.0	0.89	0.75	0.89	48.3
9	R2	25	0.0	0.422	17.0	LOS B	2.3	16.0	0.89	0.75	0.89	47.1
Approach		168	0.0	0.422	14.7	LOS B	2.3	16.0	0.89	0.75	0.89	47.7
West: Houtkop Road												
10	L2	37	0.0	0.654	15.2	LOS B	6.3	44.0	0.89	0.80	0.97	50.2
11	T1	895	0.0	0.654	9.7	LOS A	6.3	44.1	0.89	0.80	0.97	51.6
12	R2	1	0.0	0.654	15.2	LOS B	6.3	44.1	0.89	0.80	0.97	50.3
Approach		933	0.0	0.654	9.9	LOS A	6.3	44.1	0.89	0.80	0.97	51.5
All Vehicles		1868	0.0	0.654	10.7	LOS B	6.3	44.1	0.86	0.76	0.92	50.8

Table 28 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 3v [HOUTKOP RD & PERCY SHERWELL ST PM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Percy sherwell St												
1	L2	100	0.0	0.679	20.0	LOS B	3.4	23.7	0.97	0.89	1.21	44.3
2	T1	1	0.0	0.679	14.4	LOS B	3.4	23.7	0.97	0.89	1.21	45.2
3	R2	112	0.0	0.679	19.9	LOS B	3.4	23.7	0.97	0.89	1.21	44.1
Approach		213	0.0	0.679	19.9	LOS B	3.4	23.7	0.97	0.89	1.21	44.2
East: Houtkop Road												
4	L2	7	0.0	0.673	15.5	LOS B	6.6	46.3	0.89	0.82	1.00	50.3
5	T1	945	0.0	0.673	9.9	LOS A	6.6	46.3	0.89	0.82	1.00	51.5
6	R2	4	0.0	0.673	15.4	LOS B	6.6	46.0	0.89	0.82	1.00	50.1
Approach		957	0.0	0.673	10.0	LOS B	6.6	46.3	0.89	0.82	1.00	51.5
North: Percy sherwell St												
7	L2	52	0.0	0.516	17.3	LOS B	3.2	22.1	0.92	0.76	0.92	48.3
8	T1	172	0.0	0.516	11.7	LOS B	3.2	22.1	0.92	0.76	0.92	49.4
9	R2	5	0.0	0.516	17.2	LOS B	3.2	22.1	0.92	0.76	0.92	48.1
Approach		228	0.0	0.516	13.1	LOS B	3.2	22.1	0.92	0.76	0.92	49.1
West: Houtkop Road												
10	L2	20	0.0	0.372	13.4	LOS B	3.0	21.0	0.77	0.65	0.77	51.5
11	T1	500	0.0	0.372	7.9	LOS A	3.0	21.0	0.77	0.65	0.77	52.9
12	R2	4	0.0	0.372	13.4	LOS B	2.9	20.5	0.77	0.64	0.77	51.5
Approach		524	0.0	0.372	8.2	LOS A	3.0	21.0	0.77	0.65	0.77	52.8
All Vehicles		1922	0.0	0.679	11.0	LOS B	6.6	46.3	0.87	0.77	0.95	50.6

Table 29 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Percy Sherwell Street** currently operates at **LOS A** for both **the AM & PM peak**, with the intersection signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Houtkop Road** and **Japie Krige Street** are shown in **Table 30 & Table 31** for 2025 with a development scenario.

Site: 4v [HOUTKOP RD & JAPIE KRINGE ST AM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	448	0.0	0.605	13.8	LOS B	9.1	63.5	0.86	0.74	0.86	48.9
12	R2	101	0.0	0.620	32.6	LOS C	2.7	18.8	1.00	0.81	1.15	38.2
Approach		549	0.0	0.620	17.3	LOS B	9.1	63.5	0.88	0.75	0.91	46.5
North: Japie Krige St												
1	L2	322	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.2
3	R2	307	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.1
Approach		629	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.1
West: Houtkop Road												
4	L2	223	0.0	0.864	29.5	LOS C	18.3	128.1	0.99	1.08	1.32	41.3
5	T1	1046	0.0	0.864	23.8	LOS C	18.6	130.0	0.99	1.07	1.32	42.7
Approach		1269	0.0	0.864	24.8	LOS C	18.6	130.0	0.99	1.07	1.32	42.4
All Vehicles		2448	0.0	0.892	25.3	LOS C	19.9	139.0	0.97	1.00	1.26	42.0

Table 30 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 4v [HOUTKOP RD & JAPIE KRINGE ST PM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

Three-way intersection with 5-lane major road (Stop control)
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Houtkop Road												
11	T1	448	0.0	0.605	13.8	LOS B	9.1	63.5	0.86	0.74	0.86	48.9
12	R2	101	0.0	0.620	32.6	LOS C	2.7	18.8	1.00	0.81	1.15	38.2
Approach		549	0.0	0.620	17.3	LOS B	9.1	63.5	0.88	0.75	0.91	46.5
North: Japie Krige St												
1	L2	322	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.2
3	R2	307	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.1
Approach		629	0.0	0.892	33.1	LOS C	19.9	139.0	1.00	1.06	1.44	38.1
West: Houtkop Road												
4	L2	223	0.0	0.864	29.5	LOS C	18.3	128.1	0.99	1.08	1.32	41.3
5	T1	1046	0.0	0.864	23.8	LOS C	18.6	130.0	0.99	1.07	1.32	42.7
Approach		1269	0.0	0.864	24.8	LOS C	18.6	130.0	0.99	1.07	1.32	42.4
All Vehicles		2448	0.0	0.892	25.3	LOS C	19.9	139.0	0.97	1.00	1.26	42.0

Table 31 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of **Houtkop Road** and **Japie Krige Street** currently operates at **LOS C** for both **the AM & PM peak**, with the intersection signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of Houtkop Road and Senator/Sprinkbok Street are shown in Table 32 & Table 33 for 2025 with a development scenario.

Site: 5v [HOUTKOP RD & SENATOR RD AM 2025 PLUS DEVELOPMENT - SINAL UPGRADE]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Springbok St												
1	L2	24	0,0	0,411	26,7	LOS C	3,0	21,0	0,92	0,77	1,07	42,8
2	T1	68	0,0	0,411	21,1	LOS C	3,0	21,0	0,92	0,77	1,07	43,3
3	R2	34	0,0	0,411	26,6	LOS C	3,0	21,0	0,92	0,77	1,07	42,3
Approach		126	0,0	0,411	23,6	LOS C	3,0	21,0	0,92	0,77	1,07	42,9
East: Houtkop Road												
4	L2	89	0,0	0,520	14,2	LOS B	10,3	72,3	0,66	0,62	0,66	50,7
5	T1	481	0,0	0,520	8,7	LOS A	10,3	72,3	0,66	0,62	0,66	51,9
6	R2	109	0,0	0,538	30,3	LOS C	3,1	22,0	0,94	0,81	0,96	39,3
Approach		680	0,0	0,538	12,9	LOS B	10,3	72,3	0,70	0,65	0,71	49,2
North: Senator Road												
7	L2	203	0,0	0,469	27,7	LOS C	5,3	37,3	0,91	0,80	0,91	40,5
8	T1	159	0,0	0,887	35,8	LOS D	12,4	87,1	1,00	1,10	1,51	36,7
9	R2	179	0,0	0,887	41,3	LOS D	12,4	87,1	1,00	1,10	1,51	35,9
Approach		541	0,0	0,887	34,6	LOS C	12,4	87,1	0,97	0,99	1,28	37,7
West: Houtkop Road												
10	L2	88	0,0	0,831	23,2	LOS C	25,3	176,9	0,90	0,93	1,16	45,7
11	T1	918	0,0	0,831	18,7	LOS B	25,3	176,9	0,89	0,94	1,17	45,3
12	R2	220	0,0	0,831	31,0	LOS C	11,1	77,5	0,87	0,99	1,22	39,7
Approach		1226	0,0	0,831	21,2	LOS C	25,3	176,9	0,89	0,95	1,18	44,2
All Vehicles		2574	0,0	0,887	22,0	LOS C	25,3	176,9	0,86	0,87	1,07	43,8

Table 32 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 5v [HOUTKOP RD & SENATOR RD PM 2025 PLUS DEVELOPMENT - SIGNAL UPGRADE]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Springbok St												
1	L2	226	0,0	0,780	23,2	LOS C	10,5	73,7	0,93	0,99	1,36	43,8
2	T1	120	0,0	0,780	17,5	LOS B	10,5	73,7	0,93	0,99	1,36	44,3
3	R2	124	0,0	0,780	23,1	LOS C	10,5	73,7	0,93	0,99	1,36	43,2
Approach		473	0,0	0,780	21,7	LOS C	10,5	73,7	0,93	0,99	1,36	43,8
East: Houtkop Road												
4	L2	8	0,0	0,601	19,3	LOS B	9,0	62,8	0,86	0,74	0,86	47,8
5	T1	851	0,0	0,601	13,8	LOS B	9,0	62,8	0,86	0,74	0,86	48,8
6	R2	12	0,0	0,601	19,4	LOS B	8,6	60,3	0,86	0,74	0,86	47,7
Approach		871	0,0	0,601	13,9	LOS B	9,0	62,8	0,86	0,74	0,86	48,8
North: Senator Road												
7	L2	31	0,0	0,043	16,1	LOS B	0,5	3,3	0,65	0,68	0,65	46,4
8	T1	67	0,0	0,398	13,4	LOS B	4,1	28,9	0,79	0,75	0,79	46,8
9	R2	151	0,0	0,398	18,9	LOS B	4,1	28,9	0,79	0,75	0,79	45,6
Approach		248	0,0	0,398	17,1	LOS B	4,1	28,9	0,77	0,74	0,77	46,0
West: Houtkop Road												
10	L2	93	0,0	0,750	24,4	LOS C	10,0	70,0	0,96	0,92	1,24	44,7
11	T1	678	0,0	0,750	19,1	LOS B	10,1	70,7	0,95	0,91	1,17	45,1
12	R2	61	0,0	0,750	25,0	LOS C	10,1	70,7	0,95	0,91	1,11	43,9
Approach		832	0,0	0,750	20,2	LOS C	10,1	70,7	0,95	0,91	1,18	44,9
All Vehicles		2423	0,0	0,780	17,9	LOS B	10,5	73,7	0,90	0,85	1,05	46,1

Table 33 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of Houtkop Road and Senator/Sprinkbok Street currently operates at LOS C & B for the AM & PM peak, with the intersection signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of Houtkop Road and Leeuwkrol Drive/Van Riebeek Street are shown in Table 34 & Table 35 for 2025 with a development scenario.

Site: 6 [HOUTKOP RD & LEEUWKROL DR AM 2025 PLUS DEVELOPMENT]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Van Riebeeck St												
1	L2	657	0,0	2,104	1020,8	LOS F	300,2	2101,1	1,00	5,07	10,60	3,4
2	T1	617	0,0	2,104	1015,2	LOS F	300,2	2101,1	1,00	5,07	10,60	3,4
3	R2	442	0,0	2,104	1023,1	LOS F	108,6	759,9	1,00	4,38	10,67	3,3
Approach		1716	0,0	2,104	1019,4	LOS F	300,2	2101,1	1,00	4,89	10,62	3,3
East: Houtkop Road												
4	L2	297	0,0	1,585	552,9	LOS F	128,3	898,4	1,00	3,55	7,90	5,9
5	T1	662	0,0	1,585	549,0	LOS F	128,3	898,4	1,00	3,77	7,90	5,9
6	R2	436	0,0	1,585	558,1	LOS F	118,3	828,0	1,00	4,21	7,91	5,8
Approach		1395	0,0	1,585	552,7	LOS F	128,3	898,4	1,00	3,86	7,90	5,9
North: Leeuwkrol Drive												
7	L2	293	0,0	0,717	20,7	LOS C	12,1	84,6	0,90	0,86	0,97	45,3
8	T1	560	0,0	0,717	16,6	LOS B	12,1	84,6	0,92	0,87	1,01	45,9
9	R2	108	0,0	0,717	23,3	LOS C	9,9	69,0	0,93	0,87	1,04	44,7
Approach		961	0,0	0,717	18,6	LOS B	12,1	84,6	0,91	0,87	1,00	45,6
West: Houtkop Road												
10	L2	581	0,0	2,188	1096,0	LOS F	278,1	1946,5	1,00	5,02	10,93	3,1
11	T1	583	0,0	2,188	1090,5	LOS F	278,1	1946,5	1,00	5,02	10,93	3,1
12	R2	644	0,0	2,188	1097,5	LOS F	167,6	1173,1	1,00	5,08	10,95	3,1
Approach		1808	0,0	2,188	1094,8	LOS F	278,1	1946,5	1,00	5,04	10,94	3,1
All Vehicles		5880	0,0	2,188	788,3	LOS F	300,2	2101,1	0,99	4,03	8,50	4,4

Table 34 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 6 [HOUTKOP RD & LEEUWKROL DR PM 2025 PLUS DEVELOPMENT]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Van Riebeeck St												
1	L2	353	0,0	1,163	191,4	LOS F	77,6	543,3	1,00	1,92	2,94	13,8
2	T1	582	0,0	1,163	189,8	LOS F	77,6	543,3	1,00	1,94	2,96	13,8
3	R2	311	0,0	1,163	206,2	LOS F	52,7	368,8	1,00	2,00	3,04	13,5
Approach		1245	0,0	1,163	194,3	LOS F	77,6	543,3	1,00	1,95	2,97	13,7
East: Houtkop Road												
4	L2	316	0,0	1,200	225,2	LOS F	63,9	447,3	1,00	2,05	3,24	12,3
5	T1	594	0,0	1,200	224,1	LOS F	69,9	489,1	1,00	2,19	3,24	12,3
6	R2	252	0,0	1,200	233,2	LOS F	69,9	489,1	1,00	2,30	3,24	12,3
Approach		1161	0,0	1,200	226,4	LOS F	69,9	489,1	1,00	2,17	3,24	12,3
North: Leeuwkrol Drive												
7	L2	172	0,0	0,336	22,2	LOS C	7,1	49,5	0,71	0,71	0,71	44,2
8	T1	373	0,0	0,336	16,6	LOS B	7,2	50,6	0,71	0,63	0,71	46,6
9	R2	1	0,0	0,336	22,2	LOS C	7,2	50,6	0,71	0,61	0,71	46,1
Approach		545	0,0	0,336	18,4	LOS B	7,2	50,6	0,71	0,66	0,71	45,8
West: Houtkop Road												
10	L2	322	0,0	1,024	85,6	LOS F	41,1	287,7	1,00	1,38	1,94	23,2
11	T1	405	0,0	1,024	82,5	LOS F	41,1	287,7	1,00	1,38	1,96	23,2
12	R2	321	0,0	1,024	100,2	LOS F	28,1	196,6	1,00	1,38	2,07	22,5
Approach		1048	0,0	1,024	88,9	LOS F	41,1	287,7	1,00	1,38	1,99	23,0
All Vehicles		4000	0,0	1,200	152,0	LOS F	77,6	543,3	0,96	1,69	2,48	16,5

Table 35 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of Houtkop Road and Leeuwkrol Drive/Van Riebeek Street currently operates at LOS F for the AM & PM peak, with the intersection signalisation has to be synchronized with the new signals.

The results of Sidra Intersection Capacity Analyses at the existing intersection of Leeuwkrol Drive and Poole Street are shown in Table 36 & Table 37 for 2025 with a development scenario

Site: 7 [LEEUWKUIL DR & POOLE ST AM 2025 PLUS DEVELOPMENT]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Poole St												
1	L2	49	0,0	0,443	18,1	LOS B	2,1	14,4	0,92	0,76	0,92	46,6
2	T1	58	0,0	0,443	12,5	LOS B	2,1	14,4	0,92	0,76	0,92	47,6
3	R2	38	0,0	0,443	18,0	LOS B	2,1	14,4	0,92	0,76	0,92	46,4
Approach		145	0,0	0,443	15,9	LOS B	2,1	14,4	0,92	0,76	0,92	46,9
East: Leeuwkuil Dr												
4	L2	113	0,0	0,397	12,8	LOS B	3,3	23,4	0,75	0,69	0,75	50,8
5	T1	474	0,0	0,397	7,3	LOS A	3,3	23,4	0,75	0,66	0,75	52,8
6	R2	12	0,0	0,397	12,8	LOS B	3,2	22,6	0,75	0,64	0,75	51,9
Approach		598	0,0	0,397	8,4	LOS A	3,3	23,4	0,75	0,66	0,75	52,4
North: Poole St												
7	L2	23	0,0	0,409	17,9	LOS B	2,1	14,6	0,91	0,74	0,91	47,9
8	T1	114	0,0	0,409	12,3	LOS B	2,1	14,6	0,91	0,74	0,91	49,0
9	R2	13	0,0	0,409	17,8	LOS B	2,1	14,6	0,91	0,74	0,91	47,7
Approach		149	0,0	0,409	13,6	LOS B	2,1	14,6	0,91	0,74	0,91	48,7
West: Leeuwkuil Dr												
10	L2	67	0,0	0,459	13,0	LOS B	4,0	28,1	0,78	0,68	0,78	51,3
11	T1	621	0,0	0,459	7,5	LOS A	4,0	28,1	0,78	0,67	0,78	52,9
12	R2	11	0,0	0,459	13,0	LOS B	3,9	27,4	0,78	0,66	0,78	51,7
Approach		699	0,0	0,459	8,1	LOS A	4,0	28,1	0,78	0,67	0,78	52,8
All Vehicles		1592	0,0	0,459	9,5	LOS A	4,0	28,1	0,80	0,68	0,80	51,6

Table 36 SUMMARY OF 2025 AM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

Site: 7 [LEEUWKUIL DR & POOLE ST PM 2025 PLUS DEVELOPMENT]

iew Site
ite Category: (None)
ignals - Fixed Time Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Poole St												
1	L2	57	0,0	0,478	18,2	LOS B	2,3	15,9	0,93	0,77	0,93	46,5
2	T1	64	0,0	0,478	12,6	LOS B	2,3	15,9	0,93	0,77	0,93	47,6
3	R2	38	0,0	0,478	18,1	LOS B	2,3	15,9	0,93	0,77	0,93	46,4
Approach		159	0,0	0,478	15,9	LOS B	2,3	15,9	0,93	0,77	0,93	46,9
East: Leeuwkuil Dr												
4	L2	108	0,0	0,544	13,4	LOS B	5,0	34,7	0,81	0,72	0,81	50,8
5	T1	709	0,0	0,544	7,8	LOS A	5,0	34,7	0,81	0,71	0,81	52,6
6	R2	13	0,0	0,544	13,3	LOS B	4,9	34,2	0,81	0,70	0,81	51,5
Approach		831	0,0	0,544	8,6	LOS A	5,0	34,7	0,81	0,71	0,81	52,3
North: Poole St												
7	L2	26	0,0	0,388	17,8	LOS B	2,0	13,7	0,91	0,73	0,91	47,9
8	T1	103	0,0	0,388	12,3	LOS B	2,0	13,7	0,91	0,73	0,91	49,0
9	R2	12	0,0	0,388	17,8	LOS B	2,0	13,7	0,91	0,73	0,91	47,7
Approach		141	0,0	0,388	13,7	LOS B	2,0	13,7	0,91	0,73	0,91	48,6
West: Leeuwkuil Dr												
10	L2	58	0,0	0,267	12,4	LOS B	2,1	14,8	0,71	0,63	0,71	51,5
11	T1	353	0,0	0,267	6,8	LOS A	2,1	14,9	0,71	0,60	0,71	53,4
12	R2	1	0,0	0,267	12,3	LOS B	2,1	14,9	0,71	0,58	0,71	52,4
Approach		412	0,0	0,267	7,6	LOS A	2,1	14,9	0,71	0,60	0,71	53,1
All Vehicles		1542	0,0	0,544	9,6	LOS A	5,0	34,7	0,81	0,69	0,81	51,6

Table 37 SUMMARY OF 2025 PM-PEAK CAPACITY ANALYSIS RESULTS *WITH DEVELOPMENT & INTERSECTION UPGRADES*

The capacity analysis indicates that the intersection of Leeuwkrol Drive and Poole Street currently operates at LOS A for the AM & PM peak, with the existing signalisation.

The results of Sidra Intersection Capacity Analyses at the existing intersection of **Leeuwkrol Drive** and **Johannesburg Road** are shown in **Table 38 & Table 39** for 2025 with a development scenario

Site: 8 [LEEUWKUIL DR & JOHANNESBURG RD AM 2025 PLUS DEVELOPMENT]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Johannesburg Road												
1	L2	65	0,0	0,939	63,9	LOS E	35,3	246,8	1,00	1,17	1,38	30,1
2	T1	499	0,0	0,939	58,4	LOS E	35,3	246,8	1,00	1,17	1,38	30,5
3	R2	321	0,0	1,973	921,1	LOS F	82,7	578,8	1,00	2,73	5,62	3,6
Approach		885	0,0	1,973	371,6	LOS F	82,7	578,8	1,00	1,74	2,92	8,3
East: Leeuwkuil Dr												
4	L2	512	0,0	0,999	78,4	LOS E	84,3	589,9	1,00	1,25	1,51	26,5
5	T1	574	0,0	0,999	72,8	LOS E	84,3	589,9	1,00	1,25	1,51	26,8
6	R2	486	0,0	2,049	998,8	LOS F	131,0	916,9	1,00	2,85	5,78	3,4
Approach		1572	0,0	2,049	361,2	LOS F	131,0	916,9	1,00	1,74	2,83	8,5
North: Johannesburg Road												
7	L2	24	0,0	0,886	38,3	LOS D	17,8	124,7	0,94	0,81	0,94	38,2
8	T1	389	0,0	0,886	32,8	LOS C	17,8	124,7	0,94	0,81	0,94	38,9
9	R2	88	0,0	1,150	198,0	LOS F	9,8	68,3	1,00	1,31	2,77	13,6
Approach		502	0,0	1,150	62,1	LOS E	17,8	124,7	0,95	0,90	1,26	29,3
West: Leeuwkuil Dr												
10	L2	131	0,0	0,858	21,3	LOS C	24,1	168,8	0,74	0,70	0,74	46,1
11	T1	595	0,0	0,858	15,8	LOS B	24,1	168,8	0,74	0,70	0,74	47,1
12	R2	71	0,0	0,890	67,4	LOS E	4,0	27,7	1,00	0,93	1,60	28,1
Approach		796	0,0	0,890	21,3	LOS C	24,1	168,8	0,77	0,72	0,82	44,3
All Vehicles		3755	0,0	2,049	251,6	LOS F	131,0	916,9	0,94	1,41	2,21	11,5

Site: 8 [LEEUWKUIL DR & JOHANNESBURG RD PM 2025 PLUS DEVELOPMENT]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

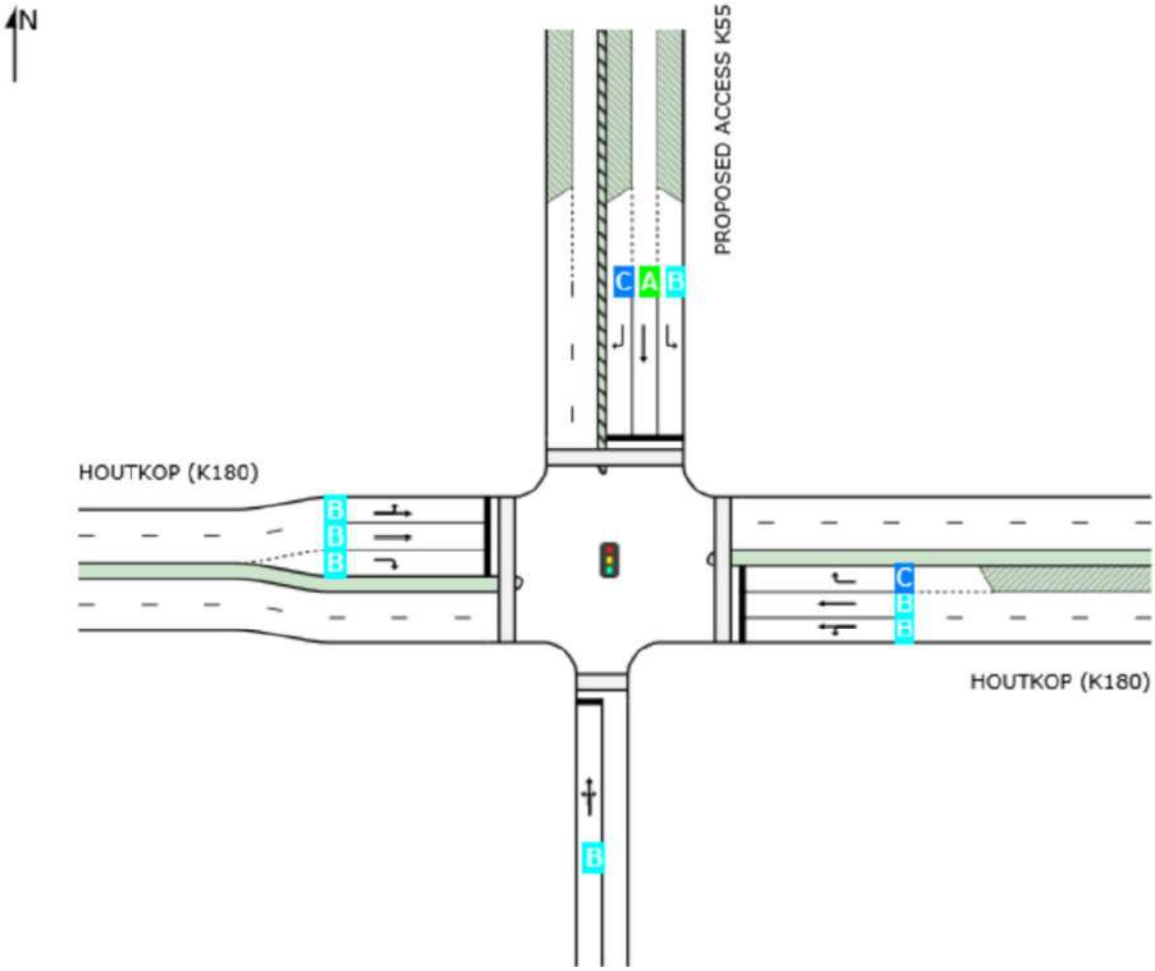
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Johannesburg Road												
1	L2	219	0,0	1,384	374,5	LOS F	130,1	910,4	1,00	4,44	7,57	8,4
2	T1	715	0,0	1,384	369,0	LOS F	130,1	910,4	1,00	4,44	7,57	8,4
3	R2	517	0,0	2,610	1468,1	LOS F	141,9	993,2	1,00	5,33	15,04	2,4
Approach		1451	0,0	2,610	761,5	LOS F	141,9	993,2	1,00	4,76	10,23	4,4
East: Leeuwkuil Dr												
4	L2	493	0,0	2,261	1160,9	LOS F	382,4	2676,7	1,00	7,76	13,70	3,0
5	T1	1233	0,0	2,261	1154,9	LOS F	382,4	2676,7	1,00	7,34	13,71	3,0
6	R2	328	0,0	2,261	1158,0	LOS F	134,5	941,2	1,00	5,27	13,75	3,0
Approach		2054	0,0	2,261	1156,8	LOS F	382,4	2676,7	1,00	7,11	13,71	3,0
North: Johannesburg Road												
7	L2	53	0,0	1,333	329,6	LOS F	116,5	815,8	1,00	4,13	6,98	9,4
8	T1	855	0,0	1,333	324,1	LOS F	116,5	815,8	1,00	4,13	6,98	9,4
9	R2	436	0,0	2,201	1100,8	LOS F	107,0	749,0	1,00	4,82	13,47	3,1
Approach		1343	0,0	2,201	576,3	LOS F	116,5	815,8	1,00	4,35	9,09	5,7
West: Leeuwkuil Dr												
10	L2	37	0,0	0,808	22,8	LOS C	11,8	82,8	0,97	0,98	1,23	45,6
11	T1	513	0,0	0,808	17,3	LOS B	11,8	82,8	0,97	0,98	1,23	46,5
12	R2	198	0,0	0,999	53,1	LOS D	6,7	47,2	1,00	1,35	2,76	31,6
Approach		747	0,0	0,999	27,0	LOS C	11,8	82,8	0,98	1,08	1,64	41,3
All Vehicles		5595	0,0	2,610	764,0	LOS F	382,4	2676,7	1,00	5,03	10,09	4,4

The capacity analysis indicates that the intersection of **Leeuwkrol Drive** and **Johannesburg Road** currently operates at **LOS F** for **the AM & PM peak**, with the intersection signalisation has to be synchronized with the new signals.

8 ACCESS

8.1 General

Access will be provided off Proposed K55 and K180 this intersection will to Gautrans Standards, and as per PRS 78/197/4Bp (refer below for the access layout configuration).



Schematic PH_004: PROPOSED SIGNALISED ACCESS

9 PARKING PROVISION

Parking will be provided within the site as required by the Emfuleni Local Municipality Town Planning Scheme.

10 NON-MOTORISED & PUBLIC TRANSPORT FACILITIES

10.1 Pedestrian Facilities

Pedestrian walkways have been provided along the site frontage of the proposed development as per the Emfuleni Local Municipality requirements or standards.

It is a requirement that pedestrian access must be provided to and from the development, particularly from public transport facilities. Currently, they are formal transport facilities in the vicinity of the development exist.

The planning of the development will however take into consideration possible future road-based public transport infrastructure along various provincial routes (existing or planned).

The conflict between vehicular and pedestrian/bicycle traffic must be minimised. As part of the development, pedestrian crossings would be provided at all major intersections and access points. Bicycle access and crossings, shared with pedestrians or otherwise, would be provided where appropriate.

The minimum footpath or cycleway and clear widths indicated in Table 40 must be provided along the perimeter of the development. The clear width is measured between the side of the road (outer edge of the kerb or shoulder) and the road reserve boundary.

Table 40 : Minimum Sidewalk, Walkway and Cycle Track Width*

Descriptions	Minimum Width
Sidewalks/ Walkways with Buffer Strip • Minimum Width • Desirable Width • Buffer Strip Width	 1.5m 1.8m 0.6m
Sidewalks/Walkways without Buffer Strip	1.8m
Sidewalks in Business Areas	2.5-3.5m
Cycle Track	2.0m
Shared Cycle Track/Walkway	2.4m

*Reference COTO TMH16 Volume 2

Table 41: Desirable Pedestrian Buffer Strips*

Road Class	Desirable Buffer Width (m)
Class 2	6.0
Class 3	4.5
Class 4a	3.0
Class 4b	2.5
Class 5a	0.6-2.5
Class 5b	0.6-1.5

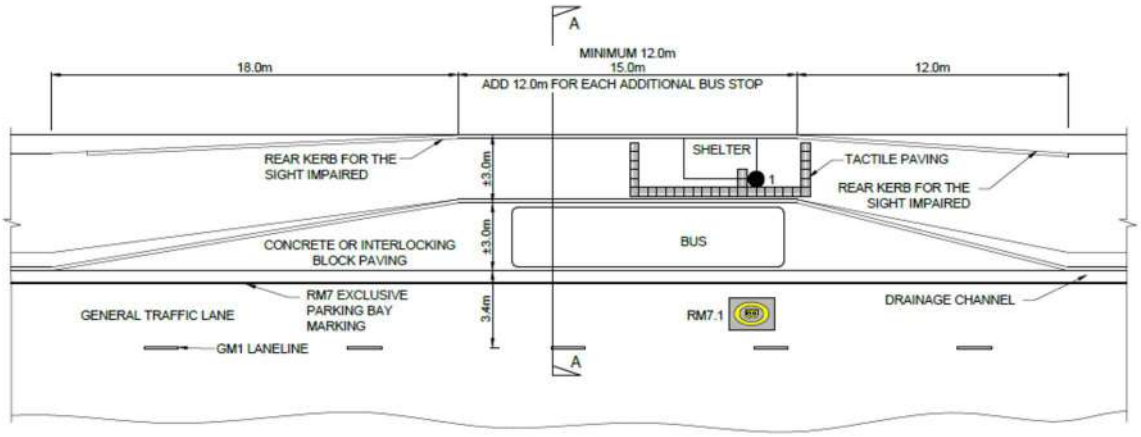
*Reference COTO TMH16 Volume 2

10.2 General

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of public transport is included in a traffic impact assessment.

The following comments are made regarding public transport:

It is recommended that road K180 be provided with a pair of public transport lay-bys in the form of bus and taxi stops at each access point where access to the township is gained. It is further recommended that the proposed lay-bys be constructed to the appropriate design standards of the relevant roads authority (See Schematic PH_005 below).



Schematic PH_005: Typical Public Transport lay-bys

11 ROAD UPGRADES HIGH-LEVEL COST ESTIMATES

TABLE 42: SUMMARY OF PRICING SCHEDULE		
SECTION	DESCRIPTION	AMOUNT
1	Houtkop Road and Gary Player Street intersection-Proposed Traffic Signal	R795 000,00
2	Houtkop Road and Laurie Stevens Street -Proposed Traffic Signal	R795 000,00
3	Houtkop Road and Percy Sherwell Street -Proposed Traffic Signal	R795 000,00
4	Houtkop Road and Japie Krige Street -Proposed Traffic Signal	R795 000,00
5	Houtkop Road and Senator/Sprinkbok Street -Proposed Traffic Signal	R795 000,00
6	Access on K55 & K180-Proposed Traffic Signal	R795 000,00
7	Proposed Bus-Laybys	R3 500 000,00
8	The proposed K55 has two access points that have been provided for in the erf subdivision.	R24 000 000,00
9	External and Site Works	R750 000,00
	Total Schedule of Prices	R33 020 000,00
	10% Contingencies	R3 302 000,00
	Subtotal	R36 322 000,00
	15% VAT	R5 448 300,00
	Estimated Order Magnitude	R41 770 300,00

12 CONCLUSION AND RECOMMENDATION

Based on the assessment of the existing and planned future road network, traffic counts, a traffic analysis and capacity analysis of road links in the study area, the following concluding remarks are relevant.

This Traffic Impact (TIA) & Access Study pertains for the establishment of a Proposed Mixed Use Residential development Unitas Park Extension 16 Situated on Portion 222 of the farm Houtkop 594-IQ (SG Diagram 7423/2008). Portion 222 of the farm Houtkop 594-IQ is in the process of subdivision and will be known as Portion 225 (a portion of 222) of the farm Houtkop 594-IQ (Subdivision Diagram 4362/2009) in the Emfuleni Local Municipality.

The site is currently undeveloped. The township locality and the surrounding road network are indicated on FIGURE PH_001 , 002 & 003.

The development consists of the following land use:

- Proposed Mixed Use Residential Development

Detailed traffic surveys (traffic counts) were carried out at the following intersections :

- Houtkop Road and Gary Player Street intersection;
- Houtkop Road and Laurie Stevens Street intersection;
- Houtkop Road and Percy Sherwell Street intersection;
- Houtkop Road and Japie Krige Street intersection;
- Houtkop Road and Senator/Sprinkbok Street intersection;
- Houtkop Road and Leeuwkrol Drive/Van Riebeek Street intersection;
- Leeuwkrol Drive and Poole Street intersection;
- Leeuwkrol Drive and Johannesburg Road intersection.

The proposed development will generate 566 trips during the weekday AM and weekday PM peak periods, respectively.

The site is well-connected on a regional scale. To the south is Houtkop Road (R54), to the south-west is the R28 and to the east is the R59 (Old Johannesburg Road). The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary.

The proposed K55 has two access points that have been provided for in the erf subdivision. This road, or a portion of it, must first be constructed before access to the site can be obtained. There is no indication as to when this will be done.

From the analysis performed, it was found that the impact of the proposed developments can be mitigated by means of several road and intersection improvements as shown in Section 7.3

The 2020 background traffic & future 2025 traffic show that there is an existing capacity constraint. Therefore the developers of the latent rights developments are required to contribute towards roads and intersection upgrades. The upgrading will be as per the requirements of ELM and GDRT.

Pedestrian walkways have been provided along the site frontage of the proposed development as per the Emfuleni Local Municipality requirements or standards.

It is a requirement that pedestrian access must be provided to and from the development, particularly from public transport facilities. Currently, they are no formal transport facilities in the vicinity of the development exist.

The planning of the development will however take into consideration possible future road-based public transport infrastructure along various provincial routes (existing or planned).

The conflict between vehicular and pedestrian/bicycle traffic must be minimised. As part of the development, pedestrian crossings would be provided at all major intersections and access points. Bicycle access and crossings, shared with pedestrians or otherwise, would be provided where appropriate.

The minimum footpath or cycleway and clear widths indicated in Table 40 must be provided along the perimeter of the development. The clear width is measured between the side of the road (outer edge of the kerb or shoulder) and the road reserve boundary.

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of public transport is included in a traffic impact assessment.

The following comments are made regarding public transport:

It is recommended that road K180 be provided with a pair of public transport lay-bys in the form of bus and taxi stops at each access point where access to the township is gained. It is further recommended that the proposed lay-bys be constructed to the appropriate design standards of the relevant roads authority (See Schematic PH_005)

13 REFERENCES

- TMH 16 Volume 2, South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual, Version 1.0, Committee of Transport Officials (COTO) August 2012
- TMH 17 Volume 1, South African Trip Data Manual, Version 1.0, Committee of Transport Officials (COTO) September 2012
- Highway Capacity Manual, Transportation Research Board, National Research Council Washington D.C., 2010
- Manual for Traffic Impact Studies, Department of Transport (DOT), October 1995
- The Development of an Operations Plan for an IRPTN North/South Corridor,City of Ekurhuleni, 2012.

APPENDIX C6

Civil Engineering Services Outline Scheme Report

GCS

Water & Environmental Consultants

GAUTENG PROVINCE
HUMAN SETTLEMENTS
REPUBLIC OF SOUTH AFRICA

GAUTENG RAPID LAND RELEASE

CIVIL ENGINEERING SERVICES OUTLINE SCHEME REPORT

UNITAS PARK EXT. 16

PROJECT No.: 7001

20 MAY 2020

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Job Title			Job Number: 7001
Document Title	CIVIL ENGINEERING SERVICES OUTLINE SCHEME REPORT UNITAS PARK EXT.16		File Ref: T:\PROJECTS 2009\7000 Projects\7001 Gauteng Rapid Land Release Programme\03 CIVL\11 Design reports\Report\CIVIL ENGINEERING SERVICES OUTLINE SCHEME
Document Revision	Revised/ Issued By		Date
A	Sikelela Mnguni (Pr.Tech.Eng)		20 MAY 2020
Compiled By:	Edward Williams		20 MAY 2020
	Name & Surname	*Signature*	*Date*
Reviewed By:	Rofhiwa Maboho		20 MAY 2020
	Name & Surname	*Signature*	*Date*
Checked By:	Sikelela Mnguni (Pr.Tech.Eng)		20 MAY 2020
	Name & Surname	*Signature*	*Date*
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CONTENTS

LIST OF ANNEXURES

EXECUTIVE SUMMARY

The Gauteng Rapid Land Release Programme aims to fast track the release of serviced stands from State-owned land to qualifying beneficiaries. Phumaf Holdings (Pty) Ltd was appointed to assist the Department of Human Settlements with all preplanning, planning work, design & construction management to enable the release of the stands in question.

One of the land parcels identified for the Gauteng Rapid Land Release Programme is Unitas Park Extension 16. The site is located on portion 222 of portion 221 of the farm Houtkop 594IQ in the Emfuleni Local Municipality of the Sedibeng District. At the time the Feasibility Report (Stage 1) was completed, an application to establish a township of 2680 erven of between 270 – 450m$_2$ was underway but not finalized hence the land parcel was still a farm portion. However, the client intends to withdraw the current application and develop a new township with higher densities and smaller stands in order to yield approximately 7 250 housing opportunities.

The purpose of this report investigates and identifies whether the proposed development can be serviced economically with the existing bulk infrastructure and, design norms and standards of the internal engineering services.
This Civil Engineering Services Outline Scheme Report addressed the following:

- Bulk Potable Water and Internal reticulation
- Bulk Portable Sanitation and Internal reticulation
- Roads Design
- Stormwater Management
- Conclusion and Recommendation

This investigation will be based on available, local knowledge and discussions with the relevant officials. This Civil engineering Services Outline scheme report is based on the Civil Engineering Services Bulk Information from Emfuleni Local Municipality (Metsi a Lekwa), Water and Sanitation GLS Master planning department, and Emfuleni Spatial Development Framework 2017-2025.

DESIGN NORMS AND STANDARDS

The following guidelines and standards will be used for the design of proposed Civil Engineering services for this development are as follows:

- Emfuleni Local Municipality (Metsi-A-Lekoa) Design Criteria and Internal Services Standards
- "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book)
- Department of public works "Appropriate development of infrastructure on dolomite: guidelines for consultants (PW 371 & 344)
- The Standardized Specification for Civil Engineering Construction (SANS 1200), published by the South Africa Bureau of Standards
- Development of Dolomite land (SANS 1936), published by SABS Standards Division.

ENVIRONMENTAL

Unitas Park Ext. 16 is located within Unitas Park, to the northeast of the R54 (Houtkop Road). The R82 is running north-south approximately 2.3km to the east of the site. The N1 is about 11km to the northwest of the site. Sebokeng lies to the northwest of the site, with Vereeniging to the south. The R59 runs from Vereeniging to Meyerton in the northwest of the site. The site is currently vacant, with immediate adjacent land portions also being vacant. There are existing external roads to provide access to the new proposed development however rehabilitation is needed. There is evidence of a wetland or some surface water on the site, as well as to the southeast of the site.

The site has an approved township layout with 2680 erven. The layout is not proclaimed or registered due to constraints with waste-water treatment capacity and electricity upgrades required. The site is in a dolomitic zone and further tests will be undertaken to confirm the risk category. There are no environmental red flags on the site and authorization should be obtained. To achieve a higher yield, the existing layout will have to be withdrawn and a new application submitted, investigations will be undertaken to determine the impact on current environmental authorization, municipal services, etc. The project is envisaged to be ready for site installation in the 3rd quarter of 2021.

WATER

The proposed development falls under the Emfuleni Local Municipality (Metsi-A-Lekoa) Water jurisdiction. Information from Emfuleni Spatial Development Framework 2017-2025, Compiled on Behalf of the Emfuleni Local Municipality by Urban Dynamics Gauteng, dated September 2017 and Project 14/2006 Civil Engineering Services Master Planning Volume 1 Water Supply, Draft report compiled in April 2009 and updated in April 2013 states that currently there is not sufficient capacity to supply the current water demand and also to accommodate future demand from future developments, therefore, new water bulk infrastructure will be required to accommodate the proposed development and other future developments.

SEWER

The proposed development falls under the Emfuleni Local Municipality (Metsi-A-Lekoa) Water jurisdiction. Information obtained from Emfuleni Spatial Development Framework 2017-2025 (ESDF), Compiled on Behalf of the Emfuleni Local Municipality by Urban Dynamics Gauteng, dated September 2017, Project SNM/2012 Civil Engineering Services Master Planning Volume 2 Sewage Disposal, first edition dated August 2013 and Southern Corridor Regional Implementation Plan indicates that the existing bulk sanitation network is old, and it is overworked due to the demand for sanitation services therefore new infrastructure needs to be constructed.

ROADS

The proposed development is currently used for farming purposes which means there are no roads and infrastructure within the site. There are existing road services to the north in Sonland Park and the southwestern side of the site in Unitas Park AH.

A new road network system, parking, and stormwater pipe systems will be constructed within the proposed site connecting to the existing road infrastructure nearby the proposed Unitas Park Extension 16 development.

The site is surrounded by classes 3, 4, and 5 roads, however, the internal main roads have a total length of approximately 9.7km including the proposed parking and walkways within and outside the proposed development. Information regarding bus and taxi bays planned for the development will be available in the Traffic Impact Assessment (TIA) report.

STORMWATER

The proposed development of land use is agriculture and currently is being used for farming crop purposes which means there is no stormwater infrastructure within the site. There are existing stormwater systems to the north in Sonland Park and the southwestern side of the site in Unitas Park AH.

A new stormwater pipe system will be constructed within the proposed site connecting to the existing stormwater infrastructure nearby and natural watercourses nearby the proposed Unitas Park Extension 16 development.

According to the stormwater drainage policy issued by JRA, all developments on land exceeding 8 500m^2 are subject to stormwater attenuation on site.
The preferred means of attenuation are on the surface. Attenuation off-site, to compensate for the lack of an on-site facility is acceptable.
The runoff associated with the development is to be attenuated such that the predevelopment flows for the 1: 5, as well as the 1:25 – year storm events, are not exceeded. The attenuation structure must be able to withstand the 1:50 - year storm event.
Discharge from the attenuation facility is subject to approval by the landowner downstream.

The minor stormwater system consists of a few sub-catchments. Stormwater is discharged from the development to the attenuation pond and existing stormwater system by means of stormwater pipes. The pipe sizes will from 450mm diameter. The total pipe length is approximately 9.7 km.

The attenuation pond outflow pipes will be designed for a 5-year recurrence interval and a 25-year recurrence interval restricted to the predevelopment runoff. The downstream outflow allows the 50-year spillway discharge.

The new development will have to have internal water, sewer, road, and stormwater networks designed in accordance with municipal standards and guidelines.

ESTIMATED PROJECT COST

There will be 11 km of water pipes, 10.5 km of sewer pipes, 8.5 km of stormwater pipes, and a total road length of 9.7km. The estimated total construction cost for this project is **R R 137 743 011.43** for **option 1 and R 215 248 281.52 for Option 2** which is inclusive of 12.5% contingencies and exclusive of VAT.

1 INTRODUCTION

1.1 Project Brief and Background

The Gauteng Rapid Land Release Programme aims to fast track the release of serviced stands from State-owned land to qualifying beneficiaries. Phumaf Holdings (Pty) Ltd was appointed to assist the Department of Human Settlements with all preplanning, planning work, design & construction management to enable the release of the stands in question.

One of the land parcels identified for the Gauteng Rapid Land Release Programme is Unitas Park Extension 16. The site is located on portion 222 of portion 221 of the farm Houtkop 594IQ in the Emfuleni Local Municipality of the Sedibeng District. At the time the Feasibility Report (Stage 1) was completed, an application to establish a township of 2680 erven of between 270 – 450m$_2$ was underway but not finalized hence the land parcel was still a farm portion. However, the client intends to withdraw the current application and develop a new township with higher densities and smaller stands in order to yield approximately 7 250 housing opportunities.

The proposed development land use is shown in **Annexure A** proposed draft layout as part of Unitas Park Extension 16 Urban design framework dated February 2020 prepared by Metroplan Town Planners and Urban Designers.

The purpose of this report investigates and identifies whether the proposed development can be serviced economically with the existing bulk infrastructure and, design norms and standards of the internal engineering services.

This Civil engineering Services Outline scheme report is based on the Civil Engineering Services Bulk information Emfuleni Local Municipality (Metsi a Lekwa) **Water and Sanitation GLS** planning department, Geographic Information System (GIS), and Infrastructure Asset Management (IAM) IMQS Software.

2 DEVELOPMENT DETAILS

2.1 Locality

The proposed site is located adjacent to the existing Houtkop Rd (R54) on the western side, this route is located where the future K180 will be positioned. Houtkop AH farm is on the eastern side, Unitas Park AH on the southern side and Unitas Park farm on the western side. Future K55 route also bounds the site to the south. A Locality Map is shown in **Annexure A.**

2.2 Proposed land – Uses and Zoning

The proposed Unitas Park Extension 16, the extent of the proposed development area, portion 222 (a portion of portion 221) of the farm Houtkop IQ 594 IQ is 151 0900m² m² on which land use is known to be agriculture according to the Emfuleni Spatial Development Framework 2017-2025, Compiled on Behalf of the Emfuleni Local Municipality by Urban Dynamics Gauteng, dated September 2017 and Vereeniging planning Scheme,1992. The site is currently vacant, with graves and an old quarry.

3 SITE CONDITIONS

3.1 Topography and Vegetation

Unitas Park Extension 16 site is predominantly flat. The lowest point on the site is recorded as being approximately 1470 meters above sea level, while the highest point is outside the site to the west and is recorded at 1481 meters above sea level. The gentleness of the terrain presents a positive attribute of the site as it reduces the likelihood of intensive earthworks during construction within the area. A detailed topographical survey of the area to be developed is not available at present.

Unitas Park Extension 16 is in Vereeniging. The Vereeniging area normally receives about 559mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (0mm) in July and the highest (108mm) in January. The average midday temperatures for Vereeniging range from 17°C in June to 27.6°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

3.2 Geological and Geotechnical Aspects

Geoid Geotechnical Engineers was appointed to conduct Geotechnical Site Investigations (GFSH2 Phase 1 Report) for Unitas Park Ext. 16.

This project site is characterised by four unique geotechnical zones. The bulk of the arable farmland is in Zone 1 and is comprised of a highly compressible /potentially highly collapsible transported profile.

Zone 2 includes the south-western sector of the site and is characterized by slightly compressible colluvial deposits. Zone 3 is incorporated in Zone 2 but due to shallow quarrying, much of the colluvial material has been removed resulting in a large depression resulting in drainage issues. Zone 4 is a low-lying area with poor drainage and has signs indicative of frequent shallow groundwater.

Based on an existing dolomitic stability report covering the project site, the stability of the site is described in two Dolomite Stability Zones.

Zone 1 carries a low inherent risk of sinkhole/ subsidence formation of all sizes with respect to the ingress of water and low inherent risk with respect to groundwater level drawdown.
Zone 2 carries a low inherent risk of sinkhole/ subsidence formation of all sizes with respect to the ingress of water and low inherent risk with respect to groundwater level drawdown. This project area is assigned a D3 Dolomite Area Designation.

Zone 1 will require internally reinforced high-quality engineered fill being imported from commercial sources. In this regard, crushed chert rubble or colluvial deposits - which are commonly available in **Zone2** - provides an excellent quality material source (typically meeting G5 standards) which can be compacted to high densities in excess of 95% Mod AASHTO.

Zone 2 is well suited to earthworks solutions, subject to the material being crushed to a size that can be adequately compacted using conventional techniques.

Zone 3 will require large-scale bulk earthworks using high-quality fill to elevate the site and deal with the civil engineering drainage challenges.

Zone 4 will require upper transported soils to be removed and replaced with high quality imported materials from commercial sources.

While this report draws on the dolomite stability classification provided by a prior feasibility-level investigation by others, a footprint-level investigation will need to be completed under a separate mandate to satisfy the minimum requirements of SANS 1936:2012, which will govern the unsupported spans required for the foundations of the proposed structures.

Further detailed information and recommendations can be found in the geotechnical investigation report located in **Annexure B.**

Also, information received from Geoscience, as per the Engeode data request ST2013-1180 drawing, confirms that the site is underlain by dolomite. See drawing ST2013-1180 Engeode data request in **Annexure B**.

3.3 Environmental Aspects

GCS Water and Environmental consultants were appointed to undertake the environmental assessment for the proposed Unitas Park Extension 16 project and the Environmental Screening report was prepared.

The above-mentioned report was undertaken for environmental authorization processes required for the stands in order for compliance with the National Environmental Management Act (Act 107 of 1998, as amended). The report provides details of an Environmental Screening exercise undertaken in order to confirm the required authorization process and to identify risks associated with the process.

The information below was extracted from the report under the heading Additional recommendations:

From the findings of this environmental screening process, it is evident that potential environmental and social impacts may be of moderate to high consequence. Therefore, the required processes, EIA and WULA, have been triggered. Several supporting assessments, processes, and reports are recommended and should be carried out in tandem with the licensing and authorisation processes.

- Environmental Management Plan (EMP) is compiled and implemented during the construction phase.

- An ecological and wetland assessment is carried out to confirm the sensitivity of the wetland and watercourse, to input recommendations to the EMP.

- An Environmental Control Officer (ECO) is employed by the client during the construction phase to audit the site on a regular basis and ensure compliance with the EMP.

- A Notice of Intent to Develop (NID) should be sent to the South African Heritage Resources Agency (SAHRA) to indicate the proposed development.

Further information and recommendations and conclusion can be found in the environmental screening report located in **Annexure H.**

3.4 Heritage Aspects

It should be noted that graves are present on site. The applicant would need to decide on whether the graves will be exhumed or remain on site. Should the graves remain on-site, a buffer would need to be applied to the gravesite and no development is to take place within it.

4 BULK WATER SUPPLY

4.1 Authority and Provider Arrangements

The proposed development area falls within the Emfuleni Local Municipality (Metsi-A-Lekoa) Water jurisdiction and the municipality serves as both the Water Service Authority as well as the Water Service Provider.

The content of this section is based on information obtained from Emfuleni Spatial Development Framework 2017-2025, Compiled on Behalf of the Emfuleni Local Municipality by Urban Dynamics Gauteng, dated September 2017 and Project 14/2006 Civil Engineering Services Master Planning Volume 1 Water Supply, Draft report compiled in April 2009 and updated in April 2013.

4.2 Bulk Services and Bulk Supply Services

The content on this section below is based on the information extracted from Emfuleni Spatial Development Framework 2017-2025 report under the Municipal Services section.
This section gives an insight on the conditions and status of the existing Bulk water infrastructure in Emfuleni, and the plans that Emfuleni Local Municipality has with regards to solving the problems they are currently facing with their old overworked bulk water infrastructure which does not have sufficient capacity to supply the current demand and also to accommodate future demand from future developments.

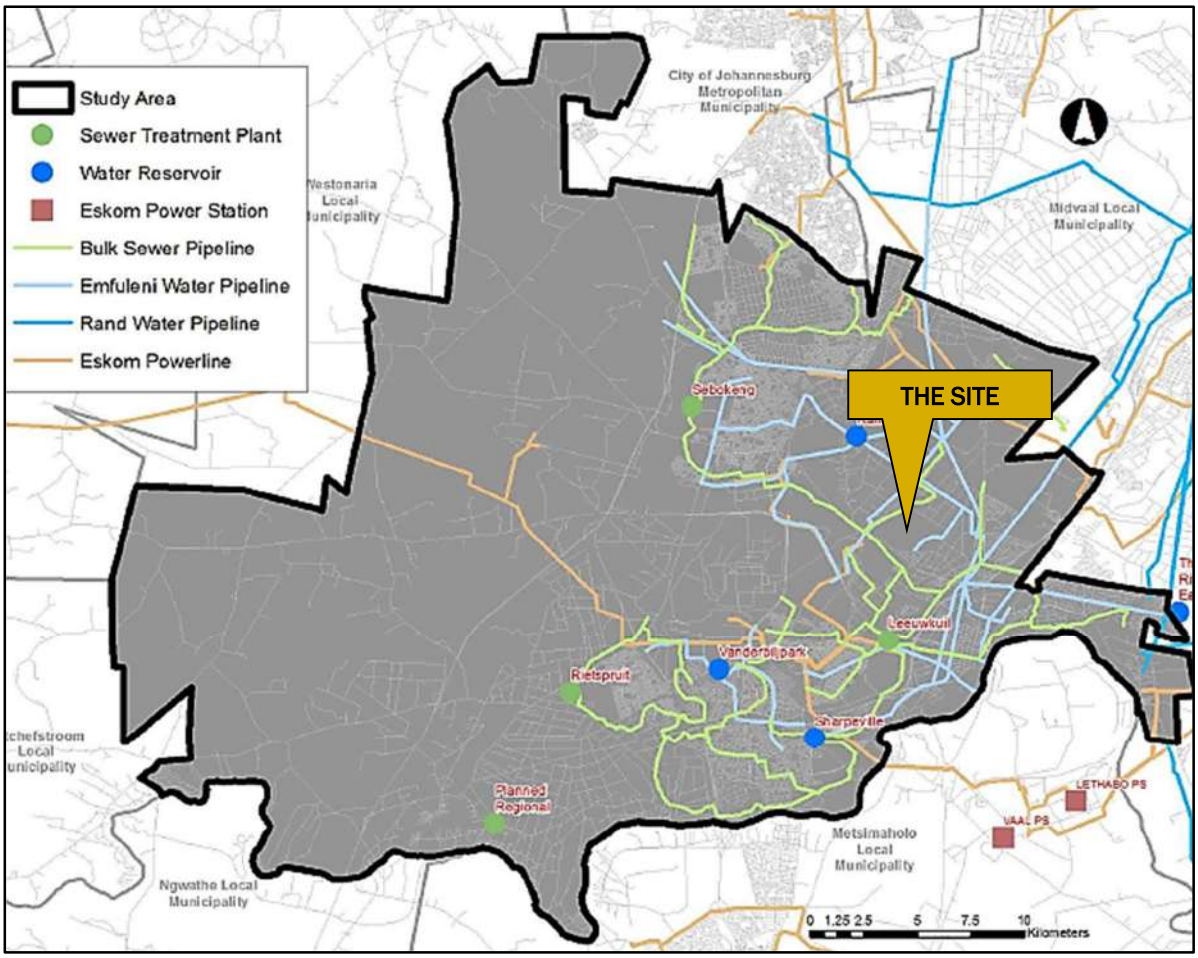

FIGURE 4. 1: BULK SERVICES

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

The water system consists of pipe networks, 9 reservoirs, and a small portable water treatment plant. Emfuleni borders the Vaal River and therefore extracts water from the river for consumption within Emfuleni. However, only a small amount of the required quantity is extracted from the Vaal River and purified at 0.2 Ml/day. Most potable water required by Emfuleni is supplied by Rand Water (205 Ml/day). The bulk water network is illustrated in **Figure 4.1**.

The bulk water network is old, and it is overworked due to the demand for potable water. Additional water connections have largely been provided to informal settlement households to cope with the growth of those settlements. In addition, water connections are continuously being provided to new housing development within Emfuleni.

Unitas Park is supplied from the Helenasrust Rand Water connection via Rand Water's Langerand reservoir. The pressures in the Rand Water pipes are limited (± 1550 m), the Rand Water connection is sufficient, but the network pipes must be augmented. No balancing and storage facilities are provided. A water line connects to Rand Water at Langerand and feeds a new reservoir north-west of Unitas Park extension. A 500ø distribution line runs from the new reservoir site to Tshepiso. Unitaspark township and densification areas can connect to the existing pipelines and no additional bulk water infrastructure was required in the short to medium term. Currently, there is no spare capacity at the Langerand but the introduction of a new supply zone with reservoir TWL 1570 m will remove all pressure on the system. The Langerand reservoir will provide storage for the 1570 m supply zone. A detailed GLS will be required to determine the impact the proposed development will have on the existing bulk infrastructure.

More information can be found in the GLS Water Master Plan report in **Annexure C**.

4.3 Design norms and standards

The design norms and standards that have been utilized for internal water reticulation for this report are the following:

- Emfuleni Local Municipality (Metsi-A-Lekoa) Design Criteria and Internal Services Standards
- "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book)
- Department of public works "Appropriate development of infrastructure on dolomite: guidelines for consultants (PW 371 & 344)
- The Standardized Specification for Civil Engineering Construction (SANS 1200), published by the South Africa Bureau of Standards
- Development of Dolomite land (SANS 1936), published by SABS Standards Division.

The design parameters utilised to calculate the demand and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

TABLE 4.1 DESIGN PARAMETERS AND DESIGN STANDARDS FOR WATER SUPPLY

PARAMETER	DETAIL	SPECIFICATION
Pressure	Maximum (Static)	90m
	Minimum (at peak flow)	24m
AADD	High rise flats according to FSR	0.4 km per unit/100m2/day
Peak Factor	Entire Development	4.0
Flow Velocity	Supply mains (max)	1,5 - 2,5 m/s
	Supply mains (recommended)	1,0 m/s
	Network pipe maximum	1,2 m/s
	Network pipe recommended	0,6 m/s
	At fire flow	3,5 m/s *
Piping	Sizes Material	Min – 75mm dia ND HDPE, uPVC class 9 / 12 SABS 966 approved No solvent welding will be allowed
Connections	Residential connections	HDPE class 12 50mm single connections – small stands 100mm single connections – larger stand Connection installed & tested up to 1m outside erf boundary
Valves	Spacing	Maximum 600m AVK Waterworks type, Cast Iron, anticlockwise closing, opposite splay pegs, Aqua-loc mono box type – blue lid color
Hydrant Spacing	Maximum Spacing	120m apart

		Underground Byonette type opposite splay pegs, Aqua-loc mono box type – red lid color
Fire flow:	Flow per hydrant (High Risk) Minimum pressure: Maximum Spacing:	25 ℓ/s 15 m 120m apart
Cover to Pipes	Minimum Cover	1 000mm

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must, therefore, be confirmed through a preliminary and final design process.

4.4 Water Demands

The peak water demand (excluding fire flow) is calculated during the preliminary designs. The summarised AADD and peak flows calculated during the preliminary designs are summarised in table 4.2 and table 4.3 below.

TABLE 4.2: WATER DEMAND (ANNUAL AVERAGE DAILY DEMAND) OPTION 1

Zoning	No of Stands	No of Dwellings	Area (ha)	AADD per Unit (l/day)	Unit	Average Water Demand (l/day)	Average Water Demand (l/s)	Peak Factor	Peak Demand (l/s)
Residential low density	7	863		600	Res Dwelling	517800	5,99	4	23,97
Residential medium density	7	741		800	Res Dwelling	592800	6,86	4	27,44
Residential high density	4	438		800	Res Dwelling	350400	4,06	4	16,22
Residential /retail mixed use @ 20kl/hectare	4		7,7	20000	Res Dwelling/Retail	154000	1,78	4	7,13
Student Village @ 0,77 kl/100m²	1		13,9	770	Student Accommodation	1070300	12,39	4	49,55
Social @ 0,77 kl/100m²	5		2,6	770	Social	200200	2,32	4	9,27
Educational @ 1,5 kl/hectare	2		7,3	1500	Educational	10950	0,13	4	0,51
Public Open Space			12,8		POS			4	
Sports Facility @ 3kl/hectare	1		2,3	3000	Sports Facility	6900	0,08	4	0,32
TOTAL						**2903350**	**33,60**		**134,41**
PLUS UAW (20% OF TOTAL AADD)									3484,02 kl/day
TOTAL AVERAGE DEMAND (AADD)									2903,35 kl/day
PEAK DEMAND inc. 20% UAW (exc. Fire flow) PF = 4									161,29 l/s
FIRE FLOW PER HYDRANT (X4) - High risk									25 l/s

TABLE 4.3: WATER DEMAND (ANNUAL AVERAGE DAILY DEMAND) OPTION 2									
Zoning	**No of Stands**	**No of Dwellings**	**Area (ha)**	**AADD per Unit (l/day)**	**Unit**	**Average Water Demand (l/day)**	**Average Water Demand (l/s)**	**Peak Factor**	**Peak Demand (l/s)**
Residential low density	7	1727		600	Res Dwelling	1036200	11,99	4	47,97
Residential medium density	7	1111		800	Res Dwelling	888800	10,29	4	41,15
Residential high density	4	603		800	Res Dwelling	482400	5,58	4	22,33
Residential /retail mixed use @ 20kl/hectare	4		7,7	20000	Res Dwelling/Retail	154000	1,78	4	7,13
Student Village @ 0,77 kl/100m²	1		13,9	770	Student Accommodation	1070300	12,39	4	49,55
Social @ 0,77 kl/100m²	5		2,6	770	Social	200200	2,32	4	9,27
Educational @ 1,5 kl/hectare	2		7,3	1500	Educational	10950	0,13	4	0,51
Public Open Space			12,8		POS			4	
Sports Facility @ 3kl/hectare	1		2,3	3000	Sports Facility	6900	0,08	4	0,32
TOTAL						**3849750**	**44,56**		**178,23**
PLUS UAW (20% OF TOTAL AADD)									4619,7 kl/day
TOTAL AVERAGE DEMAND (AADD)									3849,75 kl/day
PEAK DEMAND inc. 20% UAW (exc. Fire flow) PF = 4									213,88 l/s
FIRE FLOW PER HYDRANT (X4) - High risk									25 l/s

Total Instantaneous Peak Demand = Average Daily Demand X Instantaneous Peak = **134.41 l/s** for option 1 **or 178.23 l/s** for option 2.

Instantaneous Peak Factor = 4 (Reference 1 & 2)

Limited calculations to determine the demand for the various services were prepared to obtain an indication of the size of the services. The actual sizes of the services will have to be determined through a final design process after the relevant details (final site layout plan, number of units, size and coverage of the various land uses, etc.) have been finalised.

4.5 Existing Water Pipe Networks

Information received from the Emfuleni Local Municipality (Metsi-A-Lekwa) and GLS master planning and the topographical survey for this site indicates that there are no existing water Services within the proposed site but there are existing water services in the neighbouring areas Sonland Park located on the northern direction and in Unitas Park AH located on the southern direction of the proposed development. As attached in **Annexure C** Emfuleni Master Plan Layout Water Layout-South-Base Pipes-drawing number **S12-012-315** shows that there is various existing water infrastructure in Sonland Park situated to the north of the site and in Unitas Park AH situated to the southwest of the proposed site. The Master plan layout shows that the existing water system pipe diameters vary from 75mm diameter to 160mm diameter. However, the proposed layout plan/site development plan (SDP) is currently being prepared in order to establish the suitability and capacity of the services for the connection point.

Additional Studies such as the GLS masterplan will be required to determine the capacity analysis of the existing pipes once an SDP has been completed and approved.

4.6 Capacity analysis of Network pipes

The topographical survey done shows that there are no signs of existing water pipes within the proposed site. According to Emfuleni Local Muni, there are no records of any internal water network for the proposed development since is currently vacant land being used for crop plantation. It is therefore recommended that a GLS Masterplan report be requested to analyse the effect the proposed development proposed water system will impose on the existing water network pipes and determine the required upgrades.

4.7 Proposed Water Network

The current draft proposed layout for the proposed development will only provide the total length of water reticulation within road reserves since the SDP for the proposed development is not yet completed. The proposed internal water reticulation network is shown on **Annexure D**.

It must be noted that the total pipe length and the correct pipe sizes of the proposed water systems will, therefore, be confirmed through a preliminary and final design process when the proposed layout is completed and approved.

The Emfuleni Local Municipality and Red book design norms were considered in the design and placement for the reticulation network of the internal sewer layout.

The pipe sizes, material, and class will be **Type PE 100, PN 12,5**. The water mains will be installed 1.5m from the erf boundary forming a loop. Isolating valves will be placed at the reticulation nodes to provide effective isolation of loops.

The length of internal water pipelines as per the current proposed draft layout showing pipelines that will be installed inside road reserves for this development is approximately 9.9km. The proposed designs were done according to the yield provided from the draft proposed layout.

4.8 Pipe materials

A Criterion for the selection of pipeline material was based on geotechnical constraints. The National Department of Public Works' PW344 and 371 design manual "Appropriate development of infrastructure on dolomite: Guidelines for consultants" were used for the selection of pipeline material.

- The piping used in bulk supply, ring mains, and secondary reticulation should be flexible. Joints should be minimal in number and of the flexible, self-anchoring type, i.e. not reliant on thrust blocks or friction for their anchorage.
- Subsurface pipe materials should be one or more of the following:

TABLE 4.3: PIPE MATERIALS SPECIFICATIONS	
MATERIAL	**REQUIREMENTS**
Pipe Material	Pipes of 75 mm and larger diameter: HDPE: Type PE 100, PN 12,5 (or higher-pressure class if required) to SANS 4427.
Joint, fitting and welding Requirements	Butt-welded joints (SANS 10268-Part 2) in general. Electro-fusion welding (SANS 10268-Part 2) must be approved by Departmental Engineer, where butt welding is impossible. Fittings: Manufactured from HDPE: Type PE 100, PN 12,5 (or higher) to SANS 4427. Moulded not machined fittings are preferred. No manufactured extrusion welded fittings Welding: All welding to relevant SANS 10268, SANS 10269, SANS 10270, SANS 1655, and SANS 1671 codes.
Supply lengths	Supply pipe in 12 m (minimum) lengths.
Alternative pipe material	Alternative: High impact PVC pipes: modified poly (vinyl chloride) (PVC-M) pipes that comply with the requirements of SANS 966-2 or SANS 1283 with a pressure of not less than 12, **only if approved by the departmental engineer.** Supply length: 6m or 9m Joints: Pressed on Spheroidal Graphite Cast Iron (SG) iron or stainless-steel Victaulic shoulders. Alternatively, pipes with spigot and socket end provided with an additional metal locking ring (stainless-steel).

- Piping from the main reticulation to the building is unjointed HDPE: Type PE 100, PN 16 (or higher class if required) pipes to SANS 4427.
- Underground valves are to be placed in watertight concrete or HDPE manholes. HDPE manholes are to be manufactured to the same standard as sewer manholes Concrete manholes for the valve are to be designed as water retaining structures.
- No high-pressure compression connections are to be allowed below ground level. All such connections are to be placed in watertight manholes.
- Shut-off valves and water meters shall be supplied at the main supply with a permanently fixed pressure gauge on the building side of the main shut-off valve (for regular systems testing).
- All site services to be tested to zero percent leakage.

4.9 Standard Details

SANS 1200 (together with other applicable details) details will be used to prepare project-specific details and be submitted to Emfuleni Local Municipality (Metsi-A-Lekoa) for their approval.
The provision of SANS 1936 is also applicable to this project.

4.10 Proposed link upgrades

Land use was changed from “agricultural” to “residential” therefore upgrading of link infrastructure will be required for this project.

5 BULK SANITATION

5.1 Authority and Provider Arrangements

The proposed development area falls within the Emfuleni Local Municipality (Metsi-A-Lekoa) Water jurisdiction and the Municipality serves as both the Water Service Authority as well as the Water Service Provider.

The content of this section is based on information obtained from Emfuleni Spatial Development Framework 2017-2025 (ESDF), Compiled on Behalf of the Emfuleni Local Municipality by Urban Dynamics Gauteng, dated September 2017, Project SNM/2012 Civil Engineering Services Master Planning Volume 2 Sewage Disposal, first edition dated August 2013 and Southern Corridor Regional Implementation Plan.

5.2 Bulk Sewer Systems

The content on this section below is based on the information extracted from Emfuleni Spatial Development Framework 2017-2025 report under the Municipal Services section.

Flush toilets are the most common form of sanitation provision within Emfuleni. The only other significantly used sanitation system in use in Emfuleni is pit latrines, which is most probably used in the informal settlement of Emfuleni.

The sanitation system consists of gravity pipelines and, due to the flat terrain; it also consists of 49 sewage pump stations. The wastewater system consists of 3 wastewater treatment works. The Sebokeng wastewater treatment works, located in Sebokeng next to the Rietspruit, is the largest wastewater treatment works within Emfuleni. The Emfuleni Local Municipality sewage drain to four (4) wastewater treatment works, viz. Leeuwkuil WWTW`s, Rietspruit WWTW`s, Sebokeng WWTW`s, and the Midvaal WWTW`s. The Leeuwkuil WWTW`s drainage area has 34 sub-drainage areas, the Rietspruit WWTW`s has 3 sub-drainage areas, the Sebokeng WWTW`s has 6 sub-drainage areas and the Midvaal WWTW`s drainage area has 1 sub-drainage area inside the Emfuleni Local Municipality area, which either drain to a pump station or the water treatment works directly. Risiville, a portion of Duncanville and Lakeside Estates, which is located inside the Midvaal Municipal Area, Lenasia, Orange Farm, and Savanna City, located in the Johannesburg Municipal area, also drain to the Emfuleni sewer system.

The bulk sanitation network is old, and it is overworked due to the demand for sanitation services. The age of the networks varies between 60 -70 years across the Municipal area. The short-term sanitation infrastructure plans involve the rehabilitation of existing infrastructure, including sewer pump stations to minimize sewer spills. Existing sanitation infrastructure has reached the end of its lifespan and can only be kept operational with a high risk of sewer spills. New infrastructure needs to be constructed to prevent future sewer spills.

The Unitas Park Area has been identified as a high priority development area for housing, and the number of potential equivalent stands in this area is 8000 with an average daily dry weather flow of 6.4Mℓ/day. Bulk sewer lines have recently been installed, and the Quaggasfontein outfall sewer line runs from Quaggasfontein past Unitaspark extension up to the Leeuwkuil works.

This wastewater treatment facility has a capacity of 119 Ml/day. Significant parts of the sanitation system infrastructure, including the Rietspruit and Leeuwkuil wastewater treatment works, need to be upgraded and rehabilitated. A detailed GLS will be required to determine the impact the proposed development will have on the existing bulk infrastructure.

Further information can be found in the GLS existing Sewer Master Plan located in **Annexure E.**

5.3 Design norms and standards

The design norms and standards that have been utilized for this report are the:

- "Guidelines for Human Settlement, Planning and Design", published by the Building and Construction Technology Division of the CSIR (also known as the Red Book).
- Any relevant published SANS documents.
- Emfuleni Local Municipality (Metsi-A-Lekoa) Design Criteria and Internal Services Standards

The design parameters utilised to calculate the demand and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must, therefore, be confirmed through a preliminary and final design process.

Criteria:

A full waterborne sewerage system is proposed, with individual connections to all erven.

Elements:

- SABS approved piping with minimum size 160mm diameter.
- Concrete manholes with a spacing of not more than 80mm, installed at all direction changes and mains intersections
- 160mm dia. connection to all erven with a depth to ensure drainage of 100% of the stand.
- Erf connections end 1m inside the Erf
-

TABLE 5.1: DESIGN STANDARDS AND DESIGN PARAMETERS FOR SEWERAGE RETICULATION DESIGN		
PARAMETER	**ELEMENT**	**GUIDELINES**
Average dry weather Flow (ADWF)	High rise flats according to FSR	0.3/kl/erf/day
Minimum Pipe diameter	Gravity sewers	160 mm
Minimum Velocity at full flow	Gravity sewers	0,7 m/s at half full
Peak Factor	Entire Development	2.5 maximum
Minimum Slopes for Pipes Diameters		1:80 at head
	100 mm	1: 120
	150 mm	1: 200
	200 mm	1: 300
	225 mm	1: 350
	250 mm	1: 400
	300 mm	1: 500
Pipe Material	Underground	Any SABS approved piping
Location of Sewers	In road reserves Midblock	2,5 m from erf boundaries in a road reserve 1,3 m from erf boundaries or where possible
Manholes	Spacing Material	80 m maximum HDPE manhole /Pre-cast concrete rings

		Concrete pre-heavy-duty cast-in-situ, with step Irons and heavy-duty type concrete cover Piping inside manhole Clay/Fibre Concrete
Pipe Covers		1.0m generally 1.4 under streets
Manhole sizes		0m to 1.2m deep: 0.9m inside diameter chamber, no shaft; 1.21m to 3.5m deep: 1.25 inside dia. chamber, no shaft; deeper than 3,5m: 1,5m inside dia chamber, no shaft Erf connections 160mm dia minimum, SABS approved piping
Erf connections		160mm dia minimum, SABS approved piping
Erf connections slope		1.60 minimum
Erf connections depths		500mm minimum cover at buildings

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must, therefore, be confirmed through a preliminary and final design process.

5.4 Sewage Flows

The following are assumed:

1. Demand rates are according to the Guidelines for Human Settlement.
2. Emfuleni Local Municipality Metsi-A-Lekoa Design Criteria and Internal Services Standards

TABLE 5.2: SEWER OUTFLOW (ANNUAL AVERAGE DAILY DISCHARGE) OPTION 1

Zoning	No of Stands	No of Dwellings	Area (ha)	ADWF per Unit (l/day)	Unit	Average Sewage Outflow (l/day)	Average Sewage Outflow (ADWF)(l/s)	Peak Factor	PWWF (l/s)
Residential low density	7	863		600	Res Dwelling	517800	5,99	2,5	14,98
Residential medium density	7	741		800	Res Dwelling	592800	6,86	2,5	17,15
Residential high density	4	438		800	Res Dwelling	350400	4,06	2,5	10,14
Residential /retail mixed use @ 13kl/hectare	4		7,7	13000	Res Dwelling/Retail	100100	1,16	2,5	2,90
Student Village @ 0,77 kl/100m²	1		13,9	550	Student Accommodation	764500	8,85	2,5	22,12
Social @ 0,77 kl/100m²	5		2,6	550	Social	143000	1,66	2,5	4,14
Educational @ 1,5 kl/hectare	2		7,3	500	Educational	3650	0,04	2,5	0,11
Public Open Space	4		12,8		POS				
Sports Facility @ 3kl/hectare	1		2,3		Sports Facility				
TOTAL						**2472250**	**28,61**		**71,54**
						Total incl.15% Extraneous flow			**82,27**

TABLE 5.3: SEWER OUTFLOW (ANNUAL AVERAGE DAILY DISCHARGE) OPTION 2									
Zoning	**No of Stands**	**No of Dwellings**	**Area (ha)**	**ADWF per Unit (l/day)**	**Unit**	**Average Sewage Outflow (l/day)**	**Average Sewage Outflow (ADWF)(l/s)**	**Peak Factor**	**PWWF (l/s)**
Residential low density	7	1127		600	Res Dwelling	1036200	11,99	2,5	29,98
Residential medium density	7	1111		800	Res Dwelling	888800	10,29	2,5	25,72
Residential high density	4	603		800	Res Dwelling	482400	5,58	2,5	13,96
Residential /retail mixed use @ 13kl/hectare	4		7,7	13000	Res Dwelling/Retail	100100	1,16	2,5	2,90
Student Village @ 0,77 kl/100m²	1		13,9	550	Student Accommodation	764500	8,85	2,5	22,12
Social @ 0,77 kl/100m²	5		2,6	550	Social	143000	1,66	2,5	4,14
Educational @ 1,5 kl/hectare	2		7,3	500	Educational	3650	0,04	2,5	0,11
Public Open Space	4		12,8		POS				
Sports Facility @ 3kl/hectare	1		2,3		Sports Facility				
TOTAL						**3418650**	**39,57**		**98,92**
						Total incl.15% Extraneous flow			**113,76**

Sewer design flow is estimated at approximately 80% of the water consumption plus 15% Stormwater infiltration.

The total sanitation demand calculated for the proposed development is approximately **82.27** l/s for **option 1** and **113.76** l/s for **option 2**.

The chosen design standards used for the calculations above are:

Peak Flow Rate = Average Daily Flow Rate X Peak Factor

Peak Factor = 2.5 (Ref 2)

Limited calculations to determine the demand for the various services were prepared to obtain an indication of the size of the services. The actual sizes of the services will have to be determined through

a final design process after the relevant details (final site layout plan, number of units, size and coverage of the various land uses, etc.) have been finalised.

5.5 Existing Sewer Pipe Networks

Information received from Emfuleni Local Municipality (Metsi -A-Lekoa)/ GLS master planning and the topographical survey indicates that there are existing sewer services in the nearby suburbs to the north and the southwestern side of the proposed sit but there are no existing services within the proposed site. New sewer reticulation design within the erfs and in the road, reserves will be constructed for this proposed development. As attached in **Annexure E** Emfuleni Local Municipality Master Plan SMN 2012 drawing number SMN-2012-01-04.

The existing sewer masterplan drawings show that there are existing Sewer pipes with different pipe sizes in Sonland Park to the north and Unitas Park AH to the southern side of the proposed development. The proposed development layout plan/site development plan (SDP) is currently being prepared in order to establish the suitability and capacity of the services for the connection point.

Additional Studies such as the GLS masterplan will be required to determine the capacity analysis of the existing pipes once an SDP has been completed and approved.

5.6 Capacity analysis of Network pipes

The topographical survey done shows that there are no existing sewer systems within the proposed development. The new proposed sewer reticulation within the erfs and in road reserve will be constructed. It is therefore recommended that a GLS Masterplan report be requested to analyse the effect of the proposed development on the existing network pipes and determine the required upgrades.

5.7 Proposed Sewer Network

The current proposed draft layout will only provide the total length of sewer reticulation within road reserves since the SDP for the proposed development is not yet completed. The proposed internal sewer reticulation network is shown on **Annexure F**.

It must be noted that the total pipe length of the entire layout plan and correct pipe sizes of the Sewer services will, therefore, be confirmed through a preliminary and final design process when the proposed layout is completed and approved.

Emfuleni Local Municipality (Metsi-a-Lekoa) and Red book design norms were considered in the design and placement of the reticulation network of the internal sewer layout.

The length of internal Sewer pipelines as per the current proposed draft layout for pipelines that will be installed inside road reserves for this project approximately 9.8km. The proposed designs were done according to the yield provided from the draft proposed layout.

The pipes material will be Type PE 100 or higher, PN 10, SDR but the pipe sizes will be confirmed during preliminary and detailed design stages when the proposed layout is completed, and the manholes will be 1 000mm to 1500mm diameter HDPE manhole /Pre-cast concrete rings with concrete covers.

5.8 Pipe Materials

A criterion for the selection of pipeline material was based on geotechnical constraints. The National Department of Public Works' PW344 and 371 design manual "Appropriate development of infrastructure on dolomite: Guidelines for consultants" were used for the design of pipeline material.

- Sanitation systems shall not incorporate soakaways.
- Subsurface pipe materials should be as follows:

TABLE 5.4: PIPE MATERIALS SPECIFICATIONS	
MATERIAL	**REQUIREMENTS**
Application	Dolomite area designation (D1, D2, D3, and D4)
Pipe Material	HDPE: Type PE 100 or higher, PN 10, SDR to SANS 4427
Joint, fitting and welding Requirements	Butt-welded joints (SANS 10268-Part 1) in general. Electro-fusion welding (SANS 10268-Part 2) must be approved by Departmental Engineer, where butt welding is impossible. Fittings: Manufactured from HDPE: Type PE 100, PN 10 (or higher) to SANS 4427 Welding: All welding to relevant SANS 10268, SANS 10269, SANS 10270, SANS 1655, and SANS 1671 codes.
Supply lengths	Supply pipe in 12 m (minimum) lengths.
Alternative pipe material	**Only to be used beyond 15 m from structures**. PVC Pipe: SANS 791 Heavy-duty - Class 34 (solid wall). **Use of PVC to be approved by the departmental engineer.**
Manholes	The use of pre-manufactured HDPE manholes is advised. Alternatively use concrete manholes, designed as water retaining structures, **if approved by the departmental engineer**. HDPE manholes: All material for HDPE manholes to conform to HDPE: Type PE 100 or higher, SANS 4427 specifications and all welding to SANS 10268, SANS 10269, SABS SANS 1655 and SANS 1671. Manufacturing: HDPE structured wall pipes used as manhole shafts shall be manufactured according to SANS 21138 to SANS 674 in terms of profile, pipe, fittings, and pipe endings, but with stainless steel stiffness and 5mm minimum wall thickness. HDPE solid wall pipes used as manhole shafts shall be manufactured according to SANS 4427. Ring Stiffness: Ring Stiffness shall be tested according to ISO 9969 i. 8,0 kN/m^2 ring stiffness for all depth ii. 4,0 kN/m^2 ring stiffness for depth not exceeding 1.5m and approved by the department Joints to pipes: HDPE pipes to be extrusion welded to manhole. Benching: HDPE (PE 100 to SANS 4427) flat sheet and pipe of minimum 12mm thickness. Cover Slab: the installation of the cover slab must form an integral part of the structure by means of attaching it to the shoulder ring beam with an approved epoxy.

	Concrete manholes: Design as water retaining Structures **if departmental engineer approves use**. Inlet pipes to be provided with puddle flange or key joint (detail TYPE NO DT 12/W) to ensure watertight fixing into walls or construct the structure with flexible watertight inlets.

- All connections to manholes shall be flexible and watertight.
- All sewerage pipes and fittings must be watertight. All laid drainage and sanitary sewer pipes should be tested for leakage using the standard SANS water test on installation. Welded HDPE pipe systems to be pressure tested to relevant pipe pressure class and manufacturer's specification.
- All sewers and structures to be tested to zero percent leakage for water tests.
- Avoid using rodding and cleaning eyes and rather use small HDPE manholes (multi-directional collecting pots) that are pre-manufactured small size (300, 500- and 700-mm diameter) manholes with factory fitted HDPE benching. Piping from the manhole to surface level shall consist of HDPE pipes and long radius bends with electrofusion/butt welded connections. All HDPE material to be Type PE 100 as per SANS 4427 and all welding to conform to SANS 10268, SANS 10269, SANS method1269, SANS 0270, SANS 1655, and SANS 1671. Manhole shafts to be structured or solid wall HDPE pipes with 8,0 kN/m^2 ring stiffness or alternatively manufactured to the same standard.
- The planting of trees or general gardening within 5 meters of sewer lines should be avoided.

5.9 Standard Details

SANS 1200 (together with other applicable details) details will be used to prepare project-specific details and be submitted to Emfuleni Local Municipality (Metsi-A–Lekoa) for their approval.

The provision of SANS 1936 is also applicable to this project.

5.10 Proposed link Upgrades

Areas for future development have been identified in close collaboration with the Council and all role-players of the Master plan committee. Anticipated new development over the next 10 to 20 years has been identified.
Land use was changed from “agricultural” to “residential” therefore upgrading of link infrastructure will be required for this project.

6 ROADS

6.1 Authority and Provider Arrangements

The Emfuleni Local Municipality is responsible for the provision and maintenance of roads and stormwater infrastructure in its area of jurisdiction.

6.2 Traffic Impact Study

A traffic impact assessment (TIA) is underway. In the existing 2020 scenario, the future 2025 scenario on the existing geometry and the 2025 future scenario on the upgraded geometry will be analyzed.

The purpose of the Traffic Impact Assessment (TIA) report is to assess the traffic impact at the intersections surrounding the development, due to the additional traffic that the development will generate together with measures to mitigate the impact. See **Annexure J** for the TIA report.

6.3 Access

The existing and future proposed road networks in close proximity of the proposed development are summarized in Table 6.1 below and attached in **Annexure A** as Locality Map for Existing Major Road Networks.

TABLE 6.1: EXISTING ACCESS		
ROAD NAME	**CLASS**	**DESCRIPTION**
Existing Houtkop Road (R54)	4	Local Distributor (Main Road) to the West of the proposed Site.
Future K180 Route	3	A minor arterial road which will bound the site on its western side and will be located where existing Houtkop Road (R54) currently running.
Future K55 Route	3	A minor arterial road which will bound the site on its southern side.

Unitas Park Extension 16 development will gain access to west from the existing Houtkop Road (R54) which will also be the future K180 Route. Future K55 route will be located on the southern side forming the southern boundary to the development. These access routes will serve as the main access to the site. The collector streets from the proposed development will connect to future K-routes.

6.4 Design Standards

The design norms and standards that have been utilized for this report are the:

- Guidelines for Human Settlement Planning and Design, CSIR (Redbook) (Reference 1)
- Roads and Stormwater standard details, Emfuleni Local Municipality (Reference 2)
- Any relevant published SANS documents.

The design parameters that will be utilized for geometric design and pavement structures and requirements for civil services for this report are in accordance with the Guidelines for Human Settlement Planning and Design compiled by the Department of Housing and Construction Technology (2000) and other approved design specifications.

It must be noted that these standards have been utilised to obtain an indication of the size of the services only and they must, therefore, be confirmed through a preliminary and final design process.

TABLE 6.2: DESIGN PARAMETERS AND DESIGN STANDARDS FOR ROADS	
Class	4a, 4b, 5a, 5b and 5c
Road Width	7.5m, 7m, 6m, 5.5m, and 5m
Road Reserve	22m, 20m,16m,13m, and 12m
Pavement Layers	No layer within the pavement structure shall be less than 125mm
Cross fall/Camber	Single cross fall (3%)
Longitudinal Slope	Minimum:0.5%
Kerbing	Fig 3 barrier or type Fig 8b Mountable
Pedestrian Walkways	No pedestrian walkway shall be less than 1.2m when paved
Verges	Minimum verge width shall be 2.7m
Access to Erven	Minimum stacking distance at entrances is to be between 4.5m edge of road and gate

The classification of roads is shown in the table below:

TABLE 6.3: CLASSIFICATION OF ROAD		
CLASS NAME	**DESIGN TYPOLOGY**	**CLASS NO.**
Collector Street, commercial	Commercial Major Collector	4a
Collector Street, Residential	Residential Minor Collector	4b
Local Street, Commercial	Commercial access Street	5a
Local Street, Residential	Local Residential Street	5b
Walkway Non-Motorised Priority	Pedestrian only	6a and 6b

6.5 External Road and Intersection Upgrades Required

Unitas Park Ext. 16 is situated between Houtkop road (R54), R42 to the west and south side, Leeuwkuil Drive(M61) to the south direction, and R82 to the far south direction of the proposed development. The site is accessed from Houtkop road (R54) via Skippie Botha to the far north to Waterberg and Langraad road to the far east side of the site. See Locality Map for external roads in **Annexure A** and for possible intersection upgrades required, See **attached** Traffic Impact Assessment (TIA) report in **Annexure H.**

6.6 Internal Roads

There is no existing internal road network within the proposed development since the proposed site is vacant and currently serving as agriculture being used for crop plantation. New internal road networks will be constructed to service the development which will tie into the existing roads network in Sonland Park to the north of the proposed development. See **Annexure G** for the proposed Roads layout for the proposed development.

7 Public Transport & Non-motorised Transport (NMT)

Existing Public Transport and NMT Facilities

There is 1 formal taxi rank in Vereeniging which is 6.3km away from Unitas Park Extension 16. There are no Public transport lay-bys are located on Houtkop Road (R54). There are no formal pedestrian sidewalks located along the development boundary.

The information below was obtained from Emfuleni Spatial Development Framework 2017-2025.

Emfuleni is served by a rail network that connects Emfuleni to neighboring areas in Gauteng and the Free State. As depicted by **Figure 7.1**, this rail network consists of 3 lines. The first rail line stretches along with the P156 (R59) freeway and links Sasolburg to Vereeniging, Meyerton, and Germiston. This rail line is primarily a freight line but does contain commuter railway stations along the line. The second railway line stretches from Sasolburg, via Vereeniging towards Sebokeng, Orange Farm, and Johannesburg.

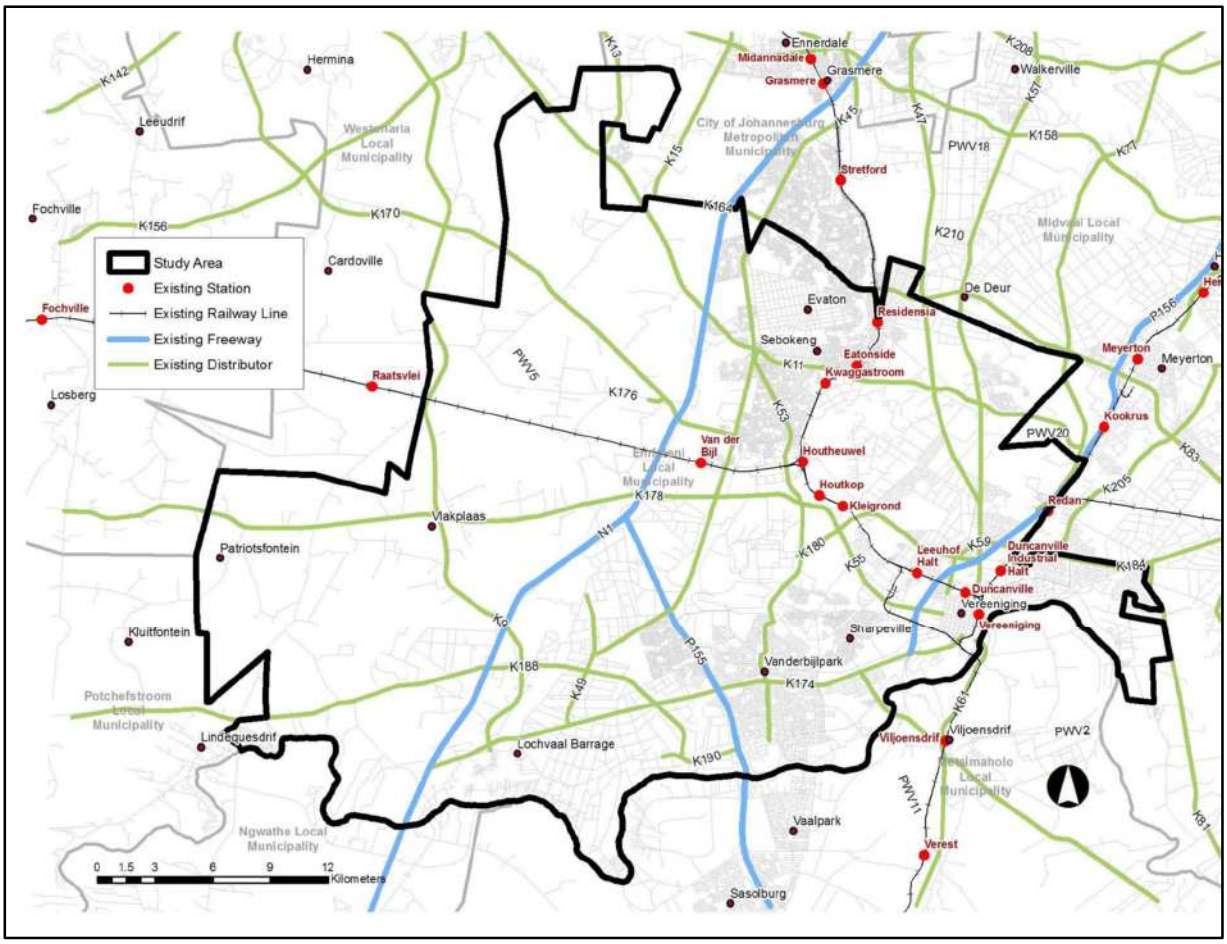

FIGURE 7.1: TRANSPORT NETWORK

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

METRORAIL

Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. This commuter rail network consists of 2 lines. The first rail line stretches from Vereeniging to Meyerton towards Germiston. This commuter railway line contains commuter railway stations, with prominent stations being the Vereeniging Station, the Duncanville Industrial Halt Station, and the Meyerton Station.

The use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. The second commuter railway line stretches from

Vereeniging towards Sebokeng, Orange Farm, and Johannesburg. Prominent stations along this line are Houtheuwel Station, Residentia Station, and Stredford Station. This railway line traverses densely built-up urban areas, as is found in Sebokeng and Orange Farm, and it, therefore, fulfills a significant commuter railway line function.

However, the full potential of this railway line to function as a commuter railway line is impeded by the following factors:

- Large undeveloped areas between Vereeniging and Sebokeng, with low residential densities to support commuter rail.
- The lack of urban development on both sides of the railway line, in particular in the Sebokeng and Evaton region.
- Gaps in the spacing of commuter railway stations, in particular on the stretches of the railway line between the Leeuhof Halt and Kleigrond Stations and between the Houtheuwel and Kwaggastroom Stations.

BUS NETWORK

Emfuleni comprises an extensive bus network that serves the municipal area. A prominent bus route is the bus route linking Vereeniging to Sebokeng along with the K53 (Moshoeshoe Road) and the K45 (Golden Highway). This bus route links Evaton and Sebokeng to the Vereeniging CBD and the industrial areas located within Vereeniging. Other bus routes worth mentioning are the bus route linking Vereeniging to Meyerton, the bus route linking Vereeniging to Residentia Station, and the Bus route linking Evaton to Meyerton. Linking the bus network to the commuter rail network will enable the bus network to act as a feeder system to the commuter rail network. This will give Emfuleni access to an integrated hierarchy of public transport modes servicing different parts of the municipal are and it will greatly improve the current public transport network serving Emfuleni.

MINI-BUS TAXI NETWORK

Emfuleni comprises an extensive minibus taxi network. This network largely uses the same routes and serves the same areas within the municipal area that the bus network does. The only significant exception is that a minibus taxi route links the Vanderbijlpark CBD to Sebokeng via Mittal Steel; a route that the bus network does not serve. A disadvantage of the minibus taxi network is that the routes of this network are not fixed and can, therefore, change in the future. Therefore, the minibus taxi route does not indicate fixed locations where Emfuleni can develop. Bus routes and in particular commuter railway lines provide a much better indication of where to densify Emfuleni.

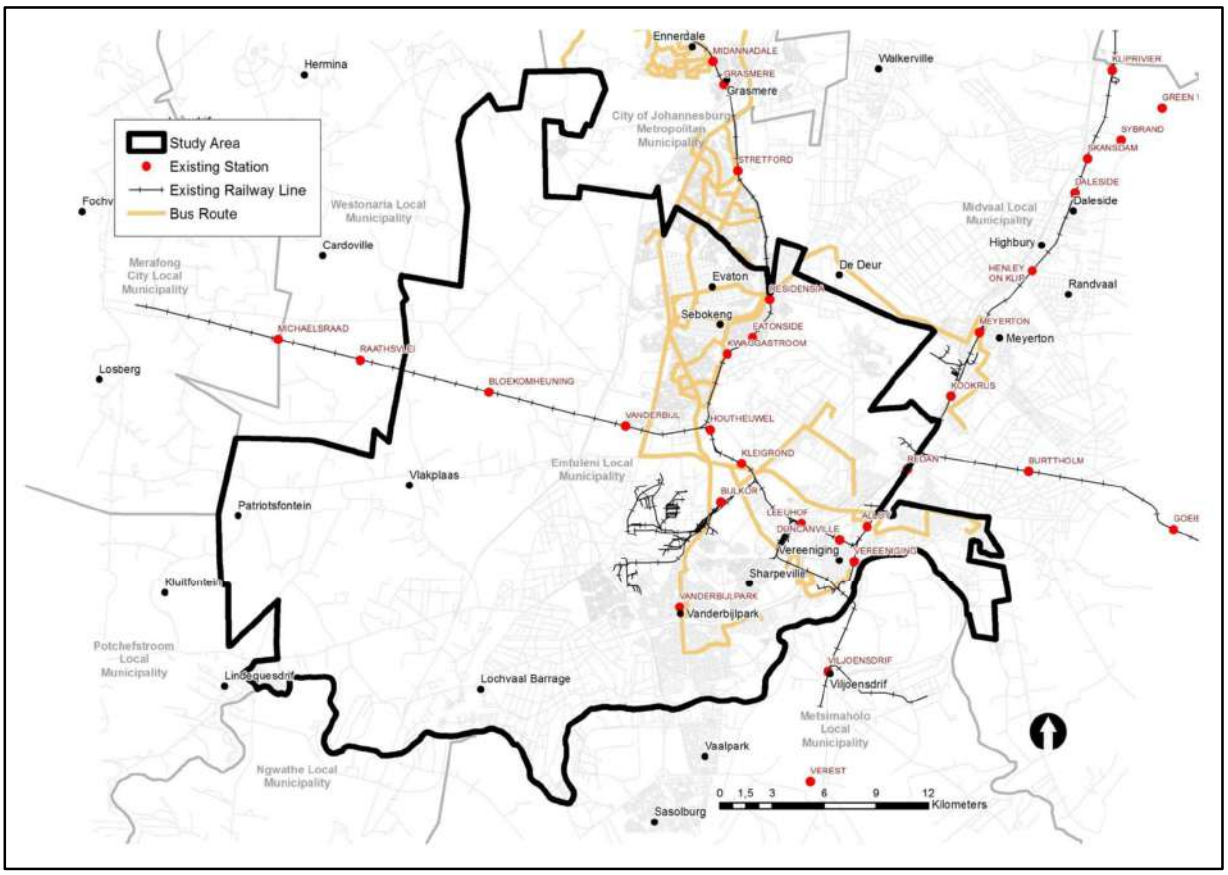

FIGURE 7.2: PUBLIC TRANSPORT

(EMFULENI SPATIAL DEVELOPMENT FRAMEWORK 2017-2025)

Public Transport Development

As was mentioned in the status quo section of this report, Emfuleni is served by a commuter rail network that connects Emfuleni to neighbouring areas in Gauteng. Prominent station along this line is Houtheuwel Station, Residentia Station, and Stredford Station. Currently, the use of this railway line as a commuter railway line is limited due to fragmented urban development and low residential densities along this railway line. Urban development along the Vereeniging-Sebokeng-Orange Farm commuter railway line will provide the necessary commuter thresholds needed to ensure the viable operation and expansion of this commuter railway line.

With regard to further developing the Vereeniging-Johannesburg commuter railway line, it is proposed the 2 new stations are developed along this line to better serve envisaged urban expansion areas within Emfuleni. The first proposed station is located at the proposed Sonlandpark Regional Node and will serve the Sonlandpark and Boipatong areas. The second proposed station is located north of Houtheuwel Station and will better serve the envisaged Lethabong extensions. The additional stations along this commuter rail line will provide opportunities for Transit-Oriented Development (TOD). This will involve focusing on new higher density, mixed-use development around these commuter rail stations. The layout of the land uses in relation to the stations is of critical importance, because it will determine the level of access that commuters will have to these stations. It should be noted that the station proposals above area Emfuleni SDF proposals and not PRASA proposals at this stage.

In addition to the above, a Strategic Public Transport Network (SPTN) is proposed by the Emfuleni SDF that will serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line. Two SPTN routes have been identified. The first route links Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway) and then turns eastward at Evaton towards Residentia Station. This SPTN route links Evaton and the Sebokeng CBD to the Vereeniging CBD. This route can be extended southwards across the Vaal River up to Sasolburg. The second SPTN route utilizes Barrage Road (K147) and links the Vanderbijlpark CBD, the Bedworthpark Regional Node, the proposed River City Node, the Vereeniging CBD, and the Three Rivers Node. This route can be extended northeastwards up to Meyerton.

A Strategic Public Transport Network (SPTN) is proposed by the Emfuleni SDF that will serve urban areas within Emfuleni that are not served by the Vereeniging-Johannesburg commuter railway line. Two SPTN routes have been identified. The first route links Vereeniging to Sebokeng along the K53 (Moshoeshoe Road) and the K45 (Golden Highway) and then turns eastward at Evaton towards Residentia Station. This SPTN route links Evaton and the Sebokeng CBD to the Vereeniging CBD. This route can be extended southwards across the Vaal River up to Sasolburg. The second SPTN route utilizes Barrage Road (K147) and links the Vanderbijlpark CBD, the Bedworthpark Regional Node, the proposed River City Node, the Vereeniging CBD, and the Three Rivers Node. This route can be extended northeastwards up to Meyerton.

Having a longer-term view of public transport network development will enable municipal planners to develop a land-use structure that can support the envisaged public transport network in the future. Municipal planners can promote the development of activity nodes at commuter railway stations and envisaged SPTN/BRT stations that would (a) apply higher land use densities, (b) a greater land-use mix and (c) a pedestrian-oriented structure.
These are all critical elements needed to support the viable operation of a public transport system and station.

Table 6.4: PROPOSED PUBLIC TRANSPORT ROUTES, STATIONS, AND LAND USE INTEGRATION			
SPTN ROUTE/ RAILWAY LINE	**NODAL AREA**	**STATION OR RANK OR STOP**	**INTEGRATION PRINCIPLES**
Vereeniging-Johannesburg commuter railway line	Vereeniging CBD	Existing Vereeniging commuter railway station A proposed bus station and minibus taxi rank at a commuter railway station	Design and locate mixed land use at a commuter railway station Design and construct pedestrian walkways to facilitate access to a commuter railway station
Vereeniging-Johannesburg commuter railway line	Sonlandpark Regional Node	Proposed Sonlandpark commuter railway station A proposed bus station and minibus taxi rank at a commuter railway station	Design and locate mixed land use at the proposed commuter railway station Design and construct pedestrian walkways to facilitate access to the proposed commuter railway station

(Source: Urban Dynamics Gauteng, 2017)

7.1 Existing Road and Intersection Upgrades Required

There are several existing Major and Minor roads located in close vicinity to the proposed site namely: R42, Houtkop Road (R54) to the western direction of the proposed site, R82 and Leeuwkuil Drive (M61) located to the far southern direction of the proposed site, Langland Road, Jimmy Sinclair Street to the far eastern direction of the proposed site and lastly Skippie Botha to the northern direction of the site. Information regarding possible Intersection upgrades will be detailed in the Traffic Impact Assessment (TIA) report Attached in **Annexure J** of this report.

8 BULK EARTHWORKS

Geoid Geotechnical Engineers was appointed to conduct Geotechnical Site Investigations (GFSH2 Phase 1 Report) for Unitas Park Ext. 16.

The information below is the findings and recommendations from the Geotechnical Site Investigations (GFSH2 Phase 1 Report) conducted and the existing dolomitic stability report available.

Based on an existing dolomitic stability report covering the project site, the stability of the site is described in two Dolomite Stability Zones.
Zone 1 carries a low inherent risk of sinkhole/ subsidence formation of all sizes with respect to the ingress of water and low inherent risk with respect to groundwater level drawdown.
Zone 2 carries a low inherent risk of sinkhole/ subsidence formation of all sizes with respect to the ingress of water and low inherent risk with respect to groundwater level drawdown. This project area is assigned a D3 Dolomite Area Designation.

Zone 1 will require internally reinforced high-quality engineered fill being imported from commercial sources. In this regard, crushed chert rubble or colluvial deposits - which are commonly available in **Zone2** - provides an excellent quality material source (typically meeting G5 standards) which can be compacted to high densities in excess of 95% Mod AASHTO.
Zone 2 is well suited to earthworks solutions, subject to the material being crushed to a size that can be adequately compacted using conventional techniques.
Zone 3 will require large-scale bulk earthworks using high-quality fill to elevate the site and deal with the civil engineering drainage challenges.
Zone 4 will require upper transported soils to be removed and replaced with high quality imported materials from commercial sources.

While this report draws on the dolomite stability classification provided by a prior feasibility-level investigation by others, a footprint-level investigation will need to be completed under a separate mandate to satisfy the minimum requirements of SANS 1936:2012, which will govern the unsupported spans required for the foundations of the proposed structures.

Further detailed information and recommendations can be found in the geotechnical investigation report located in **Annexure B.**

9 STORMWATER MANAGEMENT

9.1 Authority and Provider Arrangements

The Emfuleni Local Municipality is responsible for the provision and maintenance of roads and stormwater infrastructure in its area of jurisdiction.

9.2 Design Norms and Standards

The design criteria will be derived from the following:

- The Guidelines for Human Settlement Planning and Design (Red Book) and
- SANRAL Drainage Manual 5th Edition.

The Rational Method will be used to calculate the stormwater runoff for this site. The stormwater will be drained along the road reserve, mainly in open, unlined V-drain channels, with underground piped systems only where surface drainage is not possible or deemed to be impractical.

Designs will be such that the 1:5-year minor storm and the 1:25 year major storm are accommodated in the canals and the road structure without overtopping.

TABLE 8.1: DESIGN PARAMETERS AND DESIGN STANDARDS FOR STORMWATER	
Major system design frequency	25 year
Minor system design frequency	5 year
Minimum Pipe size within road reserves	450mm diameter
Maximum manhole spacing	100m
Minimum pipe class for 450mm and 525mm diameter	100D
All other classes to be designed	
Maximum velocity to be not more than	5m/s in pipes
	3m/s in road
Slope to be not less than	1% in order to self-clean
No hidden junction box will be allowed	
Pipe Material	Concrete interlocking

9.3 Existing Stormwater Drainage Zones

There is no information available regarding existing stormwater infrastructure on existing areas adjacent to the planned developments. The available survey information available will assist tie in positions since the new proposed stormwater systems will connect to the existing stormwater system in the close vicinity to the site and discharge to the nearest natural watercourses. In order to tie into these existing systems, the positions, levels of these existing systems need to be confirmed during the preliminary stage in order to confirm functional designs.

9.4 Proposed Internal Stormwater

No existing stormwater exists within the proposed development areas. This will be designed in accordance with the design criteria as described in Section 8.2.

A conceptual stormwater management plan for the development will be required. Stormwater will be managed on the proposed site and outlet onto the roads. Stormwater run-off from the roads will be collected using an underground pipe system and be conveyed to the nearest outlets or watercourse.

A new stormwater pipe system will be constructed within the proposed site connecting to the existing stormwater infrastructure nearby and natural watercourses nearby the proposed Unitas Park Extension 16 development.

According to the stormwater drainage policy issued by JRA, all developments on land exceeding 8 500m² are subject to stormwater attenuation on site.
The preferred means of attenuation are on the surface. Attenuation off-site, to compensate for the lack of an on-site facility is acceptable.
The runoff associated with the development is to be attenuated such that the predevelopment flows for the 1: 5, as well as the 1:25 – year storm events, are not exceeded. The attenuation structure must be able to withstand the 1:50 - year storm event.
Discharge from the attenuation facility is subject to approval by the landowner downstream.

The minor stormwater system consists of a few sub-catchments. Stormwater is discharged from the development to the attenuation pond and existing stormwater system by means of stormwater pipes. The pipe sizes will vary from 450mm diameter to 600mm.
The total pipe length is approximately 0.7 km. The attenuation pond outflow pipes will be designed for a 5-year recurrence interval and a 25-year recurrence interval restricted to the predevelopment runoff. The downstream outflow allows the 50-year spillway discharge.

Stormwater pipes capacities must be able to cater to minor storms of 1 in 5 year whilst both roads and stormwater pipes should cater to major storms 1 in 25 year. The stormwater master plan must provide for a level of attenuation and pollution control should stormwater outlet to the natural watercourse.

See **Annexure I** for the proposed Stormwater catchment Layout and proposed stormwater reticulation layout.

10 PROJECT ESTIMATES AND BUDGET

The estimated total construction cost for this project is **R 137 743 011.43 for option 1** and **R 215 248 281.52** which is inclusive of 12.5% contingencies and exclusive of VAT.

The payment of the Works would be re-measurable and would be done on a monthly basis during construction. A detailed bill of quantities would be included in the detailed design report. The table below indicates the preliminary cost estimates:

TABLE 9.1: SUMMARY OF PRICING SCHEDULE (OPTION 1)

SECTION	DESCRIPTION	AMOUNT
1	Water Network (Internal Reticulation)	R10 168 110,16
2	Sewer Network (Internal Reticulation)	R17 708 766,96
3	Roads	R57 889 393,60
4	Stormwater Network	R10 201 757,36
5	External and Site Works	R10 500 000,00
	Total Schedule of Prices	**R106 468 028,08**
	12,5% Contingencies	R13 308 503,51
	Subtotal	**R119 776 531,59**
	15% VAT	R17 966 479,74
	Estimated Order Magnitude	**R137 743 011,33**

TABLE 9.2: SUMMARY OF PRICING SCHEDULE (OPTION 2)		
SECTION	**DESCRIPTION**	**AMOUNT**
1	Water Network (Internal Reticulation)	R15 773 819,10
2	Sewer Network (Internal Reticulation)	R27 471 662,10
3	Roads	R89 803 986,00
4	Stormwater Network	R15 826 016,10
5	External and Site Works	R17 500 000,00
	Total Schedule of Prices	**R166 375 483,30**
	12,5% Contingencies	R20 796 935,41
	Subtotal	**R187 172 418,71**
	15% VAT	R28 075 862,81
	Estimated Order Magnitude	**R215 248 281,52**

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

- All internal water, sewer, roads, and stormwater will have to be designed in accordance with municipal guidelines and standards.
- The Langerand Reservoir will supply the newly proposed development. Currently, there is no spare capacity at the Langerand but the introduction of a new supply zone with reservoir TWL 1570 m will remove all pressure on the system.
- The Langerand reservoir will provide storage for the 1570 m supply zone.
- The Leeuwkuil wastewater treatment works, need to be upgraded and rehabilitated. The impact in which this new development will have on the existing infrastructure will have to be addressed on a detailed GLS report.
- Additional capacity analysis of the existing network pipes in Sonland Park and Unitas Park AH will be required with a GLS report to determine if and any upgrades that are required on the network pipes for both the water and sewer pipes.at the time of this report, the time and budget did not allow for this level of investigation.

- Additional services (Roads and stormwater, water, and Sewer) would need to be installed to accommodate the new proposed development layout.
- A traffic impact assessment is required to determine any additional capacity required on the roads.

11.2 Recommendations

Significant parts of the sanitation system infrastructure, including Leeuwkuil wastewater treatment works, need to be upgraded and rehabilitated. A new water supply zone with reservoir TWL 1570 will need to be introduced to increase the capacity of the Langerand Reservoir.

It is recommended that this report be approved to enable us to proceed to the next stage of Design Development.

ANNEXURE A

PROPOSED DRAFT LAYOUT AND LOCALITY PLAN

ANNEXURE B

GEOTECHNICAL INVESTIGATION REPORT AND ENGEODE DATA REQUEST

ANNEXURE C

GLS WATER MASTER PLAN LAYOUT

ANNEXURE D

PROPOSED WATER RETICULATION LAYOUT

ANNEXURE E

GLS SEWER MASTER PLAN LAYOUT

ANNEXURE F

PROPOSED SEWER RETICULATION LAYOUT

ANNEXURE G

PROPOSED ROADS LAYOUT

ANNEXURE H

ENVIRONMENTAL SCREENING REPORT

ANNEXURE I

PROPOSED STORMWATER RETICULATION LAYOUT

ANNEXURE J

TRAFFIC IMPACT ASSESSMENT (TIA) REPORT

PHUMAF CONSULTING ENGINEERS
P.O. BOX 4049, RANDBURG, 2125
VVM SENTRUM BUILDING
356 PRETORIA AVENUE
RANDBURG, 2194

APPENDIX C7

Heritage Impact Assessment

HERITAGE IMPACT ASSESSMENT

(REQUIRED UNDER SECTION 38 (8) OF THE NHRA (No. 25 OF 1999)

FOR THE PROPOSED UNITAS PARK EXT 16 TOWNSHIP DEVELOPMENT LOCATED IN UNITAS PARK, GAUTENG PROVINCE.

Client:

GCS Water and Environmental Consultants

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Report Author:
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2018
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Amendments on Document

Date	Report Reference Number	Description of Amendment

INDEMNITY AND CONDITIONS RELATING TO THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and HCAC reserves the right to modify aspects of the report including the recommendations if and when new information becomes available from ongoing research or further work in this field or pertaining to this investigation.

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- The technology described in any report; and
- Recommendations delivered to the client.

Should the applicant wish to utilise any part of, or the entire report, for a project other than the subject project, permission must be obtained from HCAC to do so. This will ensure validation of the suitability and relevance of this report on an alternative project.

REPORT OUTLINE

Appendix 6 of GNR 326 EIA Regulations (7 April 2017) as amended provides the requirements for specialist reports undertaken as part of the environmental authorisation process. In line with this, Table 1 provides an overview of Appendix 6 together with information on how these requirements have been met.

Table 1. Specialist Report Requirements.

Requirement from Appendix 6 of GNR 326 EIA Regulations (7 April 2017)	Chapter
(a) Details of - (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Section a Section 12
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	*Declaration of Independence*
(c) Indication of the scope of, and the purpose for which, the report was prepared	Section 1
(cA)an indication of the quality and age of base data used for the specialist report	Section 1, 3.4 and 7.1.
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	9
(d) Duration, Date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.4
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 8 and 9
(g) Identification of any areas to be avoided, including buffers	Section 9
(h) Map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 8
(I) Description of any assumptions made and any uncertainties or gaps in knowledge	Section 3.7
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity including identified alternatives on the environment or activities;	Section 9
(k) Mitigation measures for inclusion in the EMPr	Section 9 and 10
(l) Conditions for inclusion in the environmental authorisation	Section 9 and 10
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 9 and 10
(n) Reasoned opinion - (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 10.2
(o) Description of any consultation process that was undertaken during the course of preparing the specialist report	Section 6
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Refer to BA Report
(q) Any other information requested by the competent authority	Section 10

Executive Summary

HCAC was appointed to conduct a Heritage Impact Assessment of the proposed Unitas Park Ext 16 township development located between Sebokeng and Vereeniging in Gauteng Province. The aim of the assessment is to understand the heritage character of the study area as well as the impact of the proposed development on non-renewable heritage resources that might occur in the impact area. The study area was assessed both on desktop level and by a non-intrusive pedestrian field survey. The study area is approximately 149 hectares in extent and is mostly cultivated hampering access throughout the study area. The field survey was conducted as a non-intrusive pedestrian survey to cover the extent of the study area as the development lay out was not available at the time of the survey.

The field survey recorded scatters of Stone Age artefacts (Feature 1,2,4,5 and 6), a stone cairn of unknown purpose (Feature 3), and a party demolished homestead (Feature 7). An independent paleontological study (Bamford 2020) concluded that the proposed site lies on soils overlying deep deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation (Ecca Group, Karoo Supergroup) of middle Permian age. Such rocks can potentially preserve fossils of the *Glossopteris* flora however the potentially fossiliferous rocks are more than 50m below the surface so will not be impacted upon by an urban development but a Fossil Chance Find Protocol is recommended.

The impact of the proposed project on heritage resources is considered to be low and it is recommended that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- Feature 1, 2, 4, 5 and 6 must be monitored during construction to determine if *in-situ* subsurface layers are present.
- It is recommended that Feature 3 should be monitored during earthworks in the area.
- No mitigation is required for Feature 7, unless it is proven that the site is older than 60 years,

In addition to the site-specific recommendations outlined above the following applies:

- Confirmation of any grave sites in the study area as part of the social consultation process
- Graves should ideally be retained *in-situ* in open spaces
- Implementation of a chance find procedure (archaeological and paleontological) for the project as outlined in Section 10.1

.

Declaration of Independence

Specialist Name	Jaco van der Walt
Declaration of Independence	I declare, as a specialist appointed in terms of the National Environmental Management Act (Act No 108 of 1998) and the associated 2014 Environmental Impact Assessment (EIA) Regulations, that I: - I act as the independent specialist in this application; - I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant; - I declare that there are no circumstances that may compromise my objectivity in performing such work; - I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity; - I will comply with the Act, Regulations and all other applicable legislation; - I have no, and will not engage in, conflicting interests in the undertaking of the activity; - I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority; - All the particulars furnished by me in this form are true and correct; and - I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.
Signature	
Date	14/03/2020

a) Expertise of the specialist

Jaco van der Walt has been practising as a CRM archaeologist for 15 years. He obtained an MA degree in Archaeology from the University of the Witwatersrand focussing on the Iron Age in 2012 and is a PhD candidate at the University of Johannesburg focussing on Stone Age Archaeology with specific interest in the Middle Stone Age (MSA) and Later Stone Age (LSA). Jaco is an accredited member of ASAPA (#159) and have conducted more than 500 impact assessments in Limpopo, Mpumalanga, North West, Free State, Gauteng, KZN as well as he Northern and Eastern Cape Provinces in South Africa.

Jaco has worked on various international projects in Zimbabwe, Botswana, Mozambique, Lesotho, DRC Zambia and Tanzania. Through this he has a sound understanding of the IFC Performance Standard requirements, with specific reference to Performance Standard 8 – Cultural Heritage.

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ABBREVIATIONS

AIA: Archaeological Impact Assessment
ASAPA: Association of South African Professional Archaeologists
BA: Basic Assessment
BGG Burial Ground and Graves
BIA: Basic Impact Assessment
CFPs: Chance Find Procedures
CMP: Conservation Management Plan
CRR: Comments and Response Report
CRM: Cultural Resource Management
DEA: Department of Environmental Affairs
EA: Environmental Authorisation
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EIA Practitioner: Environmental Impact Assessment Practitioner
EMP: Environmental Management Programme
ESA: Early Stone Age
ESIA: Environmental and Social Impact Assessment
GIS Geographical Information System
GPS: Global Positioning System
GRP Grave Relocation Plan
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act
MSA: Middle Stone Age
NEMA National Environmental Management Act, 1998 (Act No. 107 of 1998)
NHRA National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID Notification of Intent to Develop
NoK Next-of-Kin
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)
Early Stone Age (~ 2.6 million to 250 000 years ago)
Middle Stone Age (~ 250 000 to 40-25 000 years ago)
Later Stone Age (~ 40-25 000, to recently, 100 years ago)
The Iron Age (~ AD 400 to 1840)
Historic (~ AD 1840 to 1950)
Historic building (over 60 years old)

1 Introduction and Terms of Reference:

Heritage Contracts and Archaeological Consulting CC (**HCAC)** has been contracted by GCS Water and Environmental Consultants to conduct a heritage impact assessment of the proposed Unitas Ext 16 township development located within Unitas Park, north of Vereeniging, Gauteng Province (Figure 1 – 3).

The aim of the study is to survey the proposed development footprint to identify cultural heritage sites, document, and assess their importance within local, provincial and national context. It serves to assess the impact of the proposed project on non-renewable heritage resources, and to submit appropriate recommendations with regard to the responsible cultural resources management measures that might be required to assist the developer in managing the discovered heritage resources in a responsible manner. It is also conducted to protect, preserve, and develop such resources within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999). The report outlines the approach and methodology utilized before and during the survey, which includes: Phase 1, review of relevant literature; Phase 2, the physical surveying of the area on foot and by vehicle; Phase 3, reporting the outcome of the study.

During the survey, Middle Stone Age artefact scatters, a stone cairn of unknown purpose and a dilapidated homestead were identified. General site conditions and features on sites were recorded by means of photographs, GPS locations, and site descriptions. Possible impacts were identified and mitigation measures are proposed in the following report. SAHRA as a decision-making authority under section 38(1) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) require all documents, complied in support of this application to be submitted to SAHRA.

1.1 Terms of Reference

Field study

Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development.

Reporting

Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

Table 2: Project Description

Size of property	149 hectares
Magisterial District	Emfuleni Municipality
1: 50 000 map sheet number	2627 DB
Central co-ordinate of the development	26°37'30.50"S 27°54'12.72"E

Table 3: Infrastructure and project activities

Type of development	Township Development
Project size	Approximately 149 hectares
Project Components	The Gauteng Rapid Land Release Programme aims to fast track the release of serviced stands from state-owned land to qualifying beneficiaries. Phumaf Holdings was appointed to assist the Department of Human Settlements with all pre-planning, planning work, design and construction management to enable the release of the identified stands

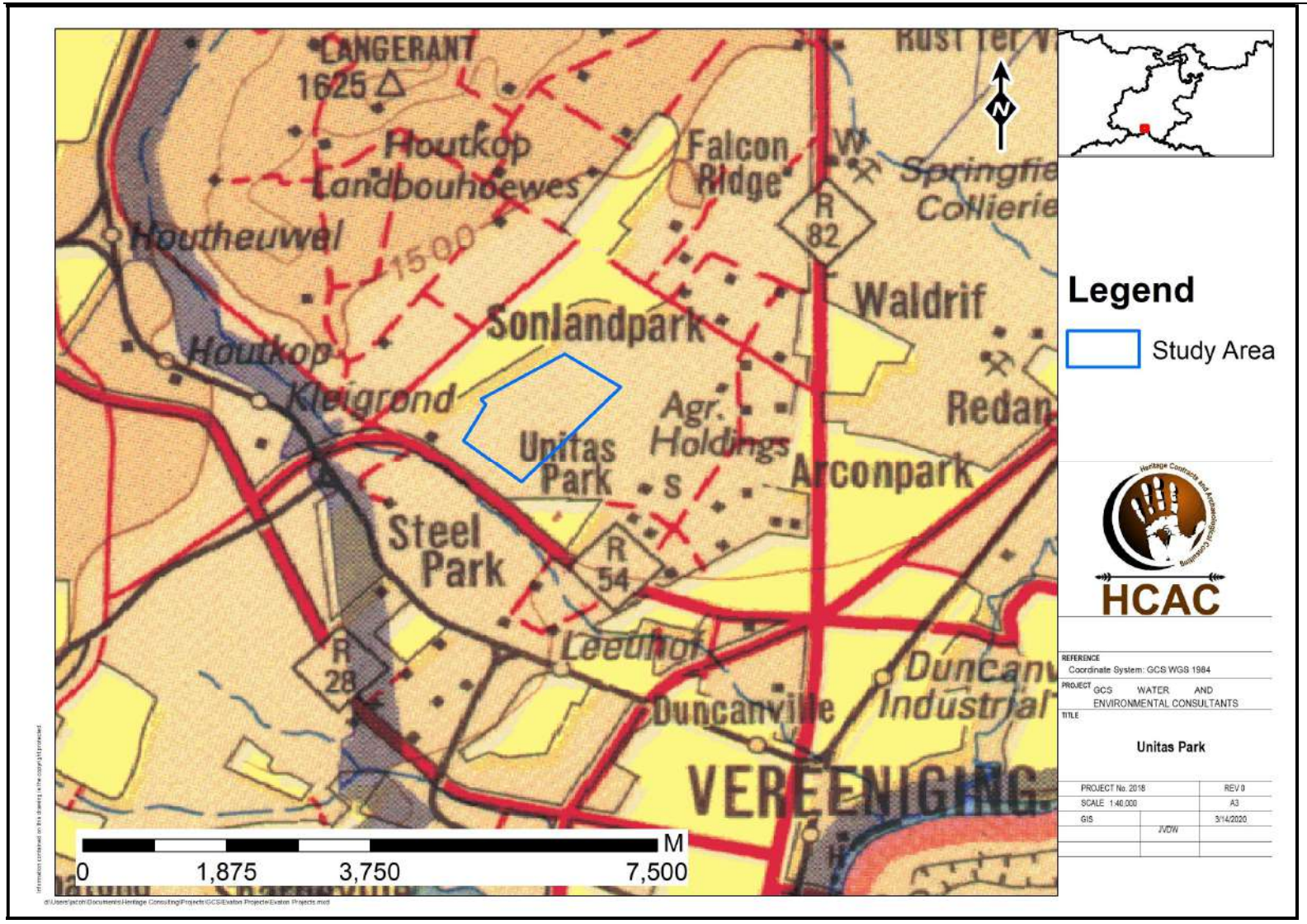

Figure 1. Regional setting (1: 250 000 topographical map).

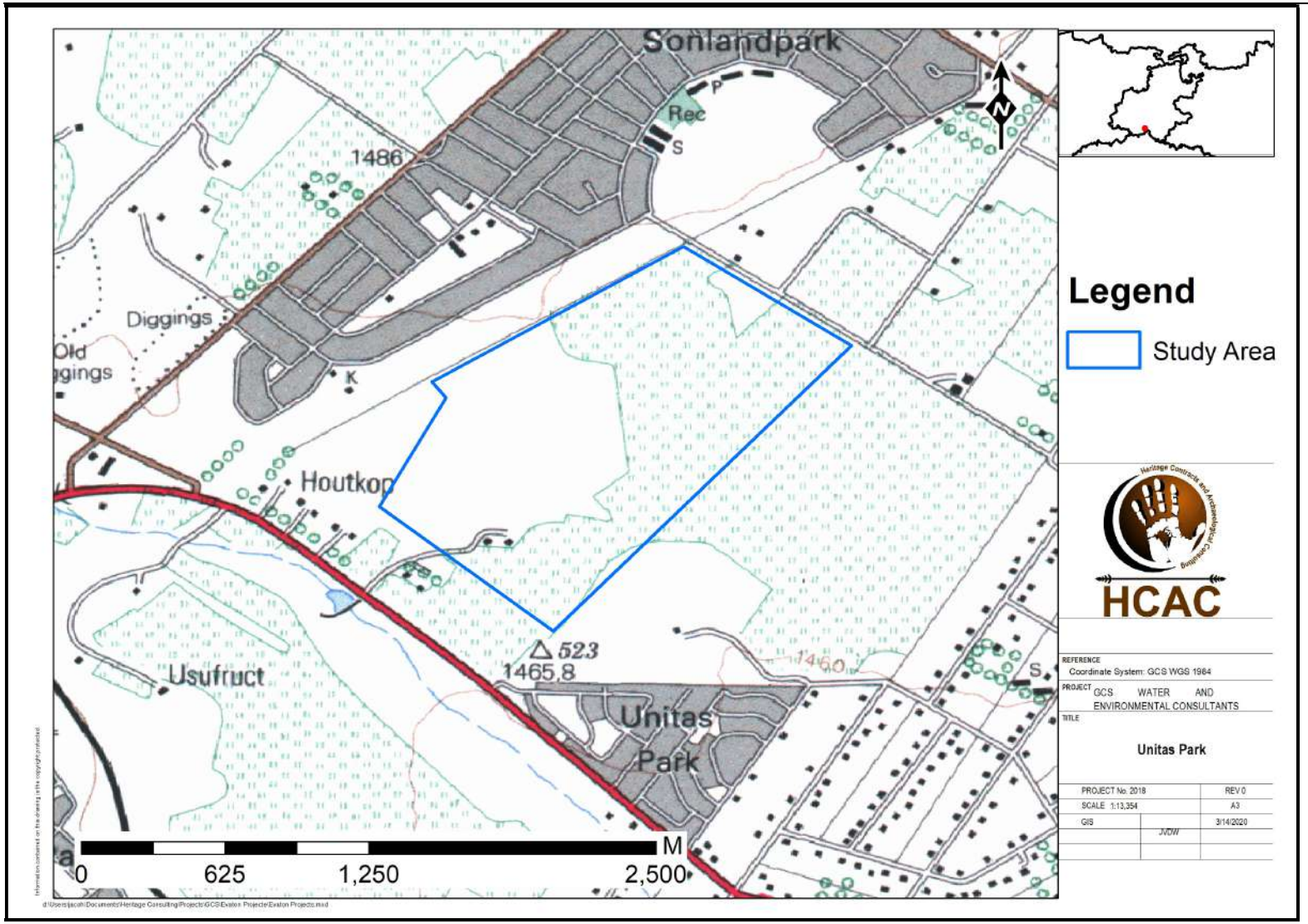

Figure 2: Local setting (1:50 000 topographical map).

Figure 3. Satellite image indicating the study area (Google Earth 2020).

2 Legislative Requirements

The HIA is required under the following legislation:

- National Heritage Resources Act (NHRA), Act No. 25 of 1999)
- National Environmental Management Act (NEMA), Act No. 107 of 1998 - Section 23(2)(b)
- Mineral and Petroleum Resources Development Act (MPRDA), Act No. 28 of 2002 - Section 39(3)(b)(iii)

A Phase 1 HIA is a pre-requisite for development in South Africa as prescribed by SAHRA and stipulated by legislation. The overall purpose of heritage specialist input is to:

- Identify any heritage resources, which may be affected;
- Assess the nature and degree of significance of such resources;
- Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;
- Assess the negative and positive impact of the development on these resources; and
- Make recommendations for the appropriate heritage management of these impacts.

The HIA should be submitted to the PHRA if established in the province or to SAHRA. SAHRA will ultimately be responsible for the professional evaluation of Phase 1 AIA reports upon which review comments will be issued. 'Best practice' requires Phase 1 AIA reports and additional development information, as per the impact assessment report and/or EMPr, to be submitted in duplicate to SAHRA after completion of the study. SAHRA accepts Phase 1 AIA reports authored by professional archaeologists, accredited with ASAPA or with a proven ability to do archaeological work.

Minimum accreditation requirements include an Honours degree in archaeology or related discipline and 3 years post-university CRM experience (field supervisor level). Minimum standards for reports, site documentation and descriptions are set by ASAPA in collaboration with SAHRA. ASAPA is based in South Africa, representing professional archaeology in the SADC region. ASAPA is primarily involved in the overseeing of ethical practice and standards regarding the archaeological profession. Membership is based on proposal and secondment by other professional members.

Phase 1 AIA's are primarily concerned with the location and identification of heritage sites situated within a proposed development area. Identified sites should be assessed according to their significance. Relevant conservation or Phase 2 mitigation recommendations should be made. Recommendations are subject to evaluation by SAHRA.

Conservation or Phase 2 mitigation recommendations, as approved by SAHRA, are to be used as guidelines in the developer's decision-making process.

Phase 2 archaeological projects are primarily based on salvage/mitigation excavations preceding development destruction or impact on a site. Phase 2 excavations can only be conducted with a permit, issued by SAHRA to the appointed archaeologist. Permit conditions are prescribed by SAHRA and includes (as minimum requirements) reporting back strategies to SAHRA and deposition of excavated material at an accredited repository.

In the event of a site conservation option being preferred by the developer, a site management plan, prepared by a professional archaeologist and approved by SAHRA, will suffice as minimum requirement.

After mitigation of a site, a destruction permit must be applied for with SAHRA by the applicant before development may proceed.

Human remains older than 60 years are protected by the National Heritage Resources Act, with reference to Section 36. Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act), as well as the Human Tissues Act (Act 65 of 1983), and are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36[5]) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in this age category, located inside a formal cemetery administrated by a local authority, require the same authorisation as set out for graves younger than 60 years, in addition to SAHRA authorisation. If the grave is not situated inside a formal cemetery, but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws, set by the cemetery authority, must be adhered to.

Human remains that are less than 60 years old are protected under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance No. 7 of 1925), as well as the Human Tissues Act (Act 65 of 1983), and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning; or in some cases, the MEC for Housing and Welfare. Authorisation for exhumation and reinternment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. To handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

3 METHODOLOGY

3.1 Literature Review

A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS).

3.2 Genealogical Society and Google Earth Monuments

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where sites of heritage significance might be located; these locations were marked and visited during the field work phase. The database of the Genealogical Society was consulted to collect data on any known graves in the area.

3.3 Stakeholder Engagement and Public consultation

Stakeholder engagement is a key component of any BAR process, it involves stakeholders interested in, or affected by the proposed development. Stakeholders are provided with an opportunity to raise issues of concern (for the purposes of this report only heritage related issues will be included). The aim of the public consultation process was to capture and address any issues raised by community members and other stakeholders during key stakeholder and public meetings. The process involved:

- Placement of advertisements and site notices
- Stakeholder notification (through the dissemination of information and meeting invitations);
- Stakeholder meetings undertaken with I&APs;
- Authority Consultation
- The compilation of a Basic Assessment Report (BAR).

Please refer to section 6 for more detail.

3.4 Site Investigation

Conduct a field study to: a) systematically survey the proposed project area to locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources recorded in the project area.

Table 4: Site Investigation Details

	Site Investigation
Date	27 February 2020
Season	Summer- Visibility on site was moderate with some areas having an overgrowth of tall grass that made ground visibility low. A large portion of the study area is situated within an existing maize field and therefore inaccessible. The area was sufficiently covered (Figure 4) to understand the heritage character of the study area.

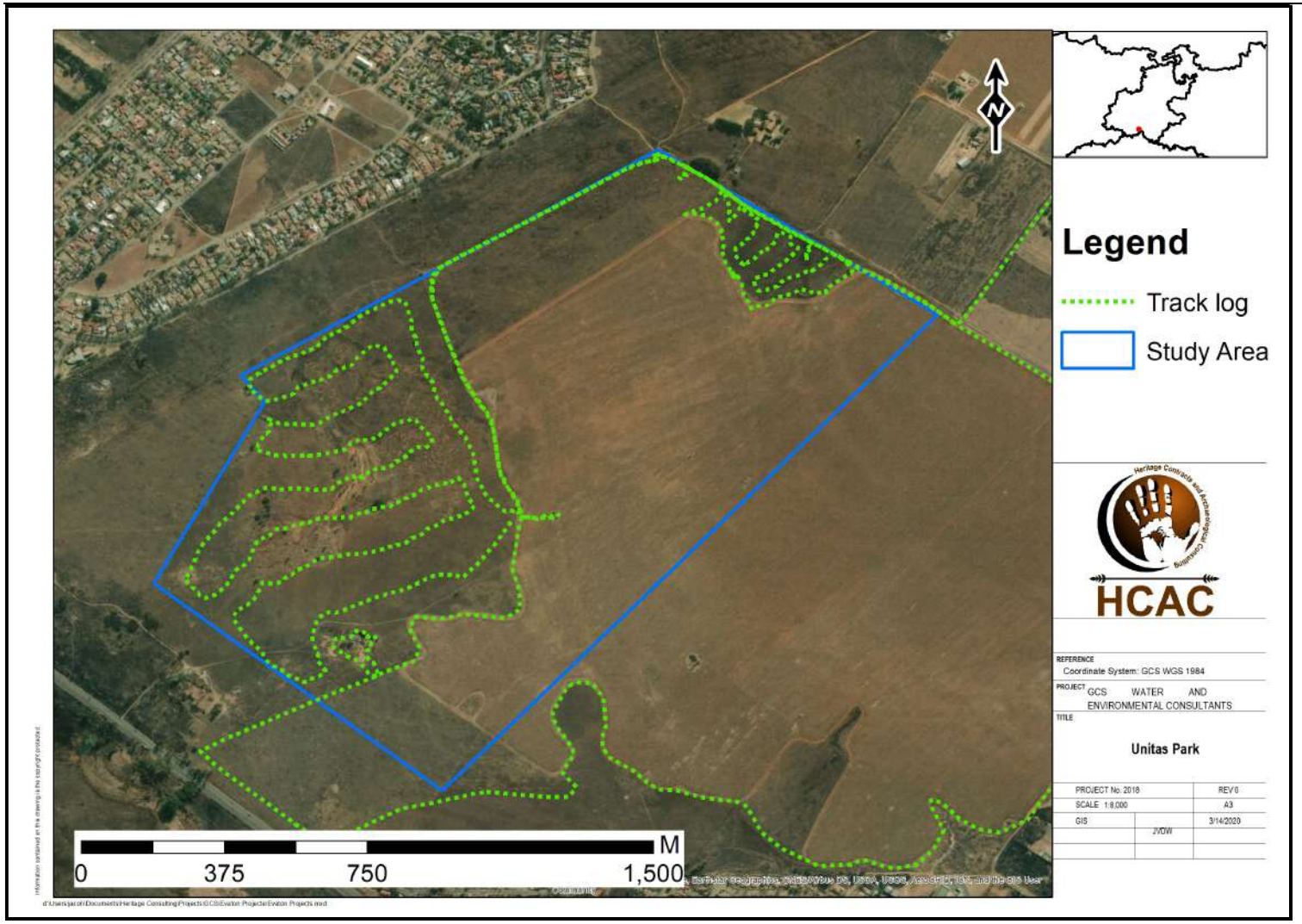

Figure 4: Track logs of the survey in green. Large parts of the study area are cultivated and therefore inaccessible – no track logs are available in these areas.

3.5 Site Significance and Field Rating

Section 3 of the NHRA distinguishes nine criteria for places and objects to qualify as 'part of the national estate' if they have cultural significance or other special value. These criteria are:

- Its importance in/to the community, or pattern of South Africa's history;
- Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
- Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
- Its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
- Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
- Sites of significance relating to the history of slavery in South Africa.

The presence and distribution of heritage resources define a 'heritage landscape'. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area, or a representative sample, depending on the nature of the project. In the case of the proposed project the local extent of its impact necessitates a representative sample and only the footprint of the areas demarcated for development were surveyed. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface. This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. The following criteria were used to establish site significance with cognisance of Section 3 of the NHRA:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposits;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined/is known);
- The preservation condition of the sites; and
- Potential to answer present research questions.

In addition to this criteria field ratings prescribed by SAHRA (2006), and acknowledged by ASAPA for the SADC region, were used for the purpose of this report. The recommendations for each site should be read in conjunction with section 10 of this report.

FIELD RATING	*GRADE*	*SIGNIFICANCE*	*RECOMMENDED MITIGATION*
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP. B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

3.6. Impact Assessment Methodology

The criteria below are used to establish the impact rating on sites:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0-1 years), assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years), assigned a score of 2;
  - medium-term (5-15 years), assigned a score of 3;
  - long term (> 15 years), assigned a score of 4; or
  - permanent, assigned a score of 5;
  - The **magnitude**, quantified on a scale from 0-10 where; 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
  - The **probability of occurrence**, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1-5 where; 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
  - The **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
  - the **status**, which will be described as either positive, negative or neutral.
  - the degree to which the impact can be reversed.
  - the degree to which the impact may cause irreplaceable loss of resources.
  - the *degree* to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:
S=(E+D+M) P
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- < 30 points: Low (i.e., where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- 60 points: High (i.e., where the impact must have an influence on the decision process to develop in the area).

3.7 Limitations and Constraints of the study

The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. The possibility exists that some features or artefacts may not have been discovered/recorded during the survey. Similarly, the possible occurrence of graves and other cultural material cannot be excluded. This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components would have been highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment. Large portions of the development are currently under cultivation and was mostly inaccessible.

4 Description of Socio-Economic Environment

Stats SÁ provides the following information: According to Census 2011, Emfuleni Local Municipality has a total population of 721 663, of which 85,4% are black African, 12% are white, 1,2% are coloured, and 1,0% are Indian/Asian. Of those 20 years and older, 3,6 % completed primary school, 36,7% have some secondary education, 32,4% completed matric, and 12,9% have some form of higher education. The percentage with no form of schooling is 4,0%. Of the population, 202 543 people are economically active (employed or unemployed but looking for work) and, of these, 34,7% are unemployed. Of the 85 594 economically active youth (15–35 years) in the area, 45% are unemployed.

5 Description of the Physical Environment:

Unitas Park Extension 16 is located within Unitas Park, to the north east of the R54. Sebokeng is located to the north west of the study area, with Vereeniging to the south. The R59 runs from Vereeniging to Meyerton in the north west of the site. The study area is mainly used for the growing of maize which makes a large portion of the site inaccessible. Two portions were accessed by using the gravel roads that provides access around the maize field (Figure 5 – 8). The first area is situated along the north-eastern border of the study area and is mostly surrounded by maize fields apart from the border along the road (Figure 9 and 10). A 2 to 3-meter-wide section of topsoil has been ploughed along the interface edge of the open field and the maize field. The second portion that was accessible is situated in the North-western section of the study area (Figure 11 and 12). This portion is characterised by a large open field that is also bordered by the maize field to the south. The northern extent of this portion has been extensively dug out as part of an old quarry (Figure 13 and 14). The extent of the digging works is visible on google earth imagery of the study area (Figure 3 and 15)

Vegetation in the area is described as Soweto Highveld Grassland (Mucina *et al* 2006). The site shows very little of the original prevailing vegetation types as it has been altered over an extended period of time. Land use surrounding the study area consist of township development cultivation activities. The study area is flat without any major topographical features like pans or ridges.

Figure 5. North Eastern border.

Figure 6. South Eastern border.

Figure 7. North Western Border.

Figure 8. South Western Border.

Figure 9. North Eastern portion of the study area.

Figure 10. North Eastern portion of the study area.

Figure 11. General site conditions – South Western portion of the study area.

Figure 12. General site conditions – South Western portion of the study area.

Figure 13. Quarry.

Figure 14. Quarry.

6 Results of Public Consultation and Stakeholder Engagement:

Adjacent landowners and the public at large were informed of the proposed activity as part of the BA process and no formal consultation was conducted by the heritage team. Site notices and advertisements notifying interested and affected parties were placed at strategic points and in local newspapers as part of the process conducted by GCS.

7. **Literature / Background Study:**

7.1. Literature Review

CRM assessments conducted in the general vicinity help to contextualise the study area. The following assessments conducted in the immediate vicinity that were consulted is listed below:

Author	Year	Project	Findings
Pistorius, J.C.C.	2007	A Phase I Heritage Impact Assessment Study for Water and Sewage Pipeline Corridors Near Vanderbijlpark In the Gauteng Province of South Africa	Graves, stone and historical structures.
Coetzee, F. P.	2008	Cultural Heritage Survey of the proposed urban development on Portions 156 & 203 of the Farm Houtkop 594 IQ, Emfuleni Local Municipality, Sedibeng District, Gauteng	Structures and cemeteries
Magoma, M.	2014	Phase 1 Archaeological Impact Assessment Specialist Study Report for The Proposed New Meteor Substation and Associated 88kv Powerlines in Sebokeng Township of Emfuleni Local Municipality Within Sedibeng District Municipality. Gauteng Province.	Graves, structures and places of worship.

7.1.1. Genealogical Society and Google Earth Monuments

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological and historical sites might be located. The database of the Genealogical Society of South Africa indicated no known grave sites within the study area.

7.2. Archaeology of the greater study area

The Stone Age

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age, the Middle Stone Age and the Earlier Stone Age. Each of these phases contain sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. The three main phases can be divided as follows;

∗ Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago

∗ Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.

∗ Earlier Stone Age (ESA); associated with early Homo groups such as Homo habilis and Homo erectus. 400 000-> 2 million years ago.

Several Stone Age sites are on record near Vereeniging and Meyerton, dating to the ESA and more specifically the Acheulean Industry (van Riet Lowe, 1937, 1952; van Riet Lowe & van der Elst, 1949; van der Elst 1950; Mason, 1962). This ESA sequence is collectively known as the 'Three Rivers Sites' or the 'Vereeniging Sites' (Kuman, 2007). With several locales (e.g., Klip River Quarry, Henley-on-Klip and Meyerton Townlands) located in the greater area. Most of the artefacts are made from dolerites and andesites as well quartzites at the Henley-on-Klip and Meyerton Townlands site.

The Henley-on-Klip site was identified in a road cutting, between Meyerton and Heidelberg (van Riet Lowe & van der Elst, 1949). The Meyerton Townlands site was exposed during pipeline trenching by the Rand Water Board who exposed gravels associated with the Klip River (le Roux and le Roux 1959). MSA and LSA assemblages are on record for the general area (van der Elst, 1950). Huffman (2008) identified an LSA site in the general area.

The Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the pre-Historic and Historic periods. It can be divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.
- The Middle Iron Age: 10th to 13th centuries AD
- The Late Iron Age: 14th century to colonial period.

Iron Age sites have been identified in an AIA produced by Huffman (2008) for the Mountain View development on Farm Nooitgedacht 176 IR, Gauteng. Stone walling and ceramic residues were identified at several localities near Perdeberg hill, located on Farm Nooitgedacht. Some ceramics were associated with the "Uitkomst facies" (AD 1800).

Extensive Stone walled sites are recorded at Klipriviers Berg Nature reserve belonging to the Late Iron Age period. A large body of research is available on this area. These sites (Taylor's Type N, Mason's Class 2 & 5) are now collectively referred to as Klipriviersberg (Huffman 2007). These settlements are complex in that aggregated settlements are common, the outer wall sometimes includes scallops to mark back courtyards, there are more small stock kraals, and straight walls separate households in the residential zone. These sites date to the 18th and 19th centuries and was built by people in the Fokeng cluster.

In this area the Klipriviersberg walling would have ended at about AD 1823, when Mzilikazi entered the area (Rasmussen 1978). This settlement type may have lasted longer in other areas because of the positive interaction between Fokeng and Mzilikazi.

Historical information

J. S. Bergh's historical atlas of the four northern provinces of South Africa is a very useful source for the writing of local and regional history. The Difaqane (Sotho), or Mfekane ("the crushing" in Nguni) was a time of bloody upheavals in Natal and on the Highveld, which occurred around the early 1820's until the late 1830's. (Bergh 1999: 10) It came about in response to heightened competition for land and trade, and caused population groups like gun-carrying Griquas and Shaka's Zulus to attack other tribes. (Bergh 1999: 14; 116-119) It seems that, in 1827, Mzilikazi's Ndebele started moving through the area where Johannesburg is located today. This group went on raids to various other areas in order to expand their area of influence. (Bergh 1999: 11)

During the time of the Difaqane, a northwards migration of white settlers from the Cape was also taking place. Some travellers, missionaries and adventurers had gone on expeditions to the northern areas in South Africa, some already as early as the 1720's.

It was however only by the late 1820's that a mass-movement of Dutch speaking people in the Cape Colony started advancing into the northern areas. This was due to feelings of mounting dissatisfaction caused by economical and other circumstances in the Cape. This movement later became known as the Great Trek. This migration resulted in a massive increase in the extent of that proportion of modern South Africa dominated by people of European descent. (Ross 2002: 39) By 1939 to 1940, farm boundaries were drawn up in an area that includes the present-day Johannesburg and Krugersdorp. (Bergh 1999: 15).

Anglo Boer War

The Anglo-Boer War, which took place between 1899 and 1902 in South Africa, was one of the most turbulent times in South Africa's history. Even before the outbreak of war in October 1899 British politicians, including Sir Alfred Milner and Mr. Chamberlain, had declared that should Britain's differences with the Z.A.R. result in violence, it would mean the end of republican independence. This decision was not immediately publicized, and subsequently republican leaders based their assessment of British intentions on the more moderate public utterances of British leaders. Consequently, in March 1900, they asked Lord Salisbury to agree to peace on the basis of the status quo ante bellum. Salisbury's reply was; however, a clear statement of British war aims. (Du Preez 1977)

An Anglo Boer War battle known as the Battle of Doornkop took place in the area on 29 May 1900. The British were advancing toward Johannesburg led by General John French. De La Rey and his men held the Klipriviersberg Ridge for the first two days but on the third day the Boers were outflanked by French's cavalry to the West, where General Sarel Oosthuizen's commando was forced to withdraw. This opened the road to Johannesburg and the British took the city peacefully on 30 May 1900 (Bikholtz 2013). Huffman (2008) recorded several sangers dating to the Boer war close to the study area on a ridge.

During the Anglo-Boer War the first blockhouses were built on the orders of the British Commander-in-Chief, Field Marshal Lord Roberts in 1900. The main aim of the blockhouses was to protect the railway lines, which were the main supply route for the British army. These blockhouses were two-storey stone buildings. The Witkop blockhouse is situated on the R59, near the Engen garage (traveling south from Johannesburg). It is one of only fifty remaining blockhouses in the country (http://www.sedibeng.gov.za/2010/2010_attractions.html) .

7.2.1. Cultural Landscape

Unitas Park Ext 16 is located within Unitas Park, to the north east of the R54. The R82 runs north-south approximately 2.3km to the east of the site. The N1 is about 11km to the north west of the site. Sebokeng lies to the north west of the site, with Vereeniging to the south. The R59 runs from Vereeniging to Meyerton in the north west of the site. The site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of a wetland or some surface water on the site, as well as to the south east of the site (Figure 15 and 16). The general area used to consist of commercial farms with their main focus on the production of crops and the raising of live-stock. Most of these farms were later sub-divided into small holdings and erven and are now densely built-up residential areas and do not have significant cultural landscape elements.

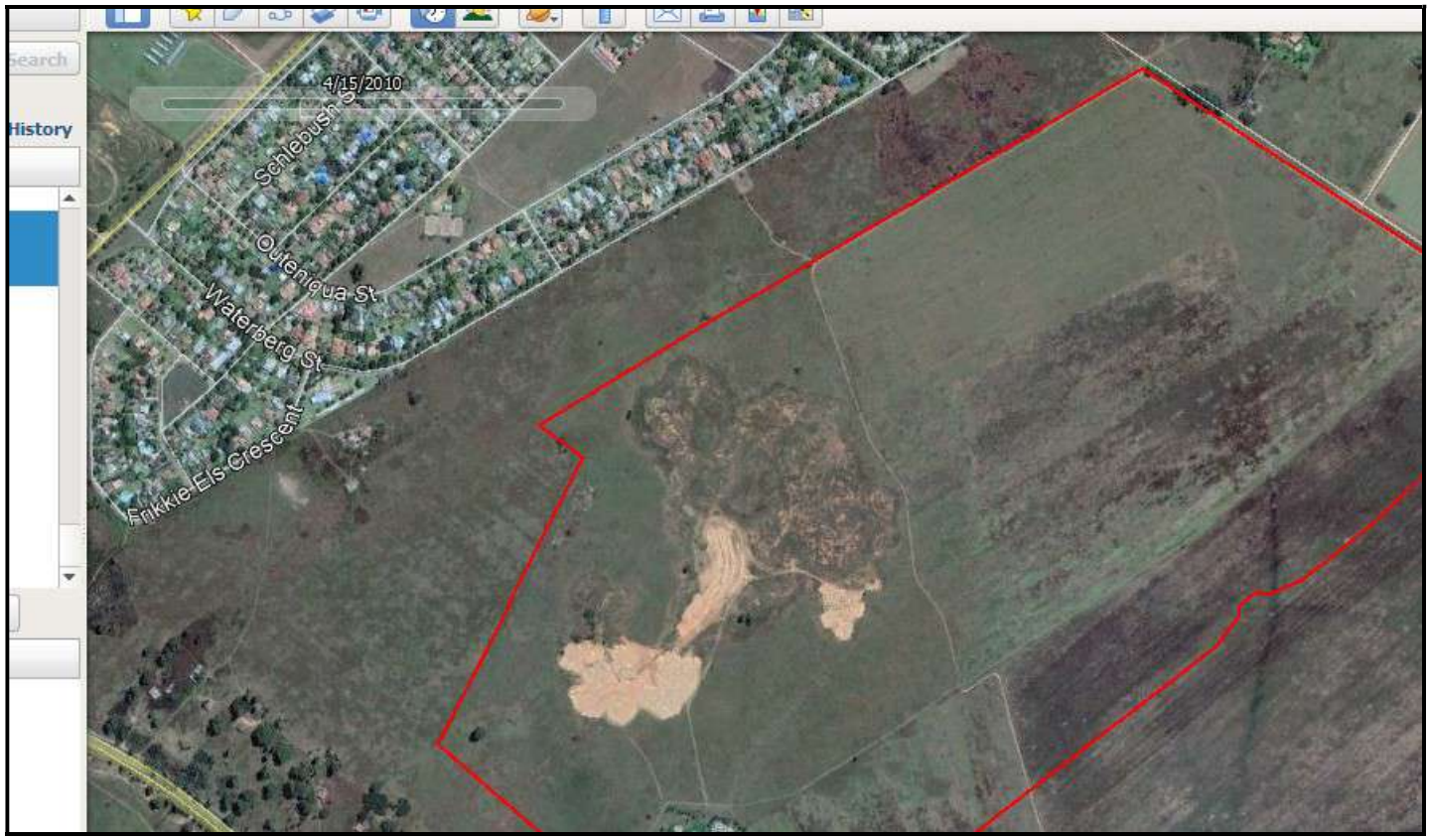

Figure 15. 2010 Google Image of the study area.

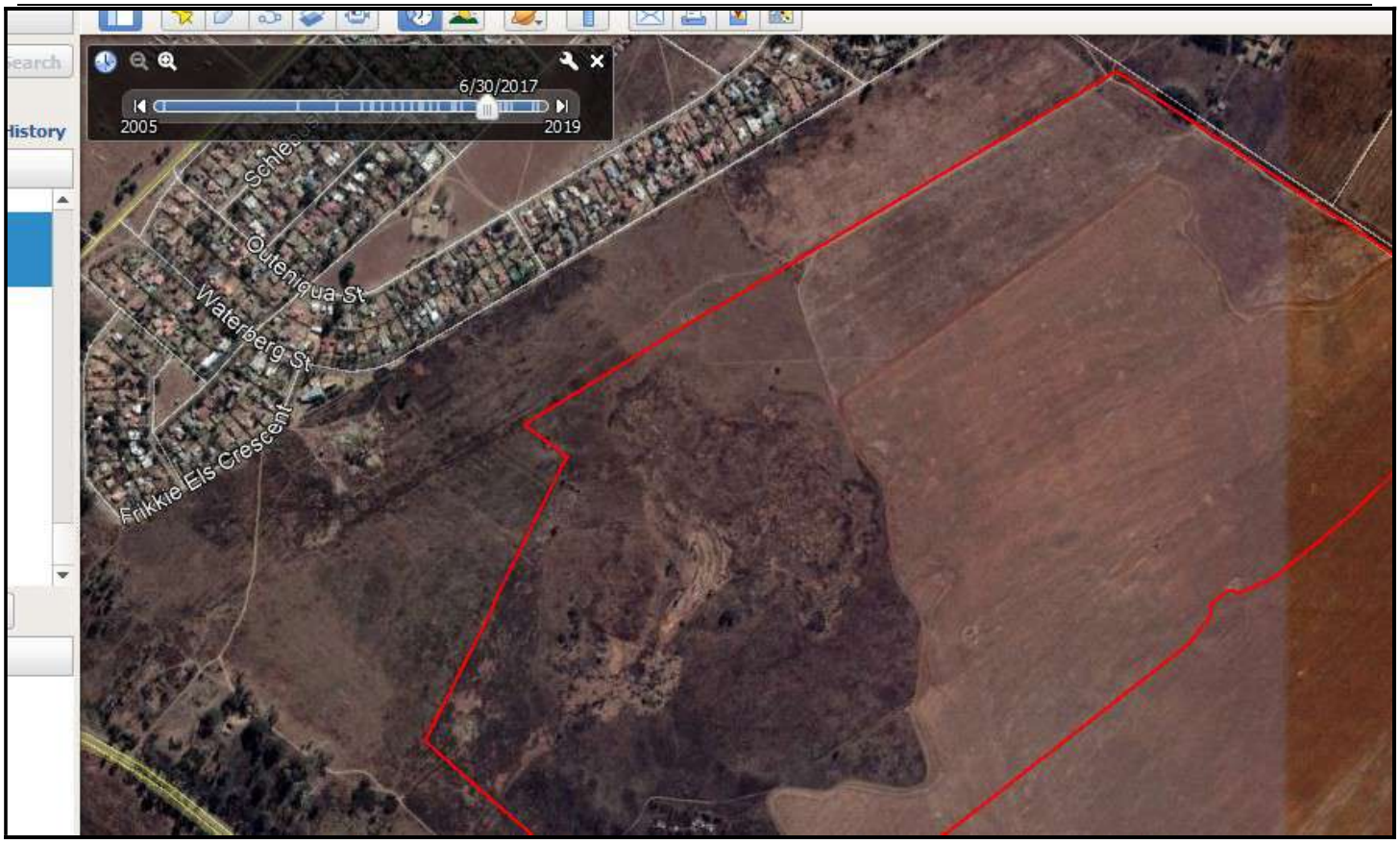

Figure 16. 2017 Google Image of the study area.

8. Findings of the Survey

It is important to note that only the development footprint was assessed as indicated in Figure 1 - 4. The study area is mainly used for the growing of maize which makes a large portion of the study area inaccessible. These cultivation activities would have impacted on surface indicators of heritage resources in the study area. Two portions were accessed by using the gravel roads that provides access around the maize field.

Large foundation blocks are located at the Northern border of the study area (Figure 18 and 19) and could possibly be attributed to infrastructure such as raised pipeline foundations etc. During the survey Stone Age artefacts, a demolished ruin and a stone cairn of unknown purpose were recorded (Table 5 & Figure 17) and is briefly explained below. Recorded Features were given the Pre-Fix F and numbered numerically.

Table 5. Recorded features

Label	Latitude	Longitude	Description	Heritage Significance	Field Rating	Recommendation
F1	26°37'15.09"S	27°54'29.19"E	Low density scatter of MSA artefacts: Mixture of raw materials- chert, fine grain quartzite. Artefacts consist of blades, miscellaneous flakes and cores.	Low	GP C	Area should be monitored during construction.
F2	26°37'10.95"S	27°54'28.12"E	Low density scatter of MSA Artefacts.	Low	GP C	Area should be monitored during construction.
F3	26°37'9.41"S	27°54'30.08"E	Stacked pile of stones.	If confirmed to be a grave – high social significance	GP A	The area should be monitored during construction.
F4	26°37'9.97"S	27°54'30.82"E	MSA Core Fine grained quartzite	Low	GP C	Area should be monitored during construction.
F5	26°37'14.06"S	27°54'30.07"E	MSA flake Fine grained quartzite	Low	GP C	Area should be monitored during construction.
F6	26°37'12.83"S	27°54'31.84"E	MSA flake Fine grained quartzite	Low	GP C	Area should be monitored during construction.
F7	26°37'45.54"S	27°53'58.19"E	Dilapidated Homestead	Low	GP C	Unless proven to be older than 60 years no further action is required.

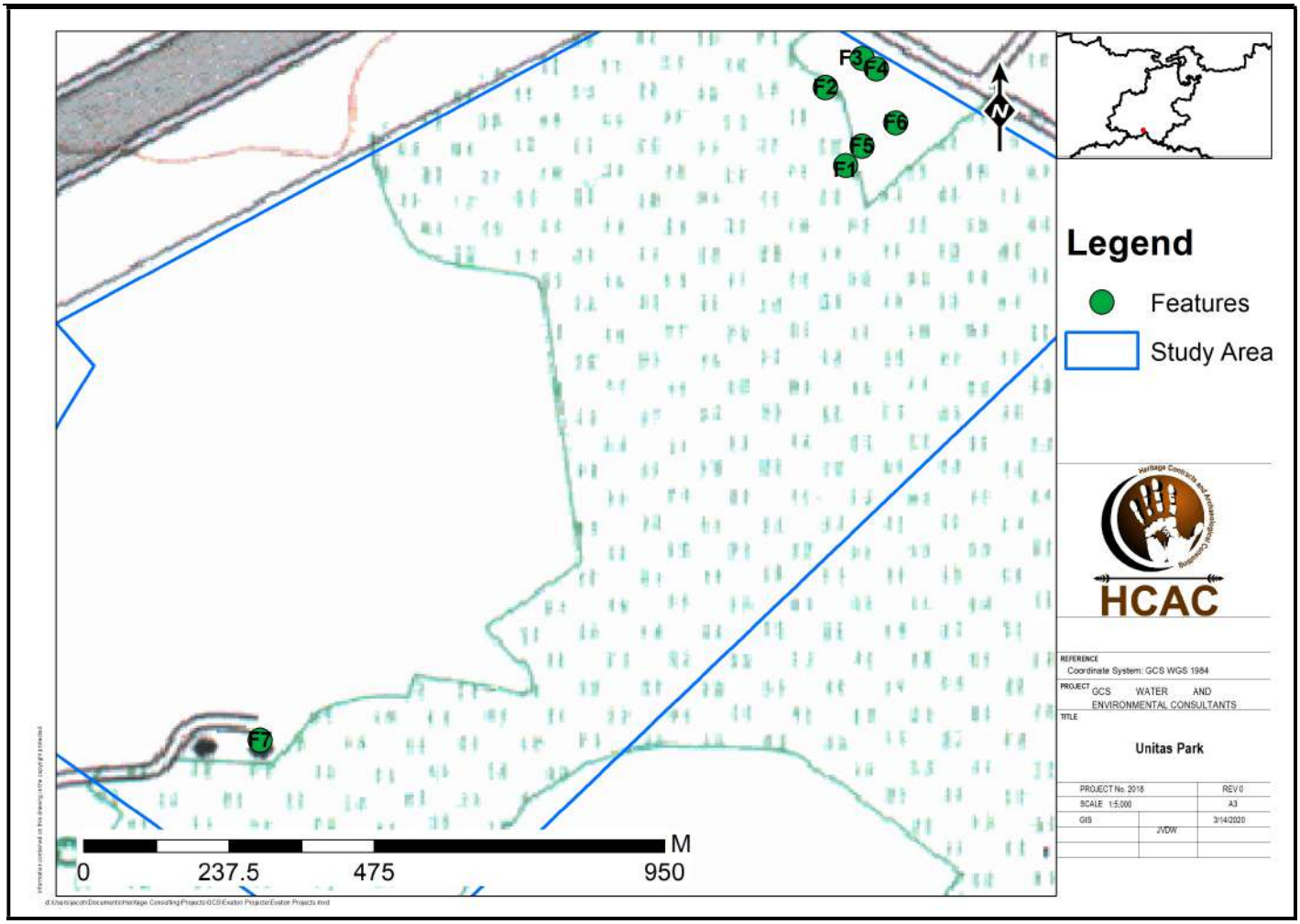

Figure 17. Site distribution map.

A low density (less than 2 artefacts per m²) scatter of Middle Stone Age artefacts was exposed by ploughing in the northern section of the study area. Raw material suitable for knapping is mantled by quaternary sands and has been exposed by ploughing activities (Figure 20 – 24). This low-density scatter was recorded as Feature 1, 2, 4, 5 and 6 but is interpreted as one site. The use of large machinery can result in pseudo tools (Van der Walt & Bradfield 2018) and fresh flakes can be seen on some of the cobbles (Figure 22) as a result of ploughing.

Feature 3 consists of a stone packed feature (Figure 25) of unknown purpose but could probably be the result of clearing for agricultural activities. Although unlikely the feature could also represent a grave.

The remains of partly demolished homestead are found in the southern portion of the study area and recorded as Feature 7 (Figure 26 and 27). The areas around the homestead is dominated by tall grass hampering visibility and the possibility of additional features in this area cannot be excluded. The structures' potential to contribute to aesthetic, historic, scientific and social aspects are non-existent and it is therefore of no heritage significance. Based on architectural elements the structure does not seem to be older than 60 years and is therefore not protected by the NHRA.

An independent paleontological assessment was conducted by Prof Marion Bamford and concluded that the proposed site lies on the soils overlying deep deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation (Ecca Group, Karoo Supergroup) of middle Permian age. Such rocks can potentially preserve fossils of the *Glossopteris* flora however the potentially fossiliferous rocks are more than 50 m below the surface so will not be impacted upon by an urban development. Based on the geological record and literature it is recommended that no palaeontological site visit is required unless the geologist or responsible person on during excavations finds fossils. The study included a Fossil Chance Find Protocol.

Figure 18. Large foundation slabs.

Figure 19. Large foundation slabs.

Figure 20. Range of artefacts exposed by ploughing.

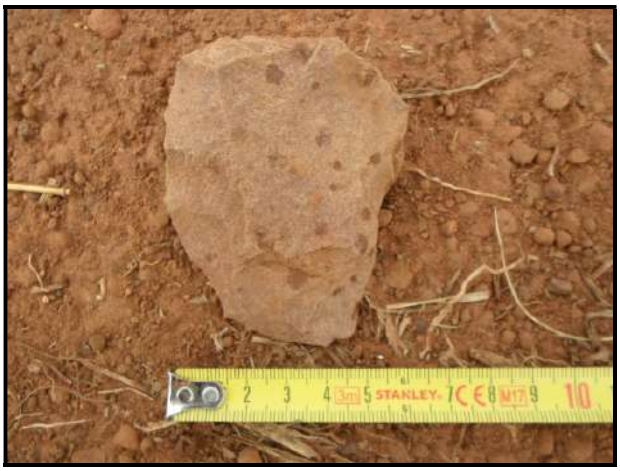

Figure 21. Quartzite Core.

Figure 22. Fresh removal visible on pebble, possibly from machinery. .

Figure 23. Ploughed area in the vicinity of Feature 1 exposing artefacts.

Figure 24. Lower density of artefacts and natural stones within ploughed material at Feature 2**.**

Figure 25. Packed stone feature at Feature 3.

Figure 26. Feature 7 Homestead.

Figure 27. Feature 7 Homestead.

9. Potential Impact

The development lay out plan was not available at the time of the survey and writing of the report and it is assumed that all sites will be directly impacted on by the development. The Stone Age scatters (Features 1,2,4,5 and 6) is out of context, impacted on by the ploughing activities and of low heritage significance and based on the considerations in Table 6 without mitigation the impact of the development on the identified features is expected to be low to medium and with mitigation low. The Stone packed feature could represent a grave, if this is confirmed and the grave is impacted on without mitigation the impact will be high. Feature 7 is a dilapidated homestead of low heritage significance and the impact on this feature is low.

9.1. Pre-Construction phase:

The area will be upgraded and it is assumed that this phase will entail groundworks. Impacts include destruction or partial destruction of non-renewable heritage resources.

9.2. Construction Phase

During this phase, the impacts and effects are similar in nature but more extensive than the pre-construction phase. These activities can have a negative and irreversible impact on heritage sites. Impacts include destruction or partial destruction of non-renewable heritage resources.

9.3. Operation Phase:

No impact is envisaged during this phase.

Table 6. Impact of the project on heritage resources.

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects as well as graves (if present).		
	Without mitigation	**With mitigation (Preservation/ excavation of site)**
Extent	Local (3)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	**36 (Medium)**	**30 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	No resources were recorded	No resources were recorded.
Can impacts be mitigated?	Yes	Yes

Mitigation:

To mitigate the impact of the proposed project on the recorded heritage resources the following recommendations apply as a condition of authorisation (part of the EMPr) and based on approval from SAHRA.

- Feature 1, 2, 4, 5 and 6 must be monitored during construction to determine if *in-situ* subsurface layers are present.
- It is recommended that Feature 3 should be monitored during earthworks in the area.
- No mitigation is required for Feature 7, unless it is proven that the site is older than 60 years,

In addition to the site-specific recommendations outlined above the following applies:

- Confirmation of any grave sites in the study area as part of the social consultation process
- Graves should ideally be retained *in-situ* in open spaces
- Implementation of a chance find procedure for the project as outlined in Section 10.1

Residual Impacts:

Although surface sites can be avoided or mitigated, there is a chance that completely buried sites would still be impacted but this cannot be quantified.

9.4. Cumulative Impacts

Table 7. Cumulative Impact of the project.

Cumulative impacts occur from the combination of effects of various impacts on heritage resources. The importance of identifying and assessing cumulative impacts is that the whole is greater than the sum of its parts. The area is of low heritage sensitivity and the possibility of unearthing subsurface heritage resources is small.

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects as well as graves (if present).		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**24 (Low)**	**16 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	No resources were recorded	No resources were recorded.
Can impacts be mitigated?	Yes.	Unknown
Confidence in findings	High	High

10. Recommendations and conclusion

The study area is mainly used for the growing of maize which makes a large portion of the study area inaccessible. The south western portion of the study area has been extensively dug out as part of an old quarry and these activities would have impacted on surface indicators of heritage resources in the study area. Large cement foundation blocks are located in the northern portion of the study area and could possibly be attributed to infrastructure such as raised pipeline foundations etc.

The field survey recorded scatters of Stone Age artefacts (Feature 1,2,4,5 and 6), a stone cairn of unknown purpose (Feature 3), and a party demolished homestead (Feature 7). An independent paleontological study (Bamford 2020) concluded that the proposed site lies on the soils overlying deep deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation (Ecca Group, Karoo Supergroup) of middle Permian age. Such rocks can potentially preserve fossils of the *Glossopteris* flora however the potentially fossiliferous rocks are more than 50m below the surface so will not be impacted upon by an urban development. Based on the geological record and literature it is recommended that no palaeontological site visit is required unless the geologist or responsible person on during excavations finds fossils. The study included a Fossil Chance Find Protocol.

The impact of the proposed project on heritage resources is considered to be low and it is recommended that the proposed project can commence on the condition that the following recommendations are implemented as part of the EMPr and based on approval from SAHRA:

- Feature 1, 2, 4, 5 and 6 must be monitored during construction to determine if *in-situ* subsurface layers are present.
- It is recommended that Feature 3 should be monitored during earthworks in the area.
- No mitigation is required for Feature 7, unless it is proven that the site is older than 60 years,

In addition to the site-specific recommendations outlined above the following applies:

- Confirmation of any grave sites in the study area as part of the social consultation process
- Graves should ideally be retained *in-situ* in open spaces
- Implementation of a chance find procedure (archaeological and paleontological) for the project as outlined in Section 10.1

10.1. Chance Find Procedure

The possibility of the occurrence of subsurface finds or previously unknown sites cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place for the project. A short summary of chance find procedures is discussed below.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

Monitoring Programme for Palaeontology – to commence once the excavations activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (stromatolites, microbially induced sedimentary structures) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar structures are provided here for the developer to assist in recognizing the microfossils.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

10.2. Reasoned Opinion

The impact of the proposed project on heritage resources is considered low and no further pre-construction mitigation in terms of archaeological resources is required based on approval from SAHRA. Furthermore, the socio-economic benefits also outweigh the possible impacts of the development if the correct mitigation measures (i.e. chance find procedure) are included in the EMPr.

10.3. Potential risk

Potential risks to the proposed project are the occurrence of unknown and unmarked graves. The possibility exists that the study area could contain graves of which surface indicators have been destroyed or obscured by vegetation and subsurface material could be uncovered during earth works. These risks can be mitigated to an acceptable level with monitoring and the implementation of a chance find procedure as outlined in Section 10.1.

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Appendix A - Curriculum Vitae of Specialist

Jaco van der Walt
Archaeologist

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Education:

Particulars of degrees/diplomas and/or other qualifications:

Name of University or Institution:		University of Pretoria
Degree obtained	**:**	BA Heritage Tourism & Archaeology
Year of graduation	**:**	2001
Name of University or Institution:		University of the Witwatersrand
Degree obtained	**:**	BA Hons Archaeology
Year of graduation	**:**	2002
Name of University or Institution	**:**	University of the Witwatersrand
Degree Obtained	**:**	MA (Archaeology)
Year of Graduation	:	2012
Name of University or Institution	**:**	University of Johannesburg
Degree	**:**	PhD
Year	:	Currently Enrolled

EMPLOYMENT HISTORY:

2011 – Present:	**Owner – HCAC (Heritage Contracts and Archaeological Consulting CC)**.
2007 – 2010 :	**CRM Archaeologist,** Managed the Heritage Contracts Unit at the University of the Witwatersrand.
2005 - 2007:	**CRM Archaeologist**, Director of Matakoma Heritage Consultants
2004:	**Technical Assistant**, Department of Anatomy University of Pretoria
2003:	**Archaeologist**, Mapungubwe World Heritage Site
2001 - 2002:	**CRM Archaeologists,** For R & R Cultural Resource Consultants, Polokwane
2000:	**Museum Assistant**, Fort Klapperkop.

Countries of work experience include:

Republic of South Africa, Botswana, Zimbabwe, Mozambique, Tanzania, The Democratic Republic of the Congo, Lesotho and Zambia.

SELECTED PROJECTS INCLUDE:

Archaeological Impact Assessments (Phase 1)

Heritage Impact Assessment Proposed Discharge Of Treated Mine Water Via The Wonderfontein Spruit Receiving Water Body Specialist as part of team conducting an Archaeological Assessment for the Mmamabula mining project and power supply, Botswana

Archaeological Impact Assessment Mmamethlake Landfill

Archaeological Impact Assessment Libangeni Landfill

Linear Developments

Archaeological Impact Assessment Link Northern Waterline Project At The Suikerbosrand Nature Reserve

Archaeological Impact Assessment Medupi – Spitskop Power Line,

Archaeological Impact Assessment Nelspruit Road Development

Renewable Energy developments

Archaeological Impact Assessment Karoshoek Solar Project

Grave Relocation Projects

Relocation of graves and site monitoring at Chloorkop as well as permit application and liaison with local authorities and social processes with local stakeholders, Gauteng Province.

Relocation of the grave of Rifle Man Maritz as well as permit application and liaison with local authorities and social processes with local stakeholders, Ndumo, Kwa Zulu Natal.

Relocation of the Magolwane graves for the office of the premier, Kwa Zulu Natal

Relocation of the OSuthu Royal Graves office of the premier, Kwa Zulu Natal

Phase 2 Mitigation Projects

Field Director for the Archaeological Mitigation For Booysendal Platinum Mine, Steelpoort, Limpopo Province. Principle investigator Prof. T. Huffman

Monitoring of heritage sites affected by the ARUP Transnet Multipurpose Pipeline under directorship of Gavin Anderson.

Field Director for the Phase 2 mapping of a late Iron Age site located on the farm Kameelbult, Zeerust, North West Province. Under directorship of Prof T. Huffman.

Field Director for the Phase 2 surface sampling of Stone Age sites effected by the Medupi – Spitskop Power Line, Limpopo Province

Heritage management projects

Platreef Mitigation project – mitigation of heritage sites and compilation of conservation management plan.

MEMBERSHIP OF PROFESSIONAL ASSOCIATIONS:

- Association of Southern African Professional Archaeologists. Member number 159

  Accreditation:
  - Field Director Iron Age Archaeology
  - Field Supervisor Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation
- Accredited CRM Archaeologist with SAHRA
- Accredited CRM Archaeologist with AMAFA
- Co-opted council member for the CRM Section of the Association of Southern African Association Professional Archaeologists (2011 – 2012)

PUBLICATIONS AND PRESENTATIONS

- A Culture Historical Interpretation, Aimed at Site Visitors, of the Exposed Eastern Profile of K8 on the Southern terrace at Mapungubwe.
  - J van der Walt, A Meyer, WC Nienaber
  - Poster presented at Faculty day, Faculty of Medicine University of Pretoria 2003
- 'n Reddingsondersoek na Anglo-Boereoorlog-ammunisie, gevind by Ifafi, Noordwes-Provinsie. South-African Journal for Cultural History 16(1) June 2002, with A. van Vollenhoven as co-writer.
- Fieldwork Report: Mapungubwe Stabilization Project.
  - WC Nienaber, M Hutten, S Gaigher, J van der Walt
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2004
- A War Uncovered: Human Remains from Thabantšho Hill (South Africa), 10 May 1864.
  - M. Steyn, WS Boshoff, WC Nienaber, J van der Walt
  - Paper read at the 12th Congress of the Pan-African Archaeological Association for Prehistory and Related Studies 2005
- Field Report on the mitigation measures conducted on the farm Bokfontein, Brits, North West Province .
  - J van der Walt, P Birkholtz, W. Fourie
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2007
- Field report on the mitigation measures employed at Early Farmer sites threatened by development in the Greater Sekhukhune area, Limpopo Province. J van der Walt
  - Paper read at the Southern African Association of Archaeologists Biennial Conference 2008

- Ceramic analysis of an Early Iron Age Site with vitrified dung, Limpopo Province South Africa.
    - J van der Walt. Poster presented at SAFA, Frankfurt Germany 2008

- Bantu Speaker Rock Engravings in the Schoemanskloof Valley, Lydenburg District, Mpumalanga (*In Prep)*
    - J van der Walt and J.P Celliers
- Sterkspruit: Micro-layout of late Iron Age stone walling, Lydenburg, Mpumalanga. W. Fourie and J van der Walt. A Poster presented at the Southern African Association of Archaeologists Biennial Conference 2011
- Detailed mapping of LIA stone-walled settlements' in Lydenburg, Mpumalanga. J van der Walt and J.P Celliers
    - Paper read at the Southern African Association of Archaeologists Biennial Conference 2011
- Bantu-Speaker Rock engravings in the Schoemanskloof Valley, Lydenburg District, Mpumalanga. J.P Celliers and J van der Walt
    - Paper read at the Southern African Association of Archaeologists Biennial Conference 2011
- Pleistocene hominin land use on the western trans-Vaal Highveld ecoregion, South Africa, Jaco van der Walt.
    - J van der Walt. Poster presented at SAFA, Toulouse, France.
      Biennial Conference 2016

REFERENCES:

1. Prof Marlize Lombard Senior Lecturer, University of Johannesburg, South Africa
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2. Prof TN Huffman Department of Archaeology Tel: (011) 717 6040
   University of the Witwatersrand
3. Alex Schoeman University of the Witwatersrand
   E-mail:Alex.Schoeman@wits.ac.za

APPENDIX C8

Palaeontological Impact Assessment

Palaeontological Impact Assessment for the proposed development in Unitas Park Ext 16, Gauteng Province

Desktop Study (Phase 1)

For

Heritage Contracts and Archaeological Consulting

09 March 2020

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Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 31 years research; 3years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Heritage Contracts and Archaeological Consulting (HCAC), Modimolle, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the proposed development in Unitas Park Ext 16, Gauteng Province in order to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA). The site was indicated as very highly sensitive on the SAHRIS map so a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development.

The proposed site lies on the soils overlying deep deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation (Ecca Group, Karoo Supergroup) of middle Permian age. Such rocks can potentially preserve fossils of the *Glossopteris* flora however the potentially fossiliferous rocks are more than 50m below the surface so will not be impacted upon by an urban development.

SAHRA requires a Fossil Chance Find Protocol it is added here. Based on the geological record and literature it is recommended that no palaeontological site visit is required unless the geologist or responsible person on during excavations finds fossils.

Table of Contents

1. Background

The Gauteng Rapid Land Release Programme aims to fast track the release of serviced stands from state-owned land to qualifying beneficiaries. Phumaf Holdings was appointed to assist the Department of Human Settlements with all pre-planning, planning work, design and construction management to enable the release of the identified stands. GCS Water and Environment has been contracted by Phumaf Holdings to undertake the environmental authorization processes required for the stands in order for compliance to the National Environmental Management Act NEMA (Act 107 of 1998, as amended).

Unitas Park ext 16 is located within Unitas Park, to the north east of the R54 (Houtkop Road). The R82 is runs north-south approximately 2.3km to the east of the site. The N1 is about 11km to the north west of the site. Sebokeng lies to the north west of the site, with Vereeniging to the south. The R59 is runs from Vereeniging to Meyerton in the north west of the site. The site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of a wetland or some surface water on the site, as well as to the south east of the site. A drainage line appears to run from the site towards Houtkop Road to the south west, where the surface water drains under the road and continues to flow into a National Freshwater Ecosystem Protection Area (NFEPA). The buffer of the NFEPA includes a portion of the south west of the site. The site is approximately 149 hectares in extent. Refer to the maps below for the location and regional locality map, indicating the surrounding residential allotment townships. Unitas Park is within the 2010 urban edge.

A Palaeontological Impact Assessment was requested for the above project. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017).

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes

cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed development of the vacant land in Unitas Park Ext 16, northern Vereeniging, with the section indicated with the red block. Map supplied by HCAC.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

Figure 2: Geological map of the area around Unitas Park in Vereeniging. The location of the proposed project is indicated within the yellow rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2626 West Rand.

Table 2: Explanation of symbols for the geological map and approximate ages (Barbolini et al., 2016; Eriksson et al., 2006, 2012; Johnson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Quaternary sands	Alluvium, sand, calcrete	ca 2.5 Ma to Present
Qw	Quaternary sands	Aeolian dands	Ca 2.5 Ma to Present
Pv	Vryheid Fm, Ecca Group, Karoo SG	Sandstone, shale, coal	Middle Ecca, early Permian, ca 270 Ma
Vdi	Diabase	Intrusive volcanic rocks	Post Transvaal SG
Vh	Hekpoort Fm, Pretoria Group, Transvaal SG	Andesite, agglomerate, tuff	Ca 2224 Ma
Vt	Timeball Hill Fm, Pretoria Group, Transvaal SG	Quartzite, mudrock, diamictite	< 2420 Ma
Vmd	Malmani Subgroup, Chuniespoort Group, Transvaal SG	Dolomite, chert	Ca 2500 – 2460 Ma

The site lies in the southern part of the Transvaal Basin, in one of three late Archaean to early Proterozoic basins that together form the Transvaal Supergroup. In the Transvaal Basin the Pretoria Group overlies the Chuniespoort Group. There are three major cycles of infilling of the basin and the Malmani Subgroup is within the first or lower cycle and the Timeball Hill Formation within the second cycle (Eriksson et al., 2012) so although the sediments are adjacent to each other there is quite a lot of time separating them. The sediments of the Karoo Supergroup overlie the ancient rocks unconformably at this northern margin of the Karoo Basin. To the east and northeast, in the Karoo Basin proper, the Vryheid Formation is well stratified and contains thick coal seams that are exploited commercially for coal. In southern Gauteng, however, the deposits are thin and poorly preserved.

The Vryheid Formation is in the middle Ecca Group and represents the infilling of the Karoo Basin from north and south highlands. The palaeoclimate of that time would have been warm and humid.

To the west are considerably younger deposits of Quaternary Kalahari sands comprising Aeolian sands, fluvial sands, alluvium and soils but they are not in the development footprint.

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The whole area is on Vryheid Formation sandstones and shales, and surrounded by much older rocks to the north and west. Vereeniging is not in the prime coal mining area. There are only two coal mines in the Vereeniging-Sasolburg Coalfield and the coal seams are about 200m below the surface (Snyman, 1998; p 175-177). The coal is overlain by two thick layers of dolerite (non-fossiliferous) and the uppermost sandstone layer is about 50m below the surface (ibid). There is a small chance that the sandstone could preserve fossil plants but generally sandstone is too coarse to preserve any useful information or detail. The surface sands and soils range from 5-10m thick in this area (Snyman, 1998), and they are too young and disturbed by vegetation, roots and humans (farming, urban developments) to preserve any Vryheid or more recent fossils.

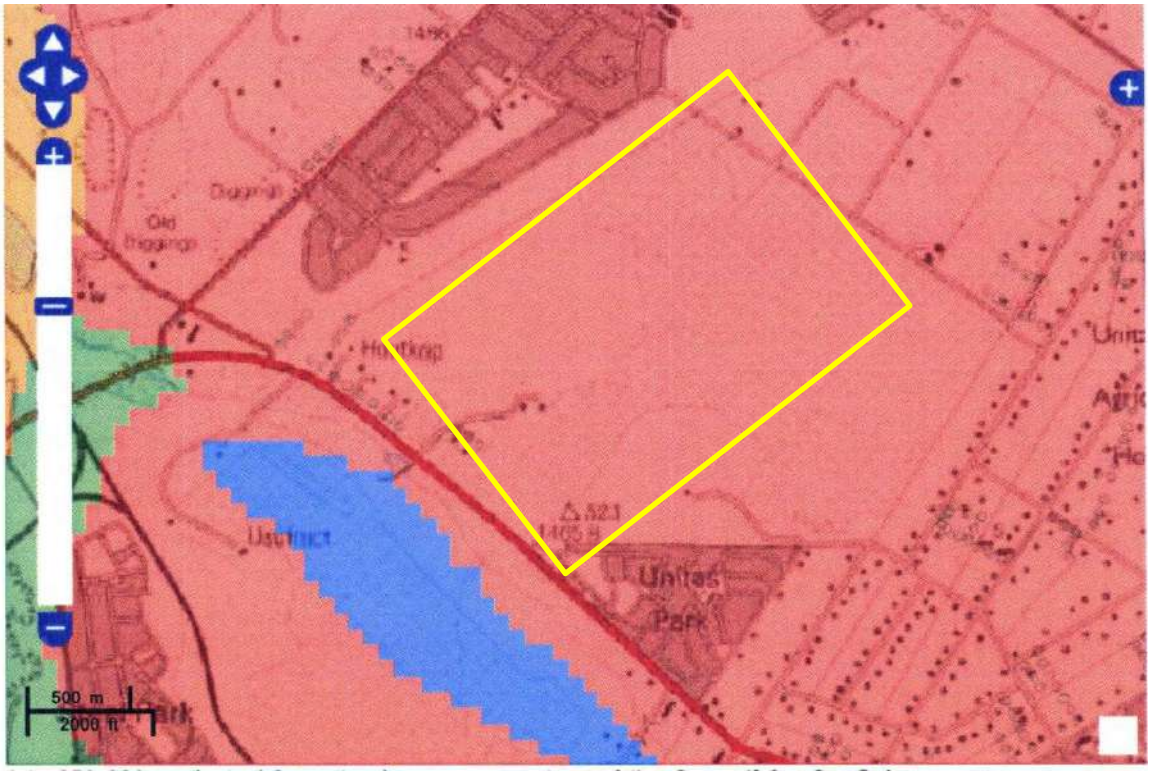

Figure 3: SAHRIS palaeosensitivity map for the proposed development in Unitas Park Ext 16 shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above (Figure 3) the area is indicated as very highly sensitive (red) so a desktop PIA has been completed.

As explained above, in this area the coal seams and associated potentially fossiliferous rocks are far below the surface. The vacant lot has evidence of earlier agriculture and more recently of human impact that can be clearly seen from the Google Earth imagery.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

TABLE 3A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.

	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	The Vryheid Fm could preserve fossils but not in the overlying soils and sands. Cores for coal mines indicate that the coals are more than 200m below the surface. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since only the possible fossils within the area would be fossil plants from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the overlying soils and sands. Coal seams are far below the surface. No fossils have been reported from here. Nonetheless, a Fossil Chance Find protocol is added here.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils of the Glossopteris flora, in the Vryheid Formation. However, the reports from coalmines in the area indicated that the coal seams and associated fine-grained sediments, are far below the surface. The project for residential housing and associated amenities is not likely to penetrate more than 5-10 m below the land surface. The area is already highly disturbed from previous agricultural activities and current human urban impact. a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sandstones, shales, coal, dolomites, cherts, basalts and lavas of the early Proterozoic Transvaal Supergroup and Palaeozoic Karoo Supergroup, are typical for the country and do NOT contain fossils in the first instance and could contain fossils in the second instance. None has been reported from this area. Borehole cores for the coalmines indicate that the coal seams are far below the surface. The surface is already highly disturbed from previous agricultural activities and current human urban impact.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Vryheid Formation. Dolerite does not preserve fossils and the uppermost potentially fossiliferous layer is more than 50 m below the surface so would not be affected by any urban development.

A Fossil Chance Find Protocol is included here for the very small chance that the excavations might reveal some fossil plants. There would be no fossils in the surface soils.

7. References

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Eriksson, P.G., Bartman, R., Catuneanu, O., Mazumder, R., Lenhardt, N., 2012. A case study of microbial mats-related features in coastal epeiric sandstones from the Palaeoproterozoic Pretoria Group, Transvaal Supergroup, Kaapvaal craton, South Africa; the effect of preservation (reflecting sequence stratigraphic models) on the relationship between mat features and inferred palaeoenvironment. Sedimentary Geology 263, 67-75.

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Snyman, C.P., 1998. Coal. In: Wilson, M.G.C., and Anhaeusser, C.P., (Eds), The Mineral Resources of South Africa: Handbook, Council for Geosciences 16, 136-205.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations for foundations and amenities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (leaf impressions, wood, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar structures are provided here for the developer to assist in recognizing the microfossils (for example see Figure 4, 5).
4. Photographs of the putative fossils from the site can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site, a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossils from the Vryheid Formation

Wide and narrow Glossopteris leaves

Narrow Glossopteris leaves

Lycopod stem with leaf abscission scars

Astertotheca (fern)

Hammanskraal fossil plants

Figure 4: Examples of fossil plants of the Glossopteris flora that could be associated with the coal seams.

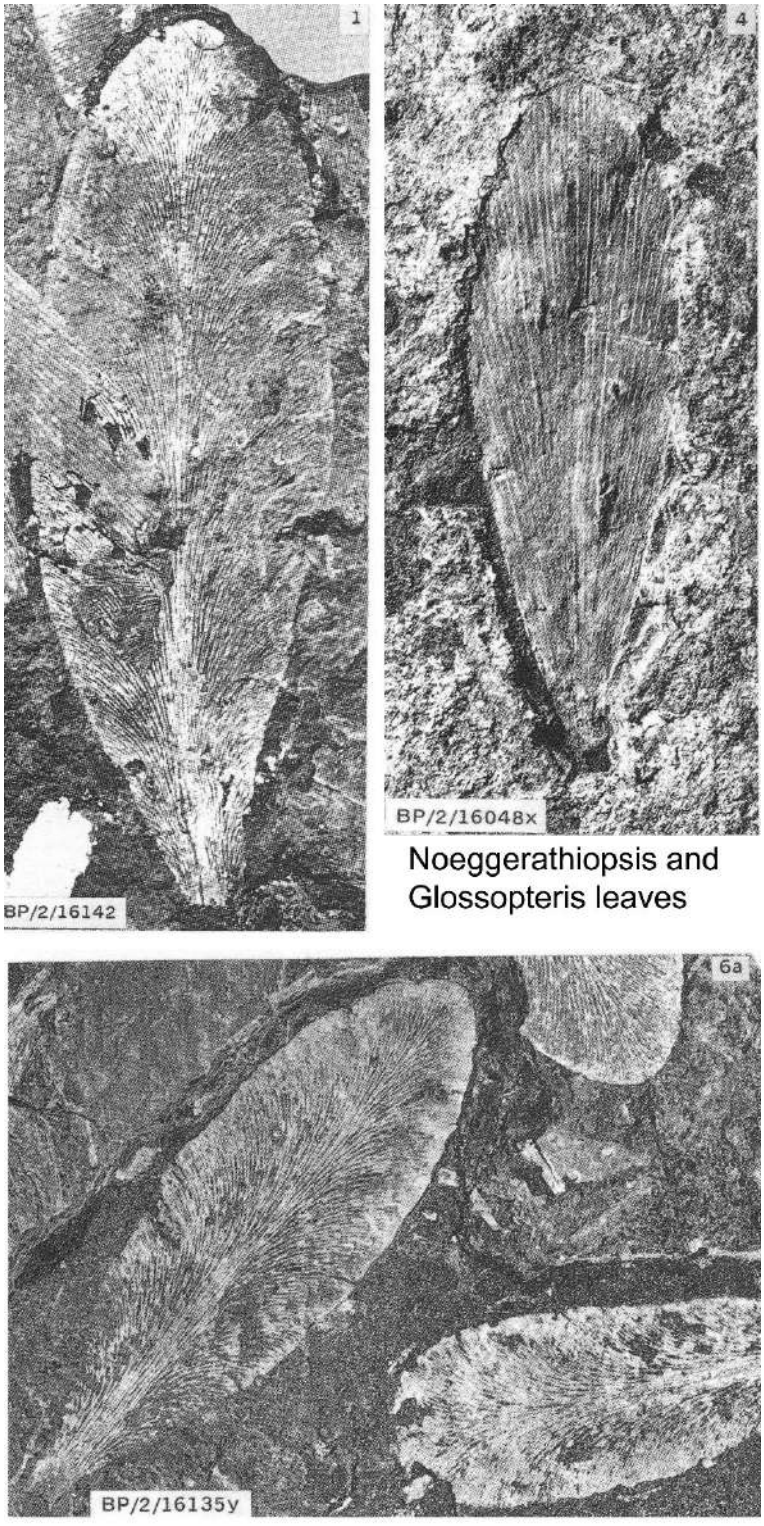

Figure 5: More examples of fossil plants from the Vryheid Formation.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
January 2020

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+

Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	7	0
Masters	10	4
PhD	12	5
Postdoctoral fellows	10	3

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 –
Journal of African Earth Sciences: 2020 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources

- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
-

xi) Research Output

Publications by M K Bamford up to December 2019 peer-reviewed journals or scholarly books: over 140 articles published; 5 submitted/in press; 8 book chapters.
Scopus h-index = 27; Google scholar h-index = 32; -i10-index = 80
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

APPENDIX C9

Highest and Best Use Market Study

UNITAS PARK EXTENSION 16 HIGHEST AND BEST USE MARKET STUDY

FEBRUARY 2020

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Executive Summary

Park Extension 16 is located in Vereeniging, Gauteng Province. The proposed site is approximately 151 hectares in extent and is planned to include 7 250 high-density residential units.

Spatial Analysis

Vereeniging is located approximately 60 km south of Central Johannesburg and approximately 12 km from the Free State provincial boundary. The major land uses surrounding the proposed development site include open spaces, residential development, and agricultural holdings. The proposed development will be a mixed-use development with the potential to add great value to the area and will complement the existing urban fabric by providing supplementary services, activities and other complementary land uses.

Macro-Economic Analysis

GVA output of South Africa in 2018 was approximately R2.85 billion. A notable decline in the South African GVA in from 2008 to 2009 can be identified, due to the Global Recession. The economy of South Africa also experienced stubborn growth since 2015. The manufacturing sector makes the largest contribution (28%) to the total GVA of Emfuleni LM, followed by general governance contributing 17%. However, manufacturing has shown a notable decline indicating that the industry is struggling and will affect the local economy and employment opportunities.

ArcelorMittal, a major supplier and manufacturer of steel products, is based in Vereeniging and created many job opportunities for people in the area. However, lacklustre performance, increasing electricity prices and increasing costs of raw materials resulted in a 30.5% decrease in share price in the past year, large-scale job losses and a drop in headline earnings. This will continue to affect employment and unemployment rate in the area and household income of people employed in the area.

The current interest rate stands at 9.25%, which is down by 0.75% since the beginning of 2019. This is a good indication of home affordability since a decline in the interest rate enables better bond affordability and household expenditure.

Since 2011, the inflation rate has remained relatively stable, and the current inflation rate stands at 3.7%. A lower inflation rate decreases financial pressure on households, which bodes well for home affordability as households have increased disposable income.

Socio-Economic Analysis

Population and Household

The population growth projections are based on a five-year historic growth rate of 0.42% per annum and a household growth rate of 0.99%. The population growth projections indicate the projected population for the primary market area (PMA) for 2021 is estimated at 319 531 people, comprising 99 855 households and is expected to increase to 331 812 people and 109 123 households by 2030. The projected increase in the population figures and the number of households shows that the demand for housing in the demarcated market area is growing.

Employment

Community, social and personal services (18%), and wholesale and retail trade (18%) make the largest contribution towards employment in the market. Additional land uses related to these industries can be considered for the proposed mixed-use development. The unemployment rate in Emfuleni LM increased from 29.3% in 2008 to 31.5% in 2018 meaning that people have less disposable income. The impact on the housing market is that people have less money available and may not be able to purchase a house or may encounter bond repayment issues.

Age Profile

The total PEA population accounts for approximately 70% of the total population and therefore a large portion of the population is able to generate personal income. A moderate portion of the population is below the age of 15 years and therefore it can be assumed that the demand for various goods and services will continue to exist as the younger portion of the population become economically active. A fairly large number of the population are economically active meaning this population can potentially spend money on housing and goods and services. However, the unemployment rate is increasing and will decrease disposable income of households.

Household Income

The annual weighted average household income of the PMA is R132 466.37 per annum. Overall, the delineated market area consists of low-income households which may limit disposable income of households. This means that less people will be able to purchase a house.

Education

A total of 33% of the primary market's population have completed high school and 36% completed some level of secondary school. A moderate to low education level results in a decrease in household income and reduces the ability of households to gain access to capital to purchase a house or that households are more likely to live in more affordable accommodation types.

Market Perspective

Residential

The housing market in Vereeniging experienced a continuous increase from 329 points in 2010 to 515 points in 2018. The performance of the housing market is increasing and, therefore, may be an indication that the demand for housing is also increasing.

The market area consists of 99.3% freehold residential units and indicate that freehold stock is most in demand. This could also be an indication of a market that requires higher densities.

The population in the surrounding area own their homes for longer, but recent sellers of 11 years and more may be an indication of a market that is moving out. One reason for this is the declining local economy leading to fewer job opportunities available. Therefore, people may seek job opportunities in other areas, neighbouring towns, or cities.

The average house price for freehold units increased from R446 000 in 2009 to R1 025 000 in 2018. The average sales price decreased with almost 20% to from the R1025 000 in 2018 to R824 700 in 2019. Since 2016, the average sales price for sectional title schemes continued to increase to R 765 000 in 2018, after which it experienced a decrease in the average sales price, reaching R588 000 in 2019. The average sales

price for vacant land increased from R166 500 in 2013 to R424 000 in 2019. The general decline in house prices (evidently seen in 2018/19) can be an indication of a residential market that is in an oversupply of houses to buy.

The tenure profile indicates that fully paid homes currently make up the largest portion of the PMA (39%). However, rental tenure is also popular presenting an opportunity to provide a mix of tenure types.

Retail

The trading density growth (as recorded in September 2019) increased with 4.3% over a period of one year in current price terms. The growth of 4.3% consisted of 5.5% growth in sales and a 1.2% increase in the trading area. The per capita spent increased with 1.7% while foot count increased with 2.5%, also contributing to the increase in trading density. The largest merchandise categories include electronics, food (grocery and supermarket tenants) and department stores.

There is no retail centre within 5 km from the proposed development site in Unitas Park, indicating the need for a retail centre to serve the population of Sonland Park and Unitas Park. The PMA consists of approximately 208 000 m2 gross leasable area (GLA) of retail space. The major anchor shops are Shoprite Checkers, Pick n Pay, and PEP. This indicates the presence of stores that capture and appeal to the local market and could be considered for a newly developed retail centre.

Office

The average rental rate in Three Rivers is R68.58 per square meter per month, whereas the average rental rate for Central Vereeniging is R62.52. The area surrounding the proposed site is not popular in terms of office space. Due to the low number of offices in the PMA, there are limited data regarding vacancy rates. It is however recommended that office space only be considered as an auxiliary land use and should target small businesses or consider office space for government departments.

Education

The nearest primary school is approximately 3.5 km from the proposed site. Additionally, a total of 77 schools are situated within the primary market area. Most schools in the PMA are primary schools. It is also evident that the demand for primary education is high due to the learner-educator ratio being higher than the average as per the OECD Indicators.

There are four main tertiary institutions in the market area. Sedibeng TVET College (Vereeniging Campus) is the closest campus to the proposed site and located approximately 10 km from the site. Other tertiary institutions are also located within reasonable proximity to the proposed development, indicating that the proposed development site could include student housing as part of the mixed-use development.

The following summarises the growth in the number of students enrolled at tertiary institutions (as identified above).

	2016	2020
NWU Vaal Campus	6748	7931
Vaal University of Technology	19079	19402
Sedibeng TVET College	11 000	10 598

The supply of student beds currently stands at 4 873 [1] Based on the data provided in the table above, it is evident that the number of student enrolments are increasing.

Clinics

The majority of clinics are located near the borders of the PMA. A total of 11 clinics are identified in this area, with most of these clustered in Sebokeng. The clinic closest to the proposed site is the Vaal Men and Women's clinic in Duncanville and is located approximately 8.6 km from the proposed site. The lack of clinics within 8 km of the proposed site indicates the need for a clinic to serve the population, especially in Unitas Park and Sonland Park.

Market Opportunity Analysis

The preliminary opportunity analysis considers the findings of the macro-economic and socio-economic property market trends and spatial analysis. This enables the identification of land uses with the highest development potential under current market conditions. The land uses identified with the highest development potential include residential, student housing, retail, clinic, school and office.

Market Potential Analysis

Residential

The demand for new residential development was determined by applying a set of residential indicators to the demand calculation model. The household income ranges and the projected household numbers were used to project the demand for both bonded and rental housing in the market area. The Net Effective Demand (NED) calculates the market gap for new housing development in the demarcated market area.

An injection factor refers to the potential tenants who would relocate to the direct market area if an opportunity to do so was presented. A leakage factor refers to the net outflow of households from within the direct market area. A 20% injection factor was applied to the effective demand whereas a 35% leakage factor was applied to compensate for the migration of households from the direct market area.

The NED presents the development potential (market gap) for residential development within the demarcated market area in Vereeniging (see table below).

YEAR	BONDED					
	Subsidised	FLISP	Affordable Housing	Middle Income	High Income	Total
2021	839	374	160	169	23	1 565
2025	1 996	890	382	403	54	3 725
2028	2 895	1 290	554	585	78	5 401
2029	3 200	1 426	612	646	86	5 971
2030	3 509	1 564	671	709	95	6 547

[1] Due to time constraints, not all the number of beds have been included in this study. However some of the larger and popular student accommodation have been included as part of the supply.

The housing market is growing and there is a demand for new residential development. The greatest demand in the primary market area for bonded housing is subsidised and FLISP housing.

The following table shows the rental demand in the demarcated market area in Vereeniging.

RENTAL							
YEAR	CRU	Social Housing		Affordable Housing	Middle Income	High Income	Total
		Primary Market	Secondary Market				
2021	135	168	108	86	92	13	603
2025	322	401	258	205	218	30	1 434
2028	467	581	374	298	316	44	2 080
2030	566	705	454	361	383	53	2 521

There is a greater demand for CRU (705 units by 2030) and social housing (56 units by 2030).

Retail

The demand calculation model calculated the total effective demand for retail floor space and is expressed as GLA (m^2). The demand model is based on the interaction between the population and number of households, household income and expenditure, leakages and injections, and trading densities

The following table presents the NED retail floor space in the primary market area.

	2020	2022	2025	2028	2030
NED	14 900	17 700	22 006	26 441	29 472

The NED is expected to increase to reach 22 006 m^2 by 2025 and 29 472m^2 by 2030.

Office

Growth projections are applied to office standard industrial parameters, which allows for the calculation of the total increase in effective demand for office floor space required per annum to sustain the office sector's growth in the market area.

The following table provides the NED for office space in the primary market area.

	2020	2022	2025	2026	2028	2030
NED	1 354	2 773	7 292	8 880	12 182	15 662

The NED for the office space in the primary market is expected to increase to 15 662m^2 by 2030.

Schools

The main factors used for determining the demand for schools are the supply of schools in the market area, population numbers, and learner-educator ratios. The closest school is located 3.5 km from the proposed site. The table below indicates the average learner-educator ratio and average OECD indicators.

Schools	Learner-educator ratio (LER)	Average OECD Indicators[2]
Primary schools	32:1	19:1
Secondary schools	25:1	28:1

The learner-educator ratio for primary schools is higher compared to that of the OECD indicators, which also indicates the demand for additional schools. The minimum norms and standards was used to identify the threshold population for determining the demand for educational facilities.

Educational facility	Threshold Population
Crèche/nursery	2 400 – 3 500
Primary Schools	2 200 – 6 600
High School	4 000 – 10 000

To calculate the demand and institutional capacity for various educational facilities, the projected population was divided by the respective threshold population. The following table presents the calculated demand and the number of educational facilities.

Year of full potential	2021	2023	2025	2028
Crèche/nursery	3	5	7	10
Primary schools	3	5	8	11
Secondary / High school	2	3	4	6

Student Housing

The calculations used to quantify the need for student accommodation made use of the projected demand and existing and future supply in student accommodation. The following table provides the estimated projected student enrolments at the various tertiary institutions.

	2021	2022	2025	2028	2030
North-West University Vaal Campus	8 225	8 533	9 529	10 642	11 455
Vaal University of Technology	19 346	19 378	19 475	19 572	19 638
Sedibeng TVET College	10 756	10 918	11 417	11 938	12 299

The interception factor refers to the portion of demand within the market areas that the proposed student accommodation development will be able to capture. A conservative approach is applied to ensure a realistic outcome therefore, a 15% interceptor factor was used to calculate the effective demand. The NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030.

	2021	2022	2025	2028	2030
Number of students	38 327	38 829	40 421	42 152	43 392

[2] OECD, Education at a Glance 2014 OECD Indicators: OECD Indicators, p. 446-452

Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED	3 703	3 810	4 140	4 497	4 751

Clinics

Most clinics in the market area are clustered in Sebokeng. The clinic closest to the proposed development is the Vaal Men and Women's clinic in Duncanville and is located approximately 8.6 km from the proposed site. This illustrates the need for a clinic to serve the population in the PMA.

Year of full potential	**2021**	**2023**	**2025**	**2028**	**2031**
Clinic	1	2	3	5	4

The table above indicates that five clinics will be required by 2028 to serve the growing population in this area.

Innovation and Incubation Hub

The innovation and incubation hub can play an important role in establishing networks, partnership and an integrated mixed-use development space. It can also facilitate economic growth and create job opportunities through skills development and mentoring programmes. These skills can be implemented and used in various small businesses and various industries. Partnerships with various institutional and educational facilities can be established in thereby driving research programmes, can provide innovative inputs within various programmes run by the hub.

Supplementary Land-Uses

The minimum norms and standards is used to identify supplementary land uses. The population threshold indicates the number of people required to sustain a particular facility. Schools, clinics and government department offices are identified as additional land uses.

Conclusion and Recommendations

The recommendations provide two scenarios that incorporate development potential and requirements for residential units, retail and office space, and additional social amenities. Scenario one considers all residential units within a given year whereas scenario two excludes CRU and subsidised housing.

Scenario One

Scenario one looks at the requirements and the demand for various facilities for the proposed mixed-use development. The residential demand and requirements include all residential categories for both bonded and rental housing. The following table provides a breakdown of the residential demand and requirements for bonded housing.

	2021	**2023**	**2025**	**2028**	**2031**
Subsidised	839	1 412	1 996	2 895	4 209
FLISP	374	629	890	1 290	1 702
Affordable Housing	160	270	382	554	731

Middle Income	169	285	403	585	772
High Income	23	38	54	78	103
Total	**1 565**	**2 634**	**3 725**	**5 401**	**7 517**

The housing market is growing and there is a demand for new residential development. The greatest demand in the primary market area for bonded housing is subsidised and FLISP housing.

The following table provides a breakdown of the demand and requirements for rental housing.

	2021	**2023**	**2025**	**2028**	**2031**
CRU	135	228	322	467	617
Social Housing Primary Market	168	283	401	581	767
Social Housing Secondary Market	108	183	258	374	494
Affordable Housing	86	145	205	298	393
Middle Income	92	154	218	316	417
High Income	13	21	30	44	58
Total	**603**	**1 014**	**1 434**	**2 080**	**2 745**

There is a greater demand for CRU and social housing and is expected to increase to increase to 617 in 2031.

The following table provides a breakdown of the NED for student housing.

	2021	**2022**	**2025**	**2028**	**2030**
Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED (number of beds)	3 703	3 810	4 140	4 497	4 751
Number of beds per unit	4	4	4	4	4
Demand (number of units)	926	953	1 035	1 124	1 188

Based on a 15% interceptor factor, the NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030. By calculating the number of units required for student accommodation, it is recommended that each unit accommodate four students. The projected demand for units is 926 for the year 2021 and is expected to grow to 1 188 units by 2030.

The following table provides a breakdown of the number of social amenities required for each year, given the number of housing.

Year of Full Potential	**2021**	**2023**	**2025**	**2028**	**2031**
Crèche/nursery	3	5	7	10	7
Primary Schools	3	5	8	11	8

Year of Full Potential	2021	2023	2025	2028	2031
High School	2	3	4	6	4
Clinic	1	2	3	5	4
Libraries	1	2	3	5	4
Community Centre	1	2	3	5	4
Religious Centre	4	6	8	12	9
Post Office	1	1	2	2	2
Police Station	1	1	2	2	2

The following table indicates the retail and office space requirements for each respective year until 2031.

	2021	2023	2025	2028	2031
Total retail space demand	16 294	19 122	22 006	26 441	30 995
Total office space demand	1 354	2 773	7 292	8 880	12 182

It is recommended that the retail and office space is student-orientated to ensure that the student housing development is supported by the necessary retail and office services.

Scenario Two

The residential demand and requirements for scenario two exclude CRU and subsidised housing. The following table provides a breakdown of the projected residential demand.

BONDED					
	2021	**2023**	**2025**	**2028**	**2031**
FLISP	374	629	890	1 290	1 702
Affordable Housing	160	270	382	554	731
Middle Income	169	285	403	585	772
High Income	23	38	54	78	103
Total	**726**	**1 222**	**1 729**	**2 507**	**3 308**

The greatest demand is FLISP and affordable housing. The demand for FLISP housing is expected to increase to 1 702 by 2031 and the demand for affordable housing is expected to increase to 731 by 2031.

The following table provides a breakdown of the demand and requirements for rental housing.

RENTALS					
	2021	**2023**	**2025**	**2028**	**2031**
Social Housing Primary Market	168	283	401	581	767
Social Housing Secondary Market	108	183	258	374	494

RENTALS					
	2021	**2023**	**2025**	**2028**	**2031**
Affordable Housing	86	145	205	298	393
Middle Income	92	154	218	316	417
High Income	13	21	30	44	58
Total	**467**	**787**	**1112**	**1613**	**2129**

The greatest demand in terms of rental housing is social housing. The demand for social housing in the primary market area is expected to increase to 767 by 2031.

The following table indicate the demand for student accommodation in the market area, based on a 15% interceptor factor.

	2021	**2022**	**2025**	**2028**	**2030**
Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED (number of beds)	3 703	3 810	4 140	4 497	4 751
Number of beds per unit	4	4	4	4	4
Demand (number of units)	926	953	1 035	1 124	1 188

The NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030. It is recommended that each unit accommodate four students. Therefore, the projected demand for units is 926 for 2021 and is expected to grow to 1 188 by 2030.

The following table provides a breakdown of the number of social amenities required for each year.

Year of Full Potential	**2021**	**2023**	**2025**	**2028**	**2031**
Crèche/nursery	1	2	3	5	7
Primary Schools	1	3	4	6	8
High School	1	1	2	3	4
Clinic	1	1	1	2	3
Libraries	1	1	1	2	3
Community Centre	1	1	1	2	3
Religious Centre	2	3	4	6	8
Post Office	1	1	1	1	1
Police Station	1	1	1	1	1

The following table indicates the retail and office space requirements for each respective year until 2031.

	2021	2023	2025	2028	2031
Total retail space demand	16 294	19 122	22 006	26 441	30 995
Total office space demand	1 354	2 773	7 292	8 880	12 182

The three retail categories identified as those in highest demand include food and non-alcohol beverages (24.1%), clothing and footwear (10.5%), and recreation and culture (38.1%)

The percentages provided above indicate the suggested share of GLA that each of these retail facilities can contribute to the total retail space in the market area. In order to support and effectively establish a student oriented living space, it is recommended that retail is aimed at providing to the needs of students.

The top three office space categories as calculated using the office demand model include wholesale and retail trade, catering and accommodation (25.68%), finance, insurance, real estate and business services (18.15%), and community, social and personal services (18.92%). With the development of a student-orientated living space, it is recommended that office space are mainly focused on providing essential services to students and thereby creating a student-friendly environment.

1. Introduction

Phumaf Consulting Engineers appointed Urban-Econ Development Economists to undertake market studies for the highest and best mixed-use development for Unitas Park Extension 16 in Vereeniging, Gauteng Province. It is understood that the proposed development is intended to consist of residential units and additional developments complementing the proposed residential development. The research should confirm the demand for the proposed product and guide the developers towards the best-suited typology mix.

The proposed site is approximately 151 hectares in extent and is planned to include 7 250 high-density residential units. Unitas Park Extension 16 is currently owned by the Gauteng Provincial Government and is zoned as farmland.

The site has a township layout with 2 680 erven which was approved but not proclaimed or registered due to constrained wastewater treatment capacity and electricity upgrades required. The site is in a dolomitic zone and further tests will be undertaken to confirm the risk category.

1.1. Project Brief

The brief of the study reveals a specialised analysis to determine the capacity of the local market to absorb a new residential development with complementary developments. It is understood that this study will be used to calculate the current demand for, and market feasibility of a new residential development located in Vereeniging, Gauteng Province.

Any development is strongly linked to the geographic attributes of the proposed site, as well as the demographic and economic characteristics of the target market. The outcome of this study will include the following components:

- Spatial analysis of the larger region
- A macro-economic perspective of South Africa
- A socio-economic analysis of the target market
- A market trend analysis (market perspective)
- A market opportunity analysis
- A market potential analysis
- Determination of supplementary land uses demand factors

1.2. Methodology

The research, which is based on Urban-Econ's extensive modelling of the target market and access to various datasets, is supported by primary research in the form of site visits. Secondary data, such as published documents, also inform the findings of this study.

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1.3. Report Outline

This sub-section provides an overview of the report and how each section contributes to the concluding recommendations provided in the final section. The following structure is followed to ensure that each aspect is explored and analysed to yield maximum benefits from potential opportunities.

Section 1: Introduction

- This section provides a brief description of the purpose of the study, the approach, and methodology that is followed. This framework provides a clear understanding of the expected outcome of the study.

Section 2: Spatial Analysis

- The spatial analysis provides an analysis of the proposed site and the areas surrounding it, highlighting essential factors influencing potential development.

Section 3: Macro-Economic Analysis

- Various macro-economic aspects are analysed to provide a clear understanding of the key economic sectors and economic trends in the area.

Section 4: Socio-Economic Analysis

- This sub-section provides an overview of the socio-economic and demographic trends of the market area.

Section 5: Market Perspectives

- In this section, the local market dynamics related to the intended use of the development are investigated. This is done to obtain a holistic perspective on key trends that could potentially affect the success of the proposed development.

Section 6: Market Opportunity Analysis

- The market opportunity analysis assesses the potential of each property type, as identified in the previous section, by considering prevalent economic and other market trends within the primary and secondary market areas. The findings of the preliminary opportunity analysis identify the property types with the highest development potential for further analysis. This section eliminates properties that may not be well-supported by the local market and highlights those that are considered the best use for the proposed development site.

Section 7: Supplementary Land Uses

- This section uses industry standards and population density related requirements to identify and guide complementary land uses for the proposed development site.

Section 8: Conclusions and Recommendations

- The final section provides the key recommendations from the previous sections. Additionally, this section makes recommendations for the highest and best use of the proposed development site along with other auxiliary land uses to be considered for future development.

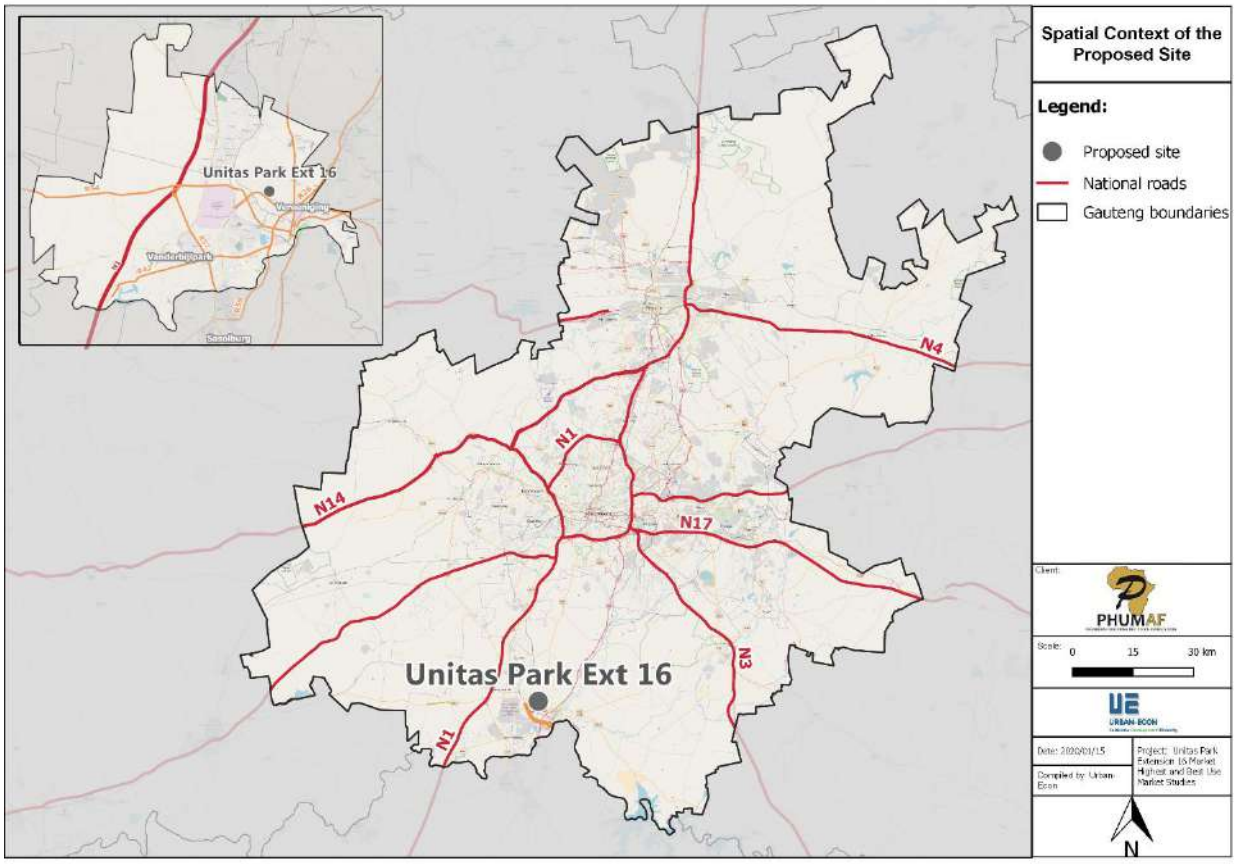
2. Spatial Analysis

The spatial analysis provides an analysis of the site and the area surrounding it. This section also unpacks the macro and micro spatial elements associated with the site and the area surrounding the proposed development site.

2.1. Macro-Level Analysis

The analysis of the site in the macro context highlights the proposed site in relation to the greater spatial environment in which it exists. The objective of this section is to establish connections and linkages from the site to the rest of the surrounding areas and to illustrate the expected movement of people both to and from the proposed site. The following map provides a macro perspective of the proposed development site within the context of the Gauteng province.

Map 1: Macro-Level Analysis



Source: QGIS, 2019

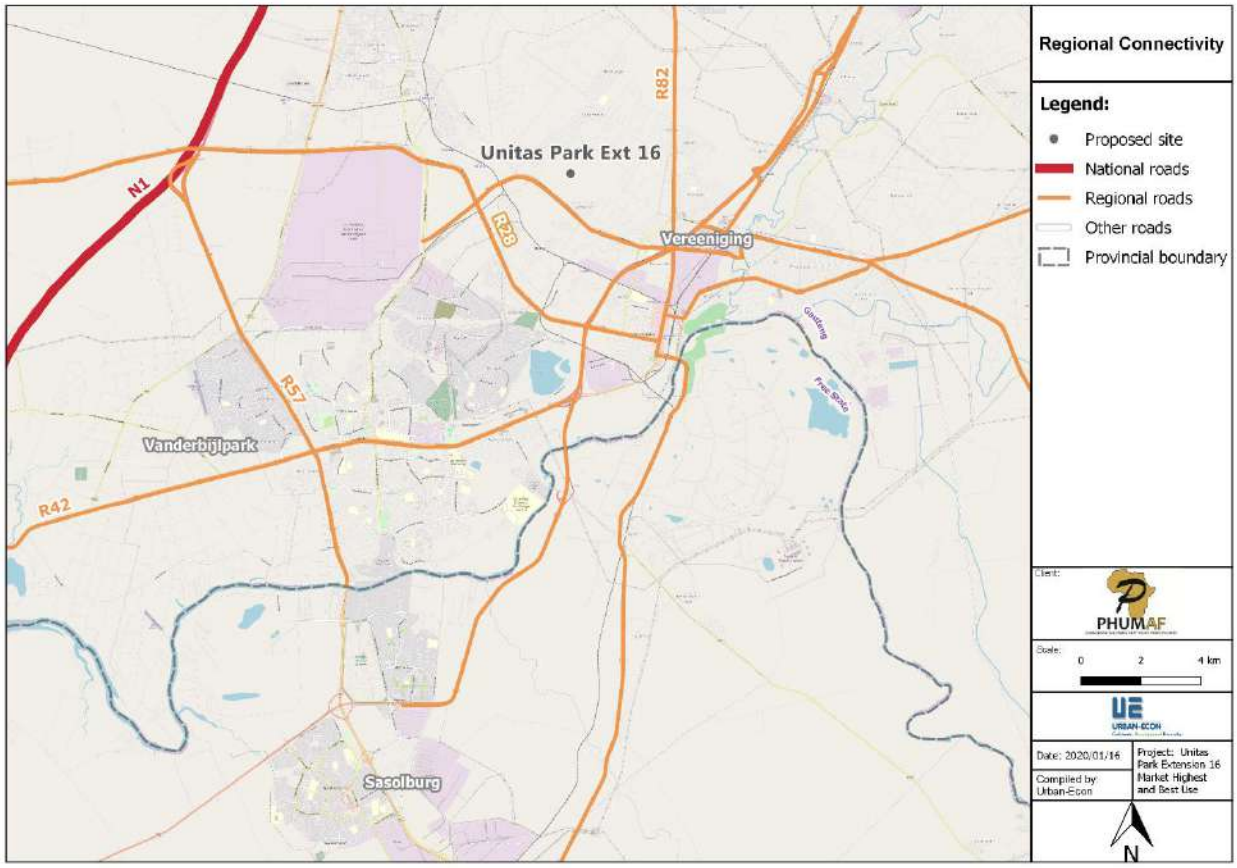
The proposed development is located in Vereeniging, in the western part of Emfuleni Local Municipality. Vereeniging is located approximately 60 km south of Central Johannesburg, 120 km from Tshwane. Vereeniging is located approximately 12 km from the Free State provincial boundary[3].

[3] Distance to the Free State border was measured from the proposed development site in Vereeniging to the nearest point on the Free State boundary accessed by road.

2.2. Regional Connectivity

Regional connectivity assesses the connections of the proposed development site in relation to the rest of the province; it also illustrates the important national and regional routes that grant access to the site and the rest of the province. The regional connectivity of the proposed development site is illustrated in the map below.

Map 2: Regional connectivity



Source: QGIS, 2019

The N1 national road is located approximately 12 km from the proposed site. Other major towns within close proximity include Vanderbijlpark (approximately 17 km), Sasolburg (approximately 32 km), and Meyerton (approximately 17 km). The R59 road facilitates traffic between Vereeniging and Sasolburg, while the R42 provides access to Vanderbijlpark.

2.3. Micro Context

The micro-level analysis aims to provide a more detailed perspective on the proposed development site by assessing the site's location in terms of local access routes and its surroundings. The following map depicts the local access and other routes providing access to the site.

Map 3: Site-level analysis

Source: QGIS, 2019

The proposed development is located in Unitas Park along the R54 road, which connects with the R26 road as well as the N1 national road. It should be noted that there is no direct access from the R54. Large areas surrounding the proposed site are vacant, while other land uses also include agricultural holdings and residential land use, amongst others. The surrounding land uses are discussed in more detail in sub-section 2.4.

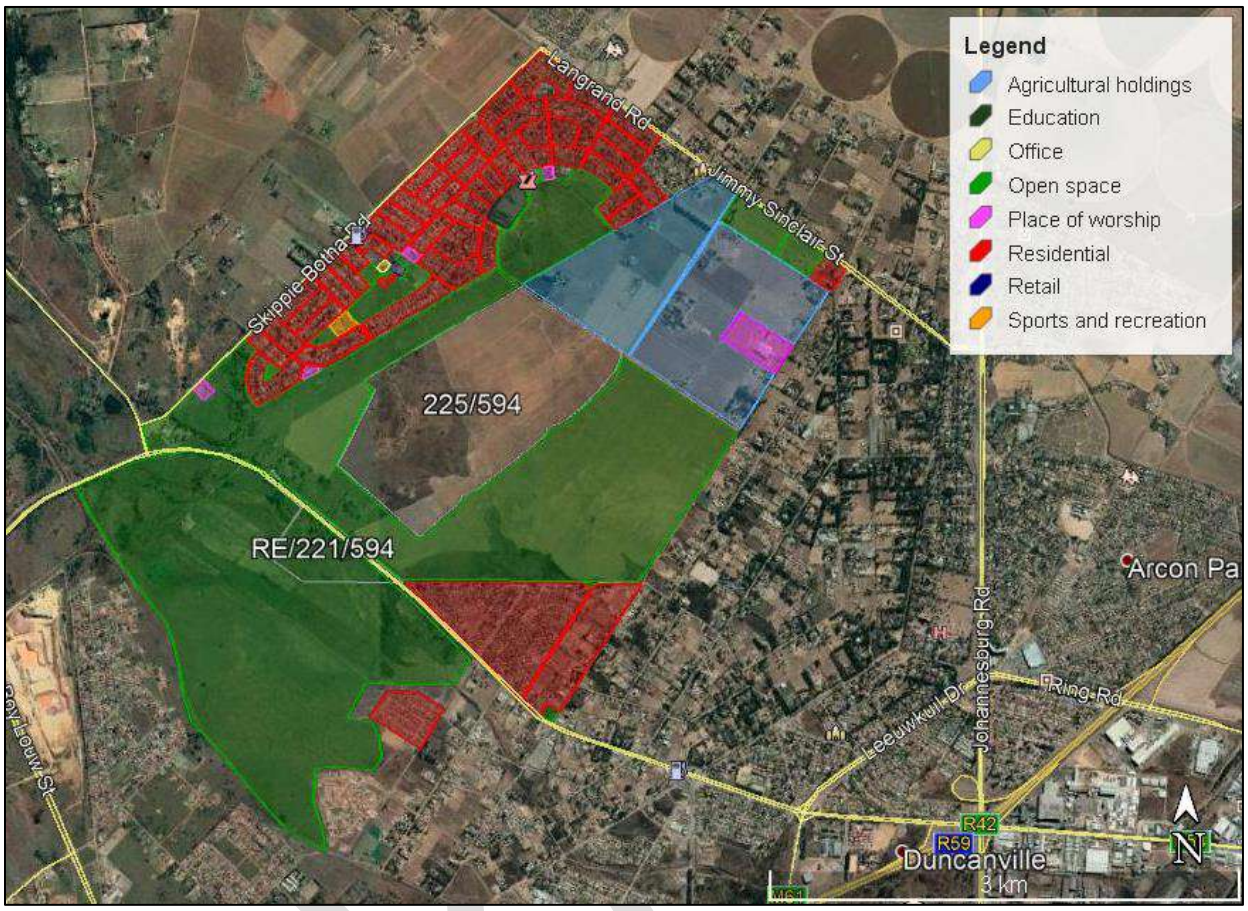
The map above shows some of the main suburbs within close proximity to the site. These suburbs are Steelpark (located towards the south of the proposed development), Sonlandpark (located towards the north of the proposed development), Waldrif, Arconpark (both located east of the proposed development), and Duncanville (situated southeast of the proposed development).

The proposed site can not be access from any regional or other major roads, but only from smaller roads within the neighbourhood. Additional access points from other roads can be considered to improve access to the proposed site.

2.4. Surrounding Land Uses

Analysing the surrounding land uses is essential to assess the appropriateness of the site and whether the proposed development will fit into the existing urban fabric. The following maps present the land uses surrounding the proposed development site.

Map 4: Surrounding land uses



Source: Google maps, 2020

A site visit was conducted in which the major land uses surrounding the proposed site were identified. The major land uses surrounding the proposed development site include open spaces, residential development, and agricultural holdings. A few churches exist in the area, along with some small retail facilities and a sports and recreational space.

The proposed development will be a mixed-use development with the potential to add significant value to the area. The proposed mixed-use development will complement the existing urban fabric by providing supplementary services, activities, and other complementary land uses.

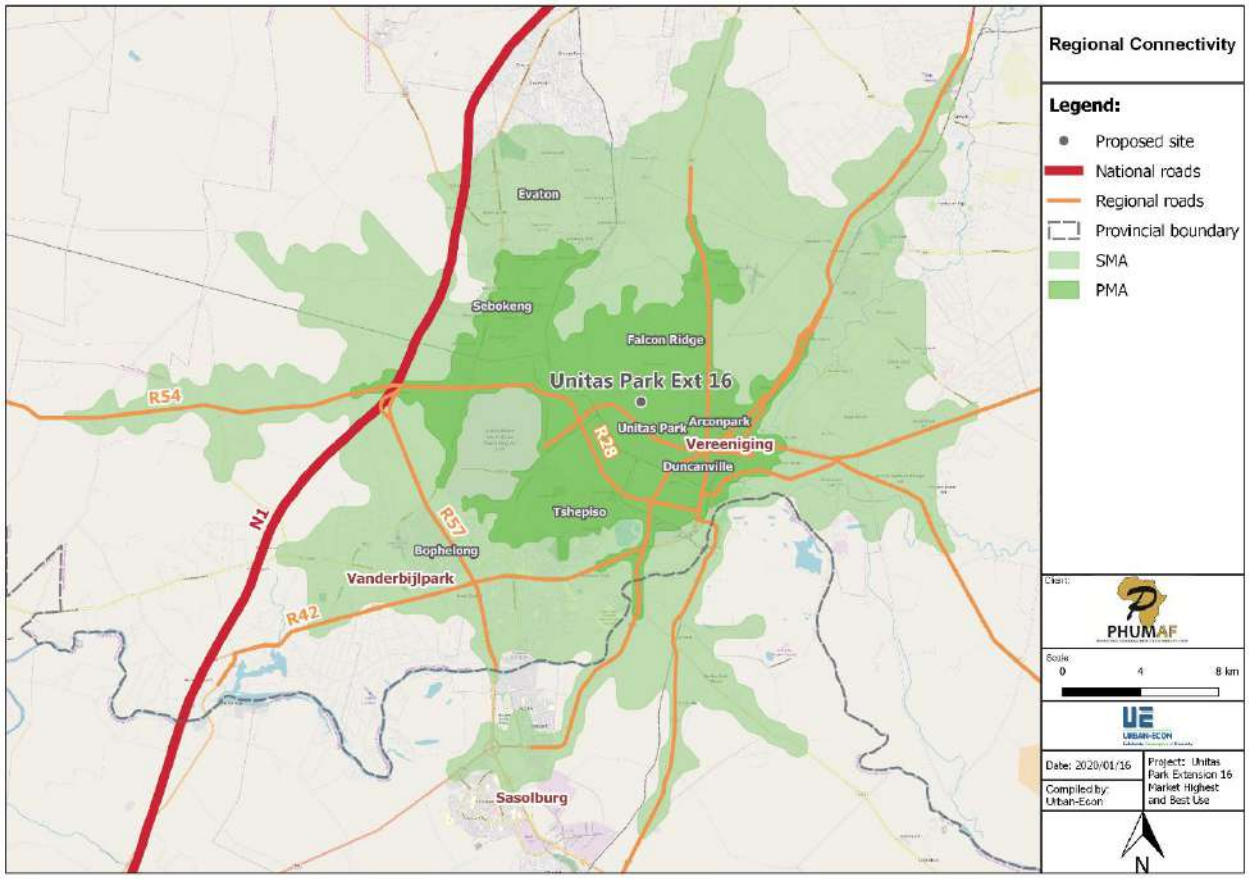
2.5. Market Area Delineation

The market area delineation makes use of several factors to derive an appropriate market area that is used to calculate the demand for housing and complementary land-uses. The market area delineation highlights the expected boundaries of the market area from which the proposed development may draw potential demand. Therefore, the market area is used to extract the necessary demographic and socio-economic data collated to simulate a demand scenario for the proposed development.

Two market areas were delineated for the proposed residential development. These market areas were based on 15-minutes' drive time for the primary market area and 25-minutes' drive time for the secondary market area.

The primary market area consists of Sebokeng, Falcon Ridge, Duncanville, Arcon Park, and Tshepiso. These areas represent the demographics of potential residents. The secondary market area consists of other outlying areas from which people may want to relocate. This market area includes a large part of the Vanderbijlpark and northern areas of Sasolburg. The primary and secondary market areas are illustrated in the map below.

Map 5: Market area delineation



Source: QGIS, 2019

Based on the drive time analysis, the location of the proposed site has the ability to attract potential market from far-reaching areas such as Vanderbijlpark and some areas of Sasolburg.

3. Macro-Economic Analysis

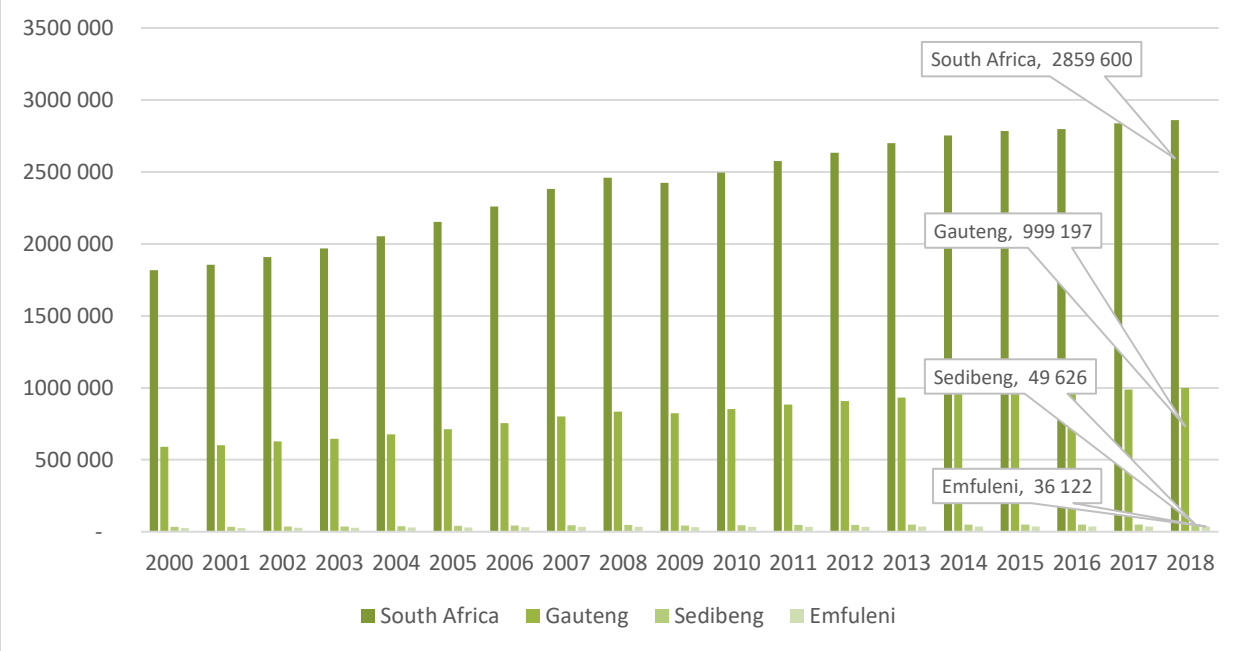
The macro-economic profile provides a detailed assessment of the composition and stability of the national and regional economies. The objective of the macro-economic analysis is to highlight significant economic trends that are likely to influence the development potential of the proposed development. The economic indicators determine specific economic trends that are used to assess the future potential growth of the local economy. In brief, the macro-economic profile covers the following components:

- National and provincial economic production
- Economic sector contribution
- Interest rate trends
- Inflation rate trends

3.1. GDP / GVA

A country's performance is measured by the growth of the gross domestic product (GDP) for each of its economic sectors. Gross domestic product is defined as the total value of goods and services that were produced within a specific geographical area during a particular period. The following figure represents the GVA growth for South Africa, Gauteng, Sedibeng District Municipality, and Emfuleni Local Municipality.

Figure 1: Gross Value Added (Constant Prices in R million) 2000 - 2018

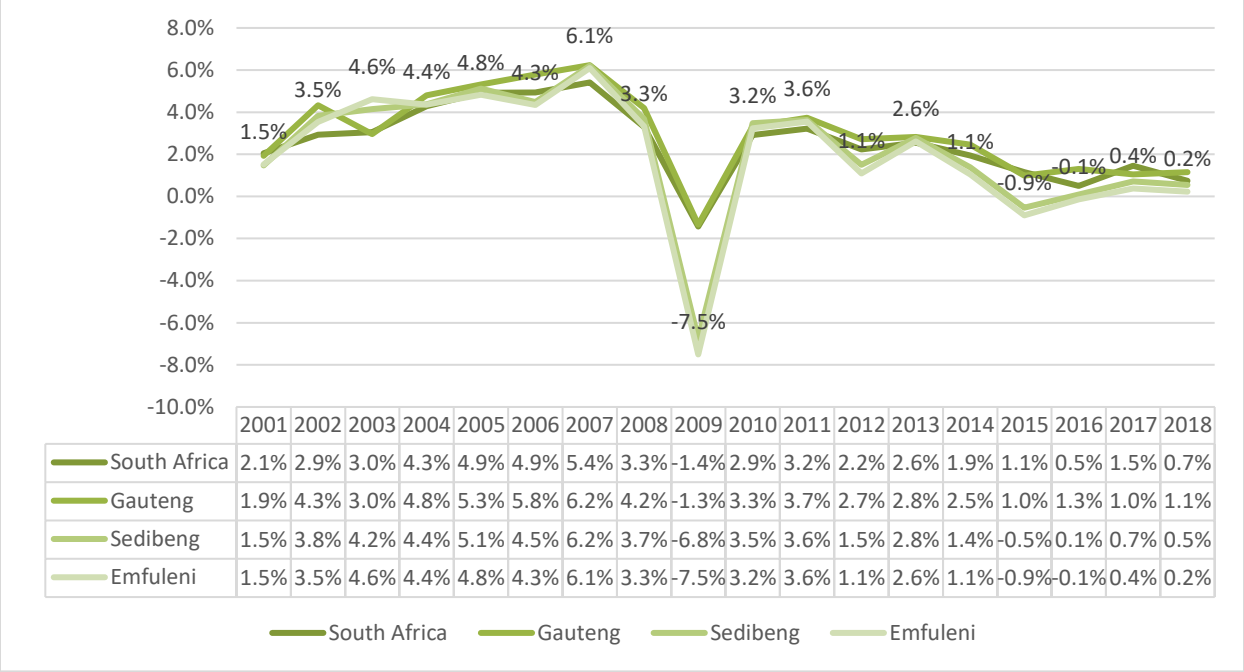


Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

According to the data displayed in the figure above, the GVA output of South Africa in 2018 was approximately R2.85 billion. From this trend, the national economy has experienced positive growth since 2 000, which is expected to continue. A notable decline in the South African GVA in from 2008 to 2009 can be identified, due to the Global Recession. The economy of South Africa also experienced stubborn growth since 2015.

The annual growth rates of the national, provincial, and local economies are presented in the figure below.

Figure 2: GVA Growth Trend 2000 - 2018



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
South Africa	2.1%	2.9%	3.0%	4.3%	4.9%	4.9%	5.4%	3.3%	-1.4%	2.9%	3.2%	2.2%	2.6%	1.9%	1.1%	0.5%	1.5%	0.7%
Gauteng	1.9%	4.3%	3.0%	4.8%	5.3%	5.8%	6.2%	4.2%	-1.3%	3.3%	3.7%	2.7%	2.8%	2.5%	1.0%	1.3%	1.0%	1.1%
Sedibeng	1.5%	3.8%	4.2%	4.4%	5.1%	4.5%	6.2%	3.7%	-6.8%	3.5%	3.6%	1.5%	2.8%	1.4%	-0.5%	0.1%	0.7%	0.5%
Emfuleni	1.5%	3.5%	4.6%	4.4%	4.8%	4.3%	6.1%	3.3%	-7.5%	3.2%	3.6%	1.1%	2.6%	1.1%	-0.9%	-0.1%	0.4%	0.2%

Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The local and district GVAs have experienced similar growth rate trends, whereas generally, provincial and national GVAs experienced similar growth trends. Based on the data, the local and national economies have in recent years experienced a downturn in their annual growth rates. After the 2008/09 recession, the South African economy recovered from negative economic growth to approximately 2.9% GVA growth in 2010.

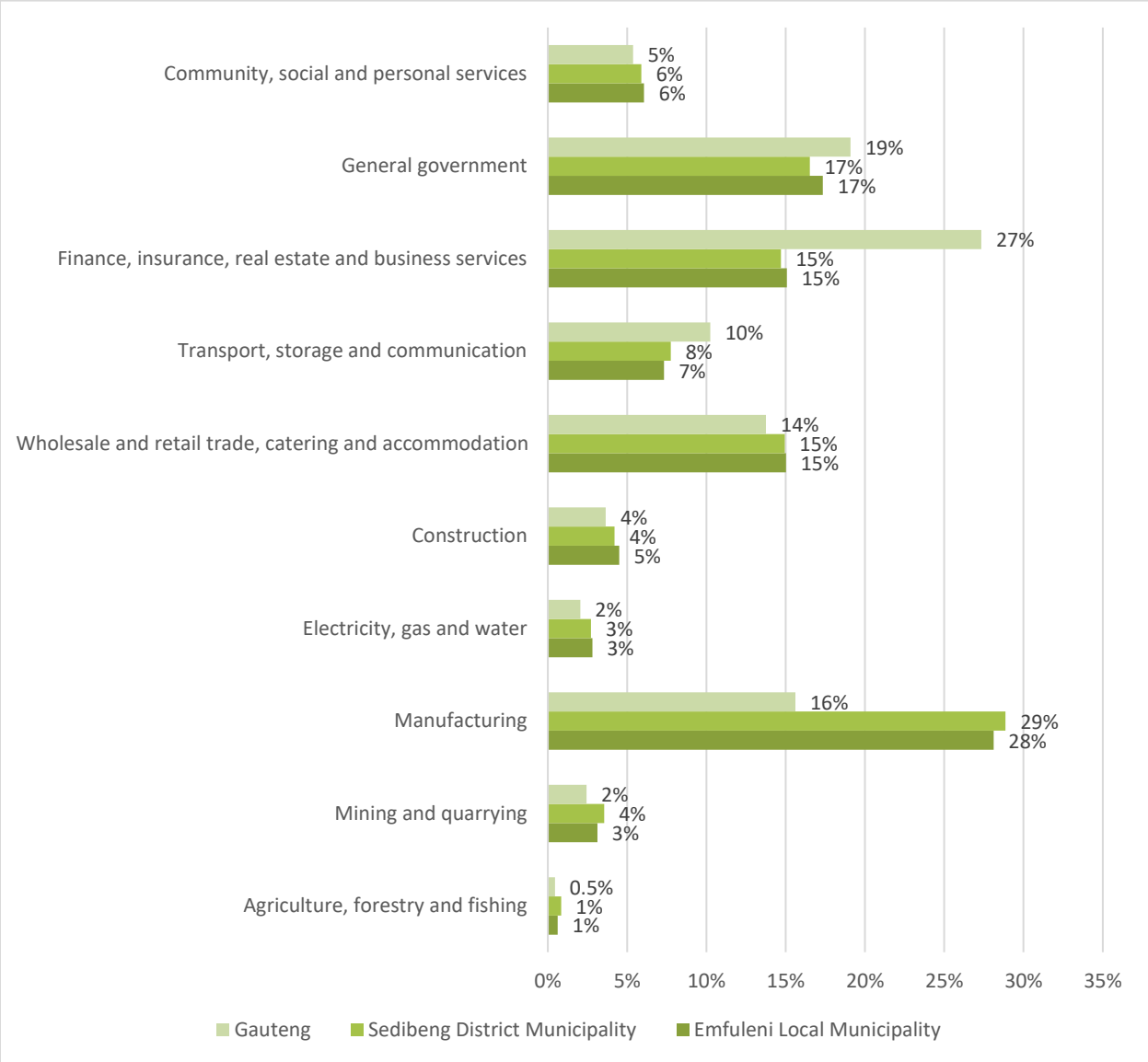
However, since 2011, the South African economy has experienced an incremental decline, with a reported GVA growth of 0.7% in 2018. At a provincial level, the GVA growth increased slightly from 1% in 2015 to 1.3% in 2016. The growth rate decreased in 2017, followed by a slight increase again in 2018 opposing the national trend. The GVA growth in 2018 for Gauteng was recorded at 1.1%, the Sedibeng District Municipality at 0.5%, and 0.2% in the Emfuleni Local Municipality. Recently, the GVA has grown by 3.1% quarter-on-quarter growth was recorded from quarter one to quarter two in 2019, with an annual growth of 0.9% from 2018 to 2019.

Generally, GVA for Emfuleni Local Municipality (LM) experienced a slowed economic growth trend from 2001 to 2018. The GVA growth trend shown in the figure above indicates little growth since 2015 – an indication that the economy of Emfuleni LM is stagnant. A stagnant growth trend also indicates that other economic indicators such as the unemployment rate are increasing. This may have further implications where people will seek job opportunities in neighbouring areas such as Johannesburg, and travel between their place of residence and areas of economic activity or where new job opportunities arise.

3.2. Economic Sector Contribution

Analysing the various economic sectors allows us to determine the overall economic contribution made by each sector and how they relate to each other. The following figure illustrates the contribution made by each sector to the respective geographical area.

Figure 3: GVA contribution per sector

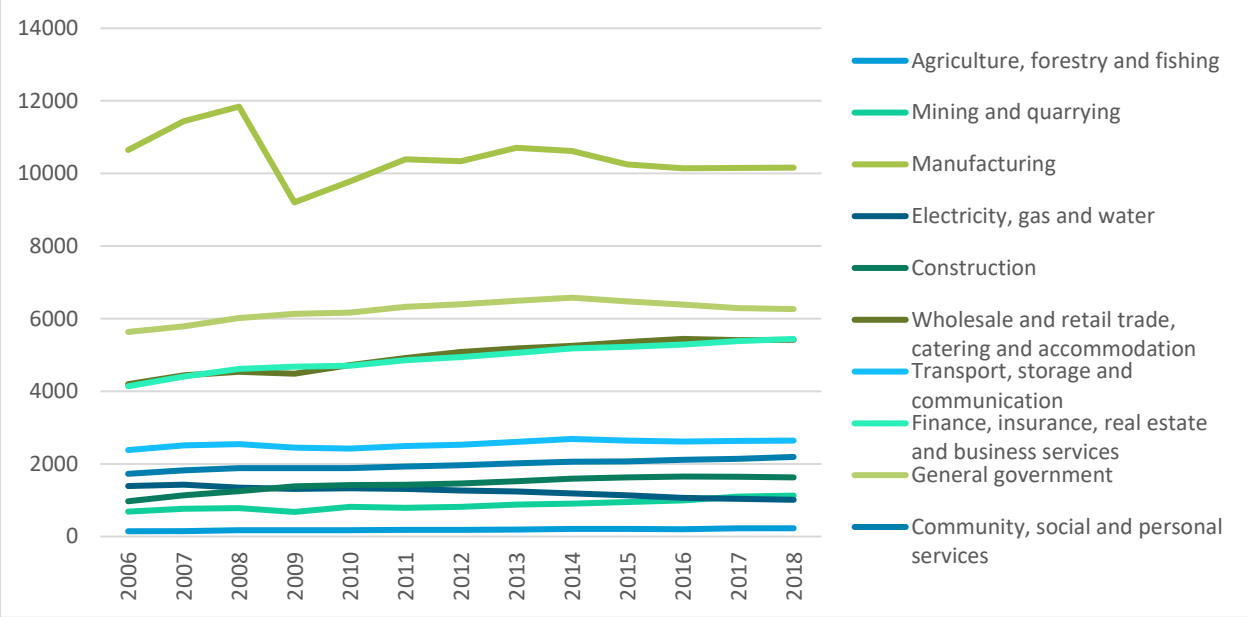


Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The figure above provides the contributions made by economic sectors on the provincial, district, and local levels. The manufacturing sector makes the largest contribution (28%) to the total GVA of Emfuleni LM, followed by general governance contributing 17% to the total GVA of the local municipality.

The following figure shows the sectoral growth trends for Emfuleni Local Municipality.

Figure 4: Sectoral growth in Emfuleni Local Municipality (2006 – 2018)



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The trends provided above indicate that general government, finance, insurance, real estate and business services, and wholesale and retail trade, catering and accommodation experienced growth from 2006 to 2018. Manufacturing (the largest contributor to the municipality's GVA) has shown a notable decline indicating that the industry is struggling. This will affect the local economy and also employment opportunities within the industry.

ArcelorMittal, a major supplier and manufacturer of steel products, is based in Vereeniging and created many job opportunities for people in Vereeniging and surrounding areas. However, lacklustre performance, increasing electricity prices and increasing costs of other raw materials have had a major impact on this industry, resulting in a 30.5% decrease in share price in the past year, large-scale job losses and a significant drop in headline earnings[4]. Moving forward, this will continue to have a major impact on employment and the unemployment rate in the area and will also affect the household income of people employed in the area.

These impacts will also affect the GVA of the local municipality and result in a further decline in one of the municipality's leading economic sectors.

Manufacturing makes the largest contribution (28%) to the total GVA of Emfuleni LM. However, this leading economic sector is expected to decline as a result of increasing electricity prices and the increasing costs of other raw materials. The local economy will be affected in terms of employment, and the revenue generated through manufacturing and other industries and sectors, depending on this sector.

[4] Eye Witness News: Arcelormittal Layoffs May Be the First Of Many, Solidarity Warns. July, 2019. Available at: https://ewn.co.za/2019/07/11/arcelormittal-layoffs-may-be-the-first-of-many-solidarity-warns.

Another sector making a significant contribution to the GVA of the local municipality is the general government sector. This sector contributes 17% to the total GVA of Emfuleni LM. With this said, potential land uses for the general government sector could be considered and incorporated into the proposed development.

3.3. Interest and Inflation Rates

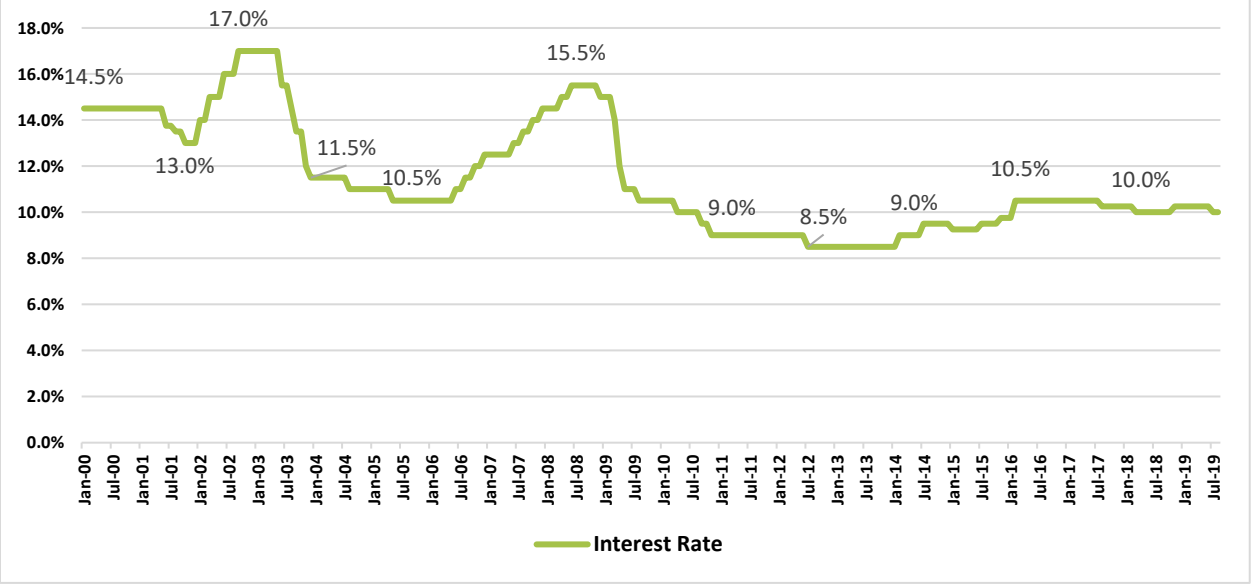
This sub-section provides an overview of the national interest and inflation rates over a period of 20 years (from January 2000 to January 2020).

3.3.1. Interest Rate

The interest rate is an additional market indicator that influences household expenditure and home affordability. Interest rates are directly linked to the level of consumer credit; thus, lower interest rates may result in higher disposable income for consumers with more credit facilities available. Additionally, interest rates have a direct effect on the housing market since a higher interest rate will have a negative impact on a homeowner's ability to secure a home loan and their ability to repay a home loan.

The real interest rate can be defined as the interest an investor expects to receive after allowing for inflation. It can be described more formally by the Fisher equation, which states that the real interest rate is approximately the nominal interest rate minus the inflation rate.

Figure 5: Interest rate



Source: South African Reserve Bank, 2015 - 2019

The most recent published statistics on the prime interest rates indicate that the interest rate has been decreasing since 2008, with a slight upward trend since 2013, seeing an increase to 10.5% in 2016. The current interest rate stands at 9.25%, which is down by 0.75% since the beginning of 2019. This is a good indication of home affordability since a decline in the interest rate enables better bond affordability and household expenditure.

Consumers are expected to have better access to capital due to the anticipated Repo rate reaching 6.25% in 2020, which is down from the average 6.5% repo rate as recorded in December 2019[5].

3.3.2. Inflation Rate

Inflation has a contributory effect on the level of disposable income within a country, which in turn influences the ability of households to gain access to home loans and credit facilities. An inflation rate can be broadly defined as the increase in prices of goods and services within a country, as presented in the national Consumer Price Index (CPI).

In terms of the residential market, inflation acts as a precursor of the prime interest rate since a rise in the inflation rate causes interest rate trends to follow suit. Thus, inflation can act as an indicator of the potential increase or decrease in the prime interest rate.

Figure 6: Inflation rate

Source: South African Reserve Bank, 2015 - 2019

The inflation rate experienced a drastic downward trend from 13% in the fourth quarter of 2002 to 0.2% in 2003, with a steep increase in 2008 to 13.7%. The inflation rate stabilised after the recession in 2008, with an inflation rate of 3.2% apparent in 2010.

Since 2011, the inflation rate has remained relatively stable, and the current inflation rate stands at 3.7%. A lower inflation rate decreases financial pressure on households, which bodes well for home affordability as households have increased disposable income. Economic analysists expected an average of 4.5% for headline inflation in 2019. The projection for 2020 is 4.8% and 5.0% for 2021[6].

[5] Business Tech: What to expect from the South African Reserve Bank in 2020. 23 December 2019. Available at: https://businesstech.co.za/news/finance/363032/what-to-expect-from-the-south-african-reserve-bank-in-2020/

[6] Bureau for Economic Research (BER): Survey of Inflation Expectations. 4th Quarter 2019.

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4. Socio-Economic Analysis

The aim of the socio-economic profile is to provide an overview of the population characteristics of the market area. The profile elaborates on information that will be used to inform the demand calculation model for housing in the delineated market area. This will establish whether the proposed development can be absorbed by the demand in the market area. The following aspects are investigated in this section:

- Population and household profile
- Age profile
- Employment profile
- Employment per industry
- Household income profile
- Education profile

The data used in this section are primarily based on secondary statistical data which inform Urban-Econ's calculations and model. The socio-economic profile plays an essential role in establishing the viability of any development as it provides an understanding of local socio-economic trends, issues, and dynamics.

4.1. Population and Households

The population of the market forms the cornerstone of any residential development since it directly influences the demand for housing. A historic five-year average growth rate is utilised to project the future population size, which in turn is incorporated into the demand calculation model to calculate the future demand for residential development. The current and projected populations of the direct and indirect market areas are provided in the table below.

Table 1: Population and household profile

	2020	2021	2025	2030
Primary Market Area Population	318 195	319 531	324 932	331 812
Primary Market Area Household	98 875	99 855	103 872	109 123
Secondary Market Area Population	513 824	515 982	524 704	535 814
Secondary Market Area Household	163 698	165 320	171 971	180 663

Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The population and household profiles are based on data from the National Census of 2011. The population growth projections are based on a five-year historic growth rate of 0.42% per annum and a household growth rate of 0.99%. These growth rates were used for both the primary and secondary market areas. The growth rates were applied to the population and household figures to project the future population growth using 2011 as the base year. Based on the findings of the population projections, approximately 318 195 people currently reside within the primary market area, comprising 98 875 households.

The projected population for 2021 is estimated at 319 531 people, comprising 99 855 households in the primary market area whereas 515 982 people and 165 320 households are expected in the secondary market area.

The population of the primary market area is expected to increase to 331 812 people and 109 123 households by 2030.

Population growth is a good indication of the demand for housing. The projected increase in the population figures and the number of households shows that the demand for housing in the demarcated market area is growing. As the population increases, the labour pool also increases; thus, more people are situated near various employment opportunities.

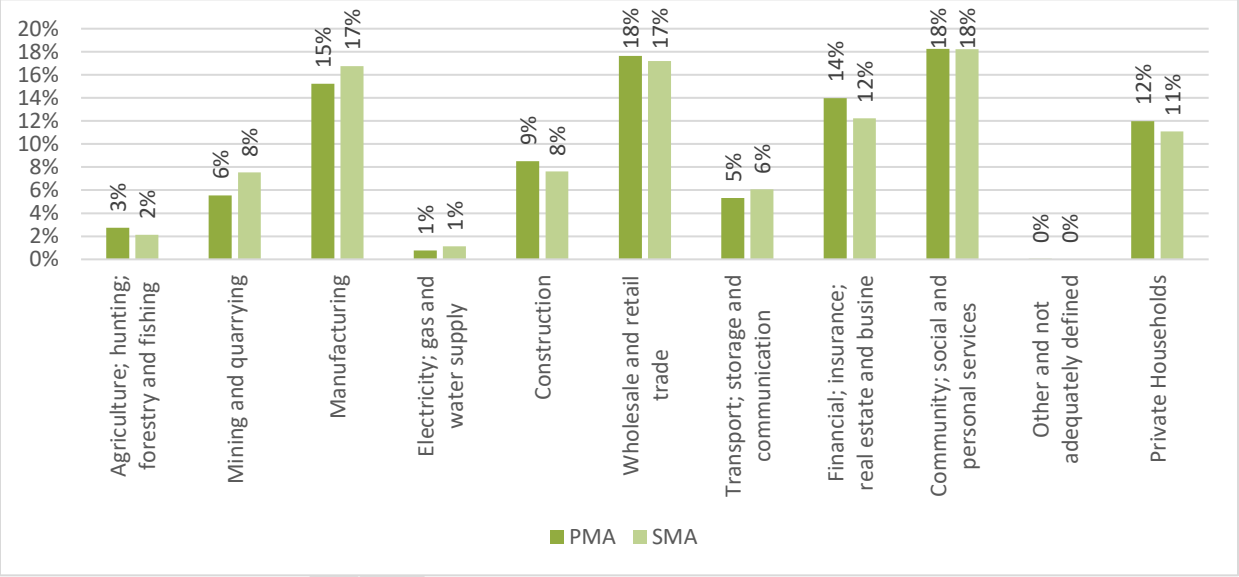
4.2. Employment

This sub-section relays information and data relating to employment within both the primary and the secondary market areas. The key topics discussed in this sub-section are the employment per industry and the employment profile, which looks at the employed and unemployed population within each market area.

4.2.1. Employment per Industry

The figure below indicates the employment per industry (provided in percentages for the respective market areas).

Figure 7: Employment per industry



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

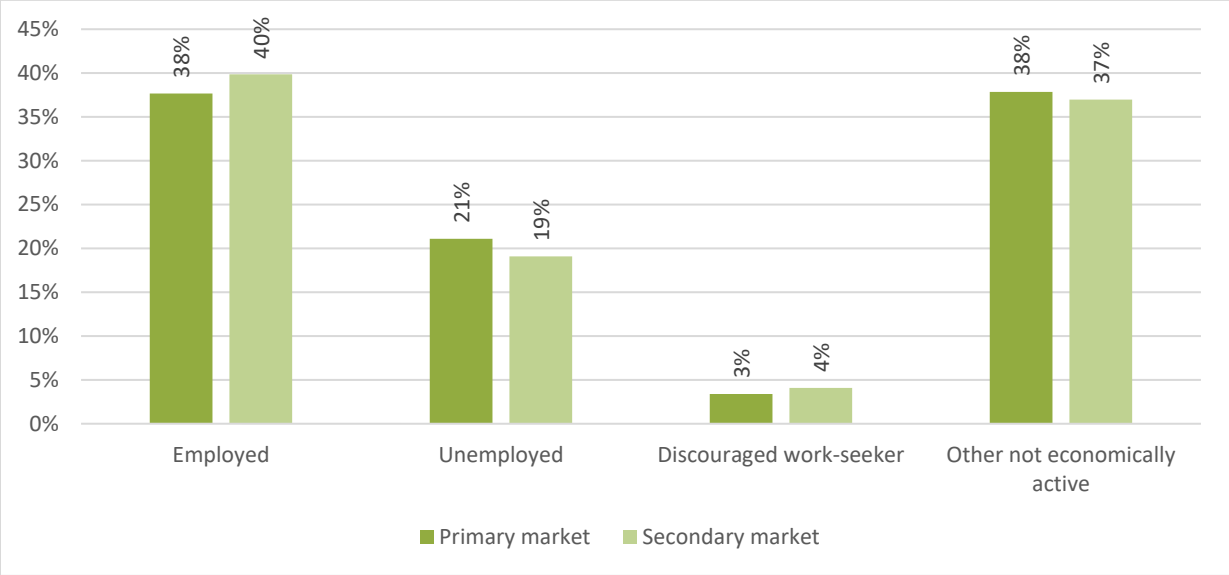
From the data provided in the figure above, it is evident that community, social and personal services, and wholesale and retail trade make the largest contribution towards employment in both the primary and the secondary market areas. Community, social and personal services contribute 18% to the employment of both the primary and the secondary market areas (respectively) whereas wholesale and retail trade contributes 18% to the primary market area employment and 17% to the secondary market area employment.

The industries making the largest employment contribution in the primary and secondary market areas are community, social and personal services, and wholesale and retail trade. This indicates that these are the most prominent industries in the area – therefore, additional land uses related to these industries can be considered for the proposed mixed-use development. Some of these facilities include offices for public administrative services, human health activities, and educational support services.

4.2.2. Employment Profile

The employment profile aims to provide a detailed breakdown of the activity status of the local population. The data used for the employment profile were derived from Stats SA. The employment profile of the market areas is provided in the figure below.

Figure 8: Employment profile



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

Of the total population in the primary market, 38% are employed, 21% are unemployed, 3% are discouraged work-seekers and 38% are other not economically active population. These figures indicate that of the working-age population, most are not employed or economically active. Thus, a large portion of the population has a low disposable income, and therefore, does not have access to capital to buy a home.

4.2.3. Unemployment Rate

The following table provides the unemployment rate of the Emfuleni Local Municipality (LM) from 2008 to 2018.

Table 2: Unemployment rate of Emfuleni Local Municipality (provided in percentages)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Emfuleni LM	29.3	30.0	30.9	30.5	30.6	30.2	30.3	30.6	31.8	32.1	31.5

Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The data provided in the table above show that the unemployment rate in Emfuleni LM increased from 29.3% in 2008 to 31.5% in 2018. An increasing unemployment rate results in a decrease in average household income, resulting in less disposable income for the population.

The unemployment rate is increasing, which means that people have less disposable income. The impact on the housing market is that people have less money available and, therefore, may not be able to purchase a house or may encounter bond repayment issues.

4.3. Age Profile

An age group classification is conducted to determine the percentage of the potentially economically active (PEA) population in relation to the not economically active (youth and retired) population. This illustrates the percentage of the population that will make up the majority of the potential target market. The following table presents an explanation of the age group classifications.

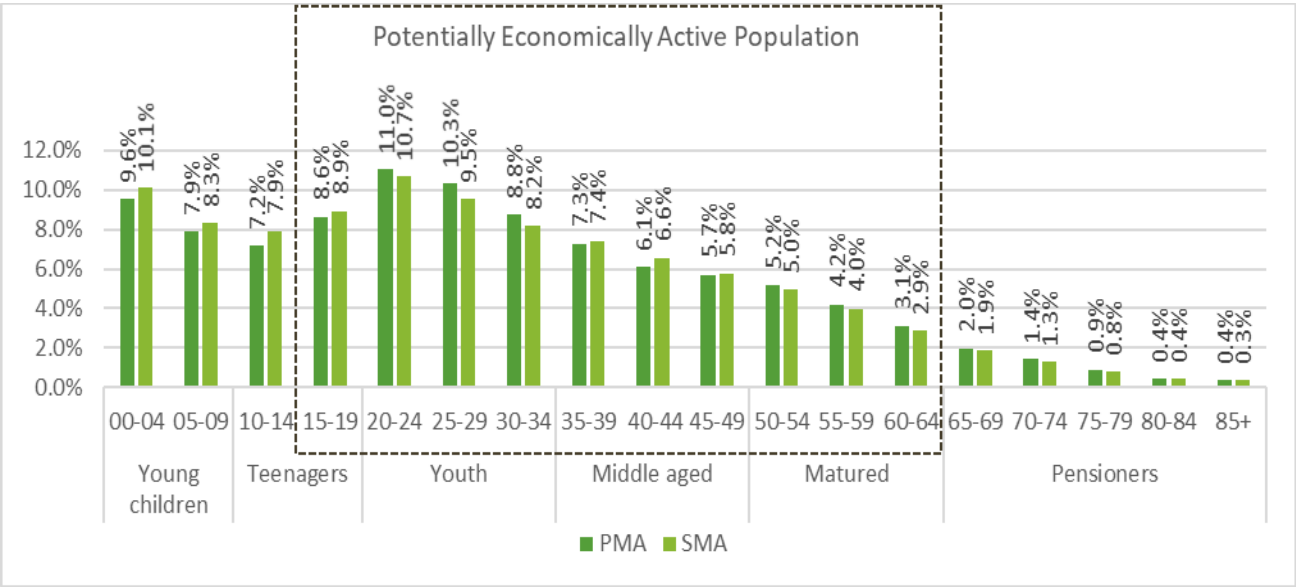
Table 3: Age group classification

Age	Category	Socio-Economic Contribution	Dependence
Younger than 19 years	Junior population	Non-working population who do not generate any form of income	Dependent on an adult to provide to their needs
Between 19 to 64 years	Potentially economically active (PEA) population	The working population and main generators of income	Independent/usually provide for the other groups
65 years and older	Senior population	Retired population who are no longer productive within the working environment	Dependent on government or relatives to provide for their needs

Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The age profile of the market area is indicated in the figure below.

Figure 9: Age profile



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The primary market area consists of approximately 70% of the total potentially economically active (PEA) population, whereas 69% of the secondary market area is potentially economic active population. Based on this data, it is assumed that most of the population within the delineated market area can contribute to both the national and local economies. Both the primary and secondary market areas have a moderate number of young dependents relying on the support of the economically active population.

The total PEA population accounts for approximately 70% of the total population. Due to this high percentage of PEA population, a large portion of the population is open to employment and to generate personal income. In turn, this generates a higher disposable income, which increases housing (bonded and / rental housing) affordability in the area.

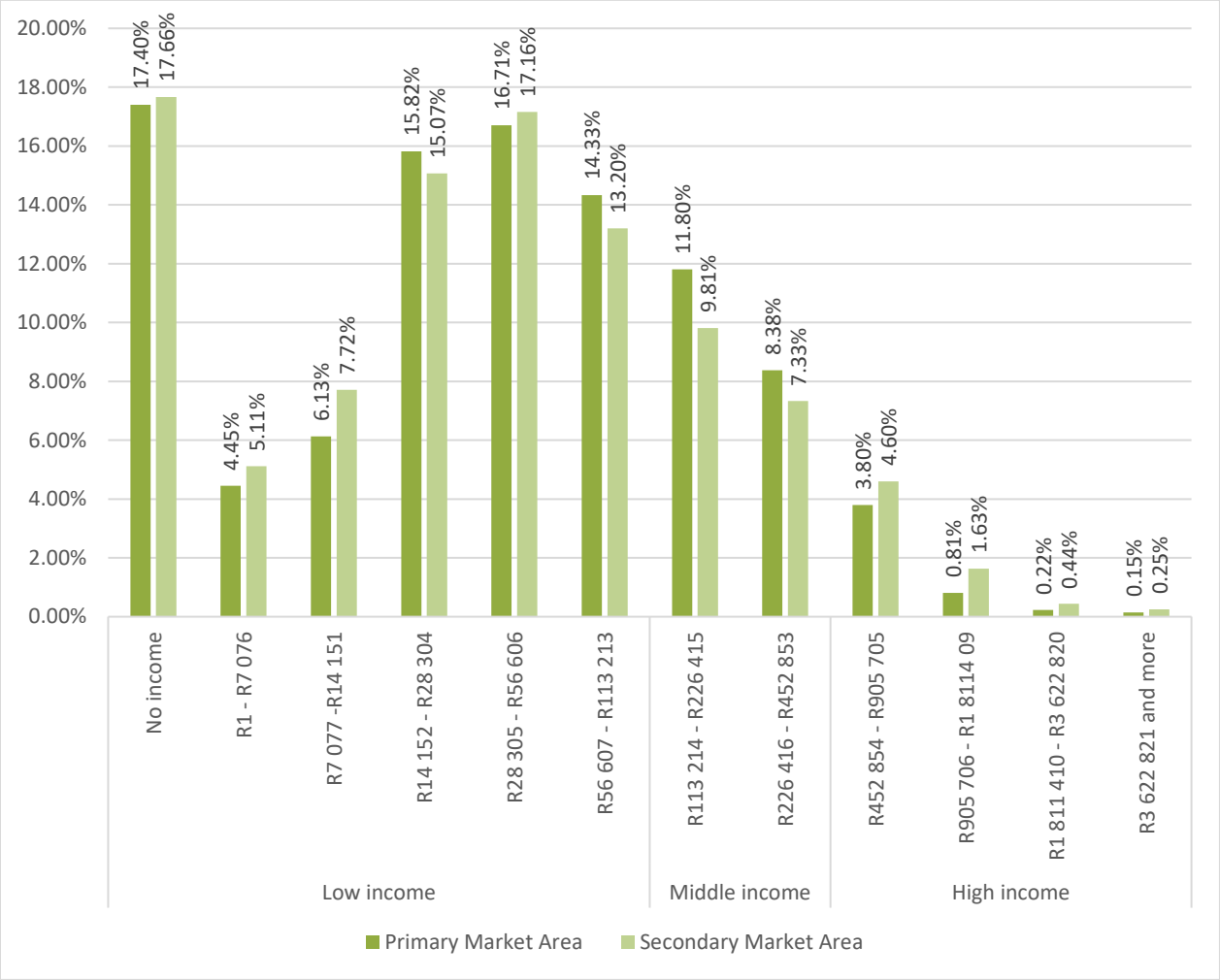
It should be noted that a moderate portion of the population is below the age of 15 years and therefore it can be assumed that the demand for various goods and services will continue to exist as the younger portion of the population become economically active. A large number of the population are economically active meaning that a large portion of the population can potentially spend money on housing and goods and services at retail facilities. However, as indicated in sub-section 4.2.2. the unemployment rate in the market area is increasing and thereby indicating that people have less disposable income. This could also indicate the need for additional employment opportunities.

4.4. Household Income

The household income profile assesses key factors that determine the viability of residential developments. Household income illustrates the overall prosperity of the local population and is a measuring tool to calculate the demand for housing across all income brackets.

The household income reflects the total amount of income available in the direct market area. Higher disposable household income is a good indication for any prospective development. The percentage distribution of household income in the market areas is presented in the figure below.

Figure 10: Household income profile



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The figure above shows the distribution of households in the market areas according to household income. Most households in both the primary (75%) and the secondary markets (76%) fall within the low-income band and earn R113 213 per annum or less. Approximately 17% of both the primary and secondary markets have no income. Approximately 20% of the primary market and almost 17% of the secondary market fall within the middle-income band, earning between R113 214 and R452 853 per annum.

A small proportion of the population in the primary market (5%) and in the secondary market (7%) fall within the high-income band. The largest portion of the population (16.7%) of the primary market area earns between R28 305 and R56 606, with a significant proportion of the primary market population (almost 16%) earning between R14 152 and R28 304.

A large portion of the population falls within the low-income brackets, indicating that residents do not have necessarily have access to capital to purchase a house.

4.4.1. Weighted Average Income

Weighted average income indicates the annual and monthly income per household within the primary and secondary market areas. The affordability of housing options is made apparent by calculating the average household income. The weighted average income of households within the primary and secondary market areas is indicated in the table below.

Table 4: Weighted average income

	Annual Weighted Income	Monthly Weighted Income
Primary Market Area	R132,466.37	R11,038.86
Secondary Market Area	R152,837.01	R12,736.42

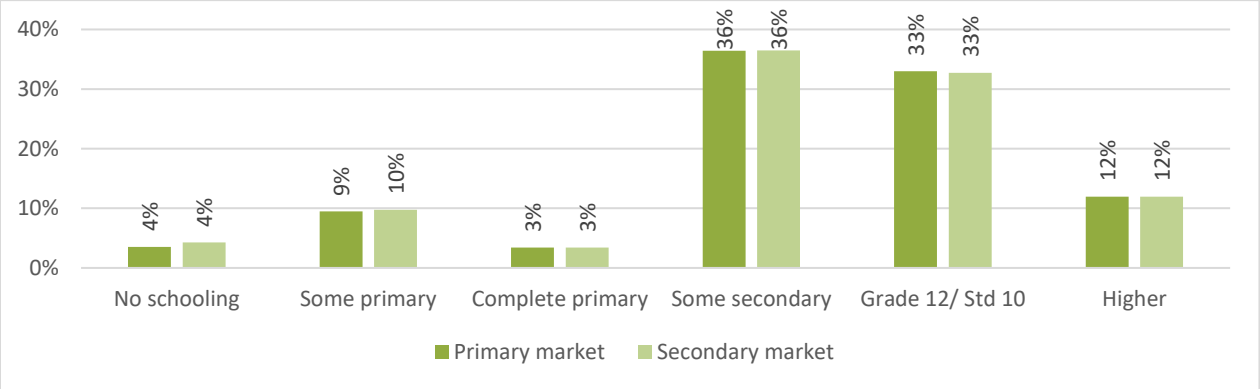
The annual weighted average household income of the primary market area is R132 466.37 per annum. The secondary market area's annual weighted household income is higher, at an average of R152 837.01 per annum. This suggests that the secondary market area's households have a higher disposable income.

Overall, the delineated market area consists of low-income households which may limit disposable income of households. This means that households have less people will be able to purchase a house. This also indicates the need for affordable retail options in the delineated market area.

4.5. Education

The sub-section aims to analyse the highest level of education of the two identified market areas. The level of literacy and levels of education are generally related to the level of income and hence also the disposable income of a market area. The following figure indicates the highest level of education in both the primary and the secondary market areas.

Figure 11: Highest level of education



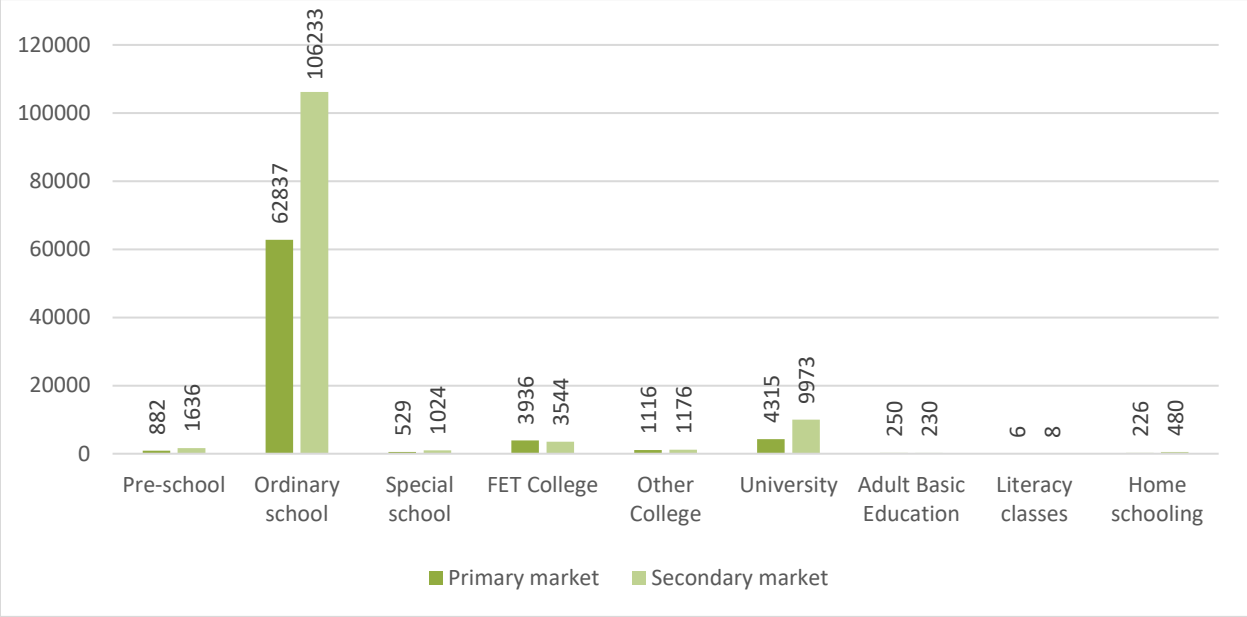
Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The figure above indicates that the largest portion of both the primary (36%) and the secondary (36%) market areas completed some level of secondary education. A large proportion of the primary and secondary market areas (33% respectively) completed Grade 12. Furthermore, 12% of both the primary and the secondary market areas respectively completed some level of tertiary education.

The primary market area's education profile indicates that at least 45% of the population have completed high school or have studied further towards a tertiary qualification. A moderate to low education level results in a decrease in household income and reduces the ability of households to gain access to capital to purchase a house or that households are more likely to live in more affordable accommodation types.

The following figure illustrates the number of people (in both the primary and the secondary market areas) attending various educational institutions.

Figure 12: Attendance at an educational institution



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The data provided in the figure above shows that most of the population (of those who attended educational institutions) attended an ordinary school. A total of 62 837 people in the primary market and 106 233 people in the secondary market attended ordinary schools. Other educational institutions attended by the population in the market areas include FET colleges, universities, adult basic education, pre-schools, and special schools.

FET colleges are at the centre of skills delivery to drive the South African economy, thereby reducing unemployment and improving the livelihoods of millions of South Africans. Government has invested resources in public FET colleges to ensure that they deliver quality higher education and become institutions of choice for learners, parents and employers.

4.6. Living Standard Measure (LSM)

Living Standards Measure (LSM) categorises a population according to their living standards by using various classification such as ownership of cars and other major appliances etc. LSM 10 is considered the highest level of living standard. The following table provides the living standard measure (LSM) for each category within the primary market area.

Table 5: Living standard measure

Living Standard Measure (LSM)		Percentage of population
LSM 5		17%
LSM 6		31%
LSM 7	Low	4%
	High	25%
LSM 8	Low	9%
	High	3%
LSM 9	Low	6%
	High	4%

Most of the population (31%) falls within the LSM 6 category, whereas the second largest portion of the population (25%) falls within the LSM 7 (high) category. The majority of the population falls within the lower LSM groups.

5. Market Perspective

The local market dynamics related to the intended use of the development are investigated by way of market analysis to obtain a holistic market perspective on key trends that could impact the potential success of the proposed development. The market perspective section will collectively look at the various suburbs that surround the proposed development site, which include the following:

- Falcon Ridge
- Acronpark
- Duncanville
- Tshepiso
- Sebokeng
- Bophelong
- Evaton

5.1. Residential

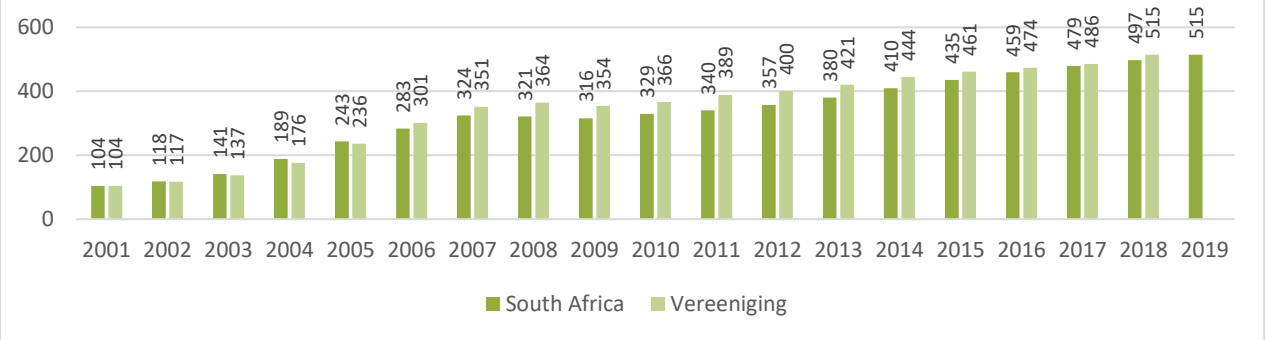
This sub-section provides a market perspective for residential developments in Vereeniging and key suburbs surrounding the proposed development site. An overview is provided on the following:

- House price index
- House market stock
- Period of residential property ownership
- Average house price
- The housing typologies
- Tenure status

5.1.1. House Price Index

The house price index (HPI) provides data on historical house price trends. Apart from serving as an indicator of house price trends, the house price index provides an analytical tool for estimating changes in the rates of mortgage defaults, re-payments, and housing affordability. The HPI is used to analyse historical and current market trends, which may be used to predict the performance of the housing market. The analysis of the housing market will provide a better understanding of housing trends and the potential success of the proposed development under current market trends. The following figure represents the First National Bank (FNB) HPI for South Africa and Vereeniging.

Figure 13: FNB House Price Index



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

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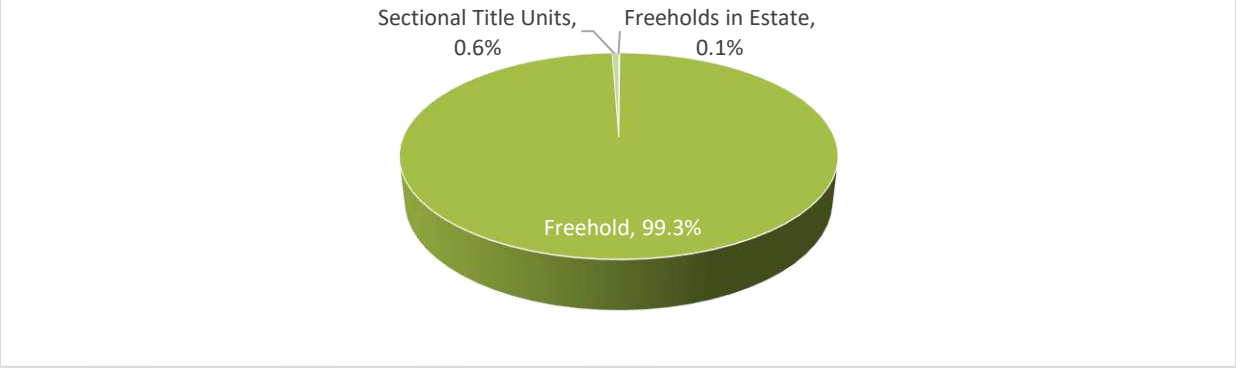
Based on the data provided in the table above, it is apparent that since 2001, the South African housing market experienced an upward trend to 324 points by 2007. From 2008, a brief decline is seen reaching 316 points in 2009. Thereafter, the housing market experienced a rise since 2010 and reached 515 points in 2019. The housing market in Vereeniging followed a similar trend compared to the housing market of South Africa[7]. A slight decline is also seen in 2008, after which the housing market experienced a continuous increase from 329 points in 2010 to 515 points in 2018.

The data provided in the figure above indicates that the performance of the housing market is increasing and, therefore, may be an indication that the demand for housing is also increasing.

5.1.2. House Market Stock

This section provides an overview of the residential market stock in areas surrounding the proposed development site, which mainly includes the suburbs Sonland Park and Unitas Park. The housing stock analysis will consider the number of registered residential units as well as the dominant residential typology within the defined area.

Figure 14: Residential market stock



Source: Lightstone Property Database, 2020

As indicated in the figure above, the residential market stock in areas surrounding the proposed development site consists of 99.3% freehold, 0.1% freehold in estates, and 0.6% sectional title units. This is an indication that freehold stock is most in-demand in the surrounding neighbourhoods.

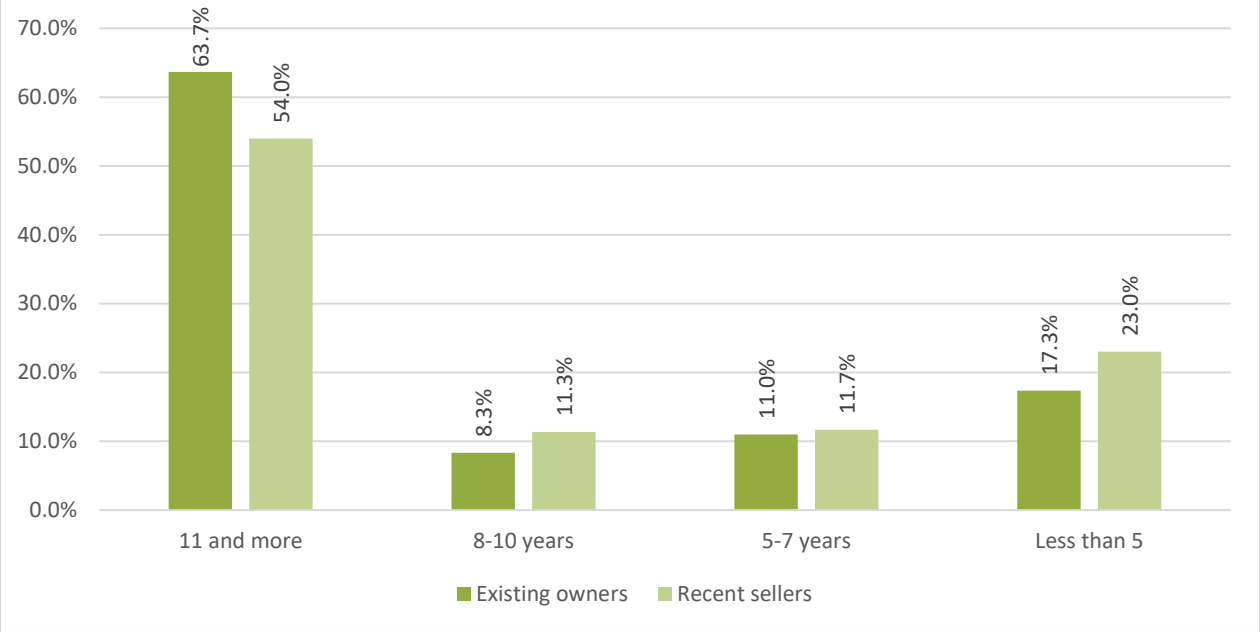
Freehold properties are highest in demand, but this could also be an indication of a market that requires higher densities.

5.1.3. Period of Ownership

The period of ownership refers to the number of years that residents have been residing in a specific area. Ownership is a good indication of the influx of people into and from the adjacent residential areas. The figure below illustrates the period of ownership of residents in the neighbouring residential areas.

[7] Data for the housing market in Vereeniging is only provided until 2018, as further data are not yet available.

Figure 15: Period of ownership (January 2019 to December 2019)



Source: Lightstone Property Database, 2020

The figure above indicates that 63.7% of existing owners in areas surrounding the proposed development site have lived in the area for 11 years or more, whereas 11% of existing owners lived in the same area for five to seven years, another 17.3% lived in the area for less than five years, and 8.3% of homeowners lived in the area for eight to ten years.

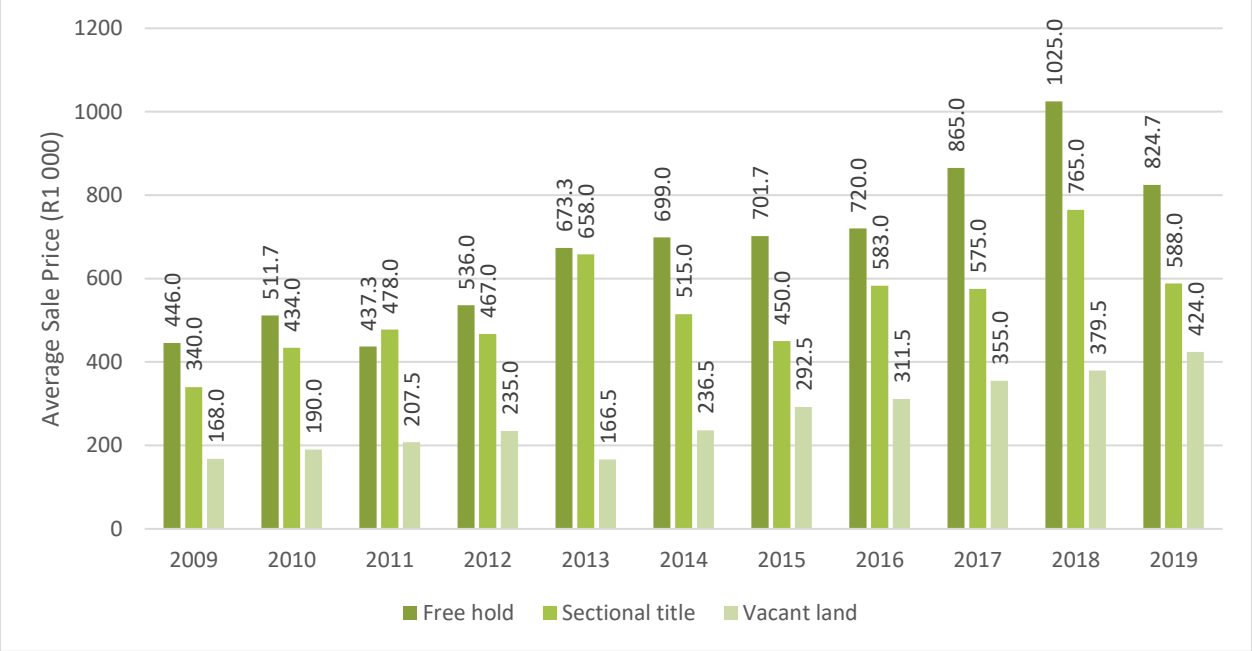
The population in the areas surrounding the proposed development site own their homes for longer, but recent sellers of 11 years and more may be an indication of a market that is moving out. One reason that might cause the population to move out is the declining local economy leading to fewer job opportunities available. Therefore, people may seek job opportunities in other areas, neighbouring towns, or cities.

5.1.4. Average House Price

The average sales price indicates the average number of households paying for a residential unit in the areas surrounding the proposed development site. These sales prices are important factors to analyse as they are an indication of the affordability of houses in the area.

The average sales prices of freeholds, sectional schemes, and vacant units from 2009 to 2019 (a period of ten years) are indicated in the figure below.

Figure 16: Average sale prices



Source: Lightstone Property Database, 2020

The data provided in the figure above provide the average residential price trend for the area surrounding the proposed development site and show the trends for different types of residential properties. A general increase in the average sales price for freehold units is evident. The average house price for freehold units increased from R446 000 in 2009 to R1 025 000 in 2018. The average sales price decreased with almost 20% to from the R1025 000 in 2018 to R824 700 in 2019.

The average sales price for sectional title schemes also increased from R340 000 in 2009 to R658 000 in 2013, after which it experienced a slight decrease, reaching R515 000 in 2014 and R450 000 in 2015. Since 2016, the average sales price for sectional title schemes continued to increase to R 765 000 in 2018, after which it experienced a decrease in the average sales price, reaching R588 000 in 2019.

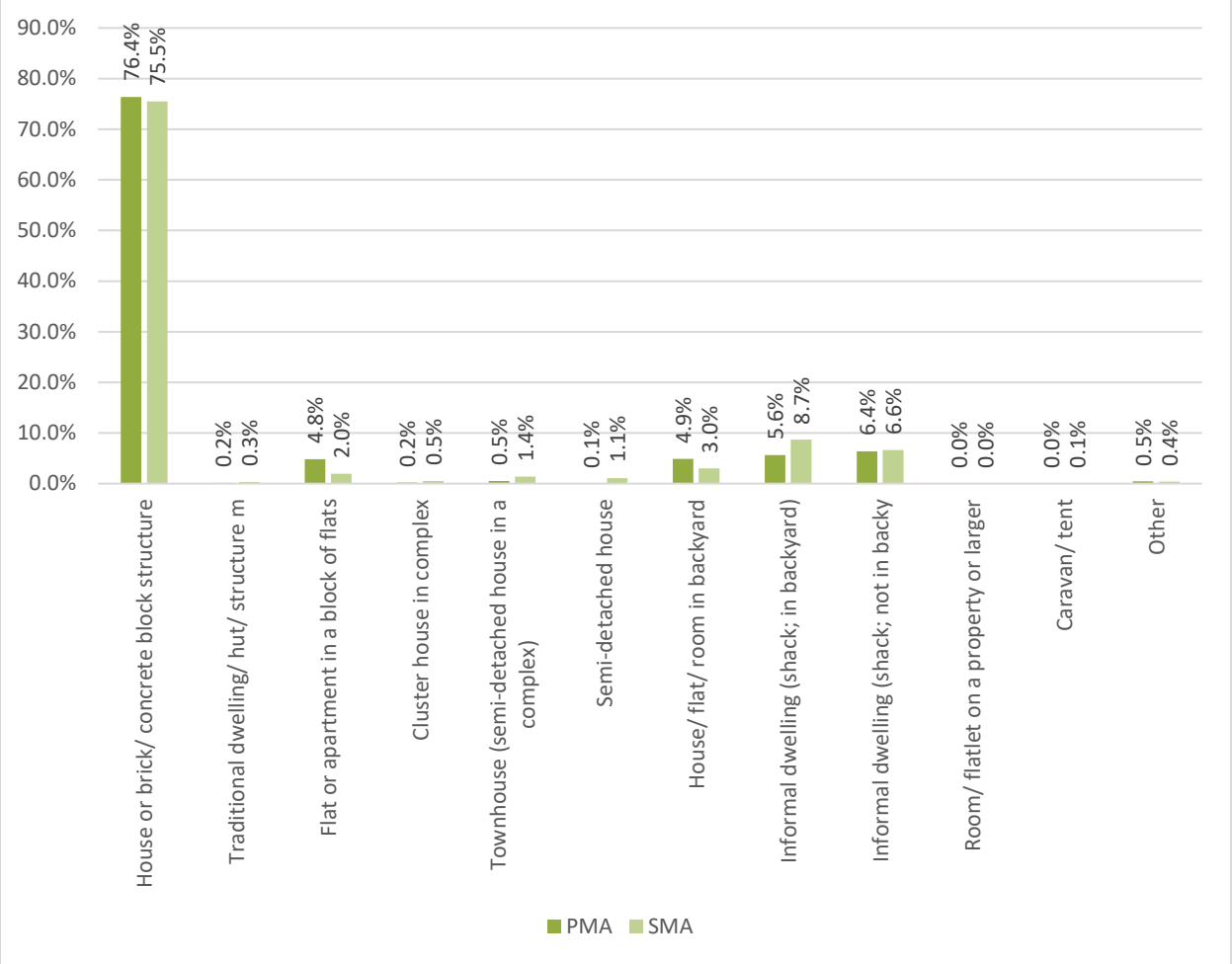
Generally, an increase in the average sales price for vacant land is evident over the past ten years. The average sales price for vacant land increased from R168 000 in 2009 to R235 000 in 2012, after which it decreased to R166 500 in 2013. The average sales price for vacant land continued to increase from R166 500 in 2013 to R424 000 in 2019.

Declining house prices (evidently seen in 2018/19) can be an indication of a residential market that is in an oversupply of houses to buy.

5.1.5. Housing Typologies

This sub-section provides an overview of the various dwelling typologies within the study area and their prominence within the market. The distribution of dwelling typologies within both the primary and secondary market areas are illustrated in the figure below.

Figure 17: Housing typologies in primary and secondary market areas



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

The most prominent dwelling typology in both the primary (76,4%) and secondary (75.5%) market areas area is a house (brick or concrete block structure). Other typologies making a smaller contribution to the housing typology of the identified market areas include (1) informal dwelling type (shack, not in a backyard), (2) informal dwelling (shack, in a backyard), and (3) house, flat or room in a backyard.

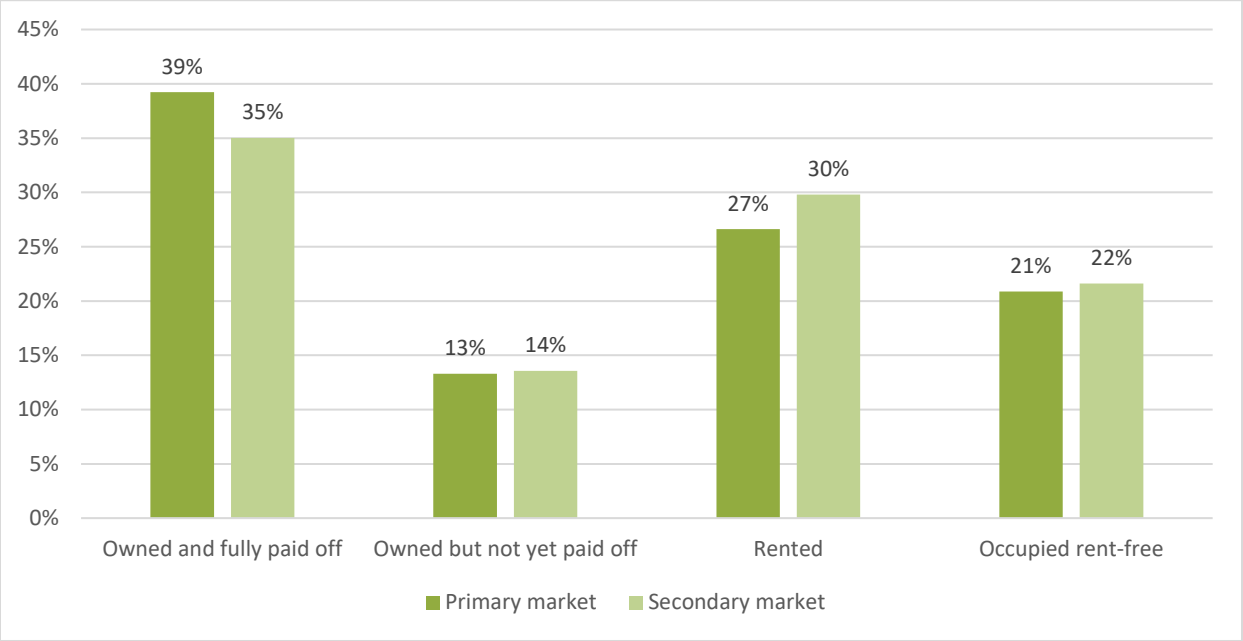
Informal dwelling types (shack, not in a backyard) contributes 6.4% to the housing typology in the primary market area and 6.6% in the secondary market area. Informal dwelling (shack, in a backyard) contributes 5.6% to the housing typology in the primary market area and 8.7% in the secondary market area. Houses, flats or rooms in a backyard contributes 4.9% to the housing typologies in the primary market area and 3% to the housing typology in the secondary market area.

The dominant housing types include a house or brick structure, which indicates that this type of housing is most in demand.

5.1.6. Tenure Status

Tenure refers to the extent of homeownership within the study area and the conditions under which land or buildings are occupied. The tenure status aims to present the distribution of tenure within the primary and secondary market areas. The tenure profile and status of the primary and secondary market areas are illustrated in the figure below.

Figure 18: Tenure status



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

Most of both the primary (39%) and secondary (35%) market areas consist of homeowners with fully paid off homes. The second-largest portion of the primary (27%) and secondary (30%) market areas consist of rented homes, followed by 21% of the primary market and 22% of the secondary market with rent-free occupancy. The smallest portion of both the primary (13%) and the (14%) secondary market area consists of homes that have not yet been paid off.

The tenure profile indicates that fully paid homes currently make up the largest portion of the primary market area (39%). However, rental tenure is also popular, which presents an opportunity to provide a mix of tenure types within the proposed development as rental orientated developments are expected to be well received in the primary market area.

5.1.7. Similar Projects in the Region

This sub-section focusses on similar projects in this area, particularly looking at the Savanna City development.

Savanna City is a R24.9 billion development project of mixed housing development which focusses on affordability. This development includes fully bonded units, Finance Linked Individual Subsidy Programme housing, high-density apartments, and fully subsidised housing. Savanna City is a 1 462-hectare

development envisioned to include 16 schools, eight churches, nine business, and retail facilities, public parks, and 400 hectares of environmental area[8].

The development of Savanna City started in 2013 but struggled to get off the ground due to a number of challenges. The main issue related to the challenges experienced by this development is funding[4].

Other key factors that had an impact on the struggles of the development were mainly related to socio-economic issues such as rising interest rates, continued high unemployment, and limited household incomes[9].

Figure 19: Savanna City RDP houses

Source: Sedibeng Ster, 2019

The following table provides the average sales prices, average erf and floor size for various houses (categorised as per number of bedrooms and bathrooms.

Table 6: Savanna City average sales prices

	Price	Erf Size (m2)	Floor Size (m^2)
2 bedrooms, 1 bathroom	R 501 308	210	44
2 bedrooms, 1,5 bathrooms	R 526 380	215	50
2 bedrooms, 2 bathrooms	R 580 230	300	50
3 bedrooms, 1 bathroom	R 605 731	255	60
3 bedrooms, 1.5 bathrooms	R 611 439	200	55
3 bedrooms, 2 bathrooms	R 669 135	290	73

Source: Property 24, 2020

Based on information found on Property 24, most sales listings within Savanna City are units with two bedrooms and one bathrooms, and units with three bedrooms and two bathrooms. The average sales price for units with two bedrooms and one bathroom is R501 308 with an average erf size of 210m^2 and an average floor size of 44m^2. The average price of units with three bedrooms and two bathrooms is R669 135 with an average erf size of 290m^2 and an average floor size of 73m^2.

[8] Creamer Media's Engineering News: Basil Read enters new avenue with Savanna City residential development. June 2018. Available at: http://m.engineeringnews.co.za/article/basil-read-enters-new-avenue-with-savanna-city-residential-development-2018-06-07

[9] Creamer Media's Engineering News: Basil Read records R820m loss in challenging market. March 2015. Available at: http://www.miningweekly.com/article/basil-read-reports-r820m-loss-2015-03-27

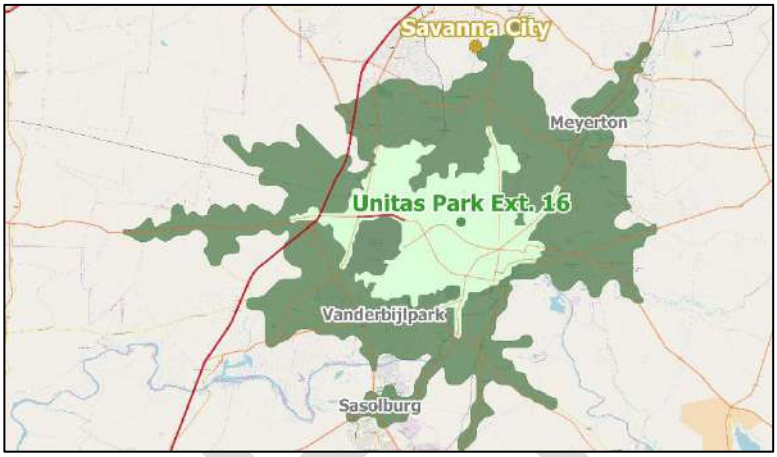
These figures provide an indication of sales prices, popular housing types (based on number of bedrooms and bathrooms), and average size houses and can also be used as guidelines for housing development at the proposed site.

The map shows the spatial context of Savanna City and its proximity to the proposed development site.

Savanna City is located approximately 25 km from the proposed development site in Unitas Park, Vereeniging. The demarcated market area faces similar economic challenges than that of Savanna City.

Therefore, it is important to take note of these challenges and the potential impacts on the proposed development.

Map 6: Savanna City



Source: QGIS, 2020

5.2. Retail

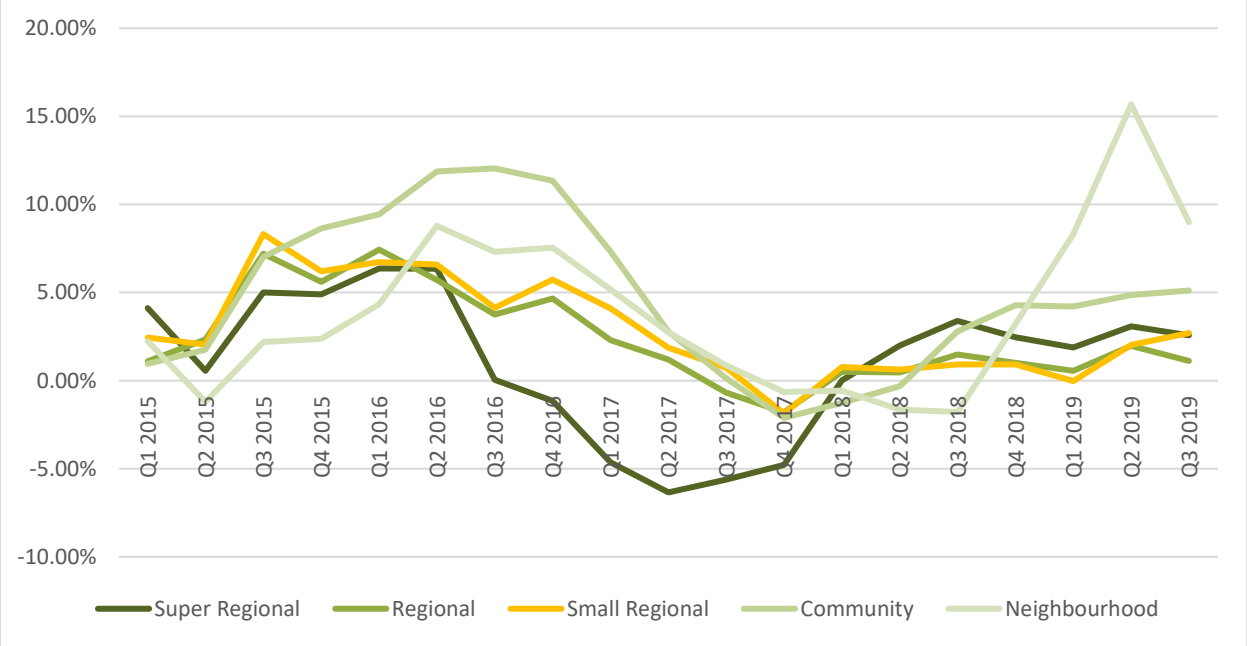
The trading density growth (as recorded in September 2019) increased with 4.3% over a period of one year in current price terms. The Retail Trading Density Index is based on sales performance along with other retail performance metrics and is recorded for 24 merchandise categories in more than 100 retail centres extending over 5 million square metres[10].

The growth of 4.3% consisted of 5.5% growth in sales and a 1.2% increase in the trading area. The per capita spent increased with 1.7% while foot count increased with 2.5%, also contributing to the increase in trading density. Smaller retail formats (such as neighbourhood retail centres) are mainly responsible for trading density growth. The largest merchandise categories include electronics, food (grocery and supermarket tenants) and department stores[2].

This sub-section provides an overview of retail market trends in the primary market area and will mainly look at the number of retail centres in the primary market area, the gross leasable area (GLA) of each identified retail centre and the anchor shops within each centre. The following figure provides an overview of the retail trading densities in South Africa for super-regional, regional, small regional, community, and neighbourhood retail facilities.

[10] SAPOA: SAPOA's Retail Trends Report, 2019

Figure 20: Retail trading densities growth rates

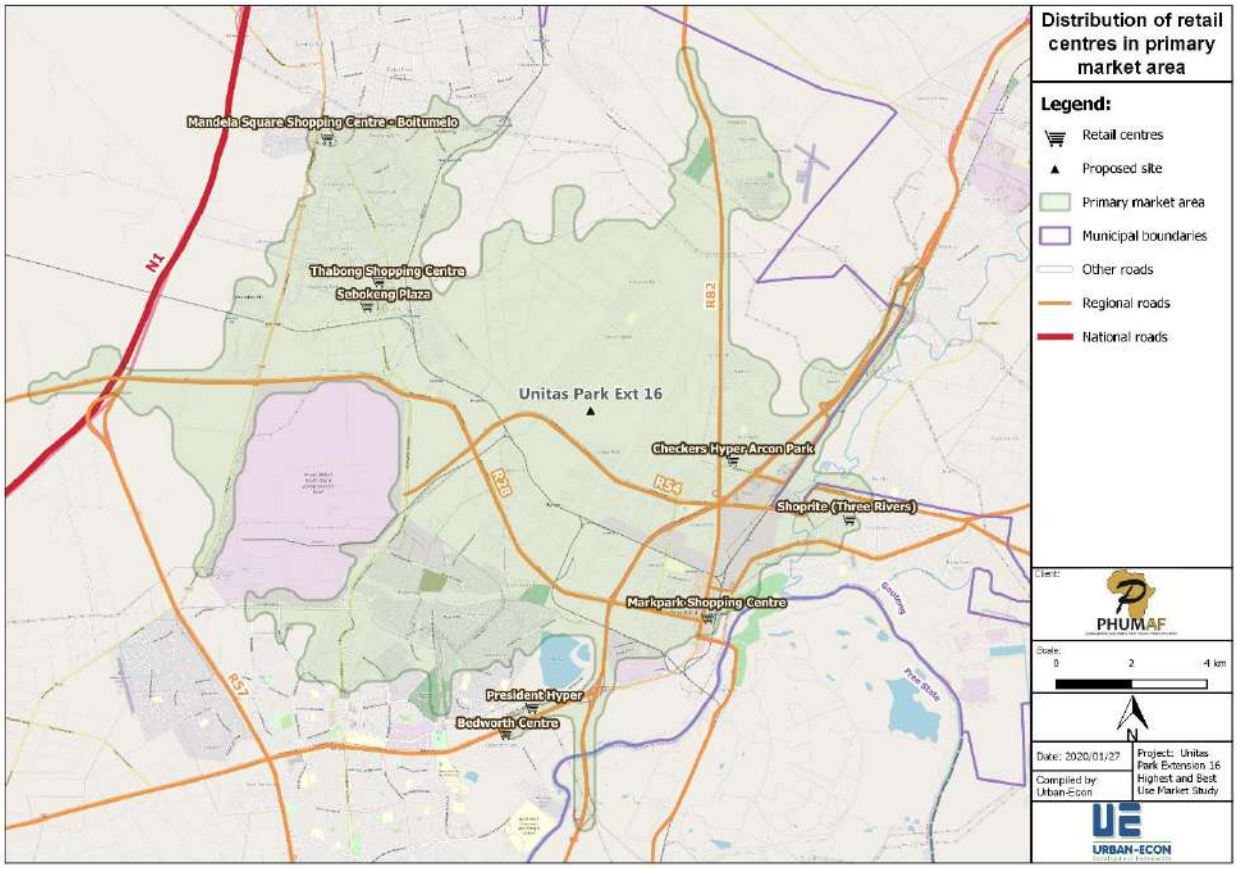


The data presented in the figure above show the trading density growth rates for various retail facilities. Regional and small regional follow a similar trend from 2015 to 2019, both experiencing growth in trading densities since the first quarter of 2019 with small regional continued to increase in the second quarter. The growth rate for super-regional retail trading densities experienced a decline between the second quarter of 2016 to the same quarter in 2017.

The growth rates for trading densities for super-regional facilities experienced a significant upward trend from the third quarter in 2017 to the third quarter of 2018. A general decline is evident in super regional trading densities from the third quarter of 2018 to the third quarter of 2019.

The trading density growth rates for neighbourhood retail spaces experienced a rapid increase from the third quarter in 2018 to the second quarter in 2019, after which the growth rate declined with almost 6% from the second quarter of 2019 to the third quarter of 2019. The following map depicts the distribution of retail centres within the primary market area.

Map 7: Distribution of retail centres



Source: Data derived from Leo Lightstone modified with QGIS, 2020

The map illustrates the distribution of retail centres in the primary market area. There are eight shopping centres or malls identified in the primary market area, with most of these located close to the primary market area borders. The shopping centre closest to the proposed development site is Checkers Hyper Arcon Park and is approximately 5.5 km from the proposed site.

There is no retail centre within 5 km from the proposed development site in Unitas Park, indicating the need for a retail centre to serve the population of Sonland Park, especially the local market within the boundaries of the market area.

The following table provides a list of all the retail centres within the primary market area, the key anchor stores, the gross leasable area (GLA) of each centre and distance of each of these facilities from the proposed development site.

Table 7: Retail stores in the primary market area

Name	Anchor stores[11]	Distance from the proposed site (km)	GLA (m^2)
Mandela Square Shopping Centre (Boitumelo)	• Pick n Pay	15.4	6 399[12]
Checkers Hyper Arcon Park	• Checkers	5.5	10 573
Thabong Shopping Centre (Sebokeng)	• Pick n Pay • Spar • Mr. Price • Pep • Clicks	15.2	41 145
President Hyper Vanderbijlpark	• President Hyper Vanderbijlpark	14.2	26 000
Sebokeng Plaza	• Shoprite Checkers	12.5	11 422
Shoprite Checkers Centre - Three Rivers	• Shoprite Checkers • Pep	10.5	6 164
Bedworth Park Value Centre	• Pick n Pay • Builders Warehouse	13.8	83 942
Markpark	• Shoprite • Pep • Ackermans • Jet • Clicks	9.6	22 355
			208 000

Source: Data derived from Leo Lightstone, 2020

The primary market area consists of approximately 208 000 m^2 gross leasable area (GLA) or retail space. Bedworth Park Value Centre (83 942m^2 GLA) and Thabong Shopping Centre in Sebokeng (41 145 m^2 GLA) are the two largest retail centres in terms of GLA. From the data provided in the table above, the major anchor shops are Shoprite Checkers, Pick n Pay, and PEP.

Eight shopping centres/malls are identified in the primary market area; most are located close to the primary market area borders. Checkers Hyper Arcon Park is the shopping centre located closest to the proposed development (5.5 km). This indicates that there is a need for a retail centre within the demarcated area to serve the population of Unitas Park and Sonland Park. The primary market area consists of approximately 208 000 m^2 gross leasable area (GLA) or retail space. The major anchor shops are Shoprite Checkers, Pick n Pay, and PEP. This indicates the presence of stores that capture and appeal to the local market and could be considered as anchor stores for a newly developed retail centre.

[11] South African Council of Shopping Centres: Shopping Centre Directory, 2019
[12] Ikon Property Group. Available at: http://ikongroup.co.za/properties/mandela-square-shopping-centre-sebokeng/

5.3. Office

This sub-section will analyse office market trends in the demarcated market area. This analysis is used to help identify the demand for offices in the identified area and help to inform decision-making for developers. This sub-section will focus on the following key topics:

- Vacancy rates
- Rental rates
- Capitalisation rates

5.3.1. Vacancy Rates

The identified area is not popular in terms of office space. Due to the low number of offices in the primary market area, there are limited data regarding vacancy rates.

5.3.2. Rental Rates

This sub-section provides insight into the rental rates in areas close to the proposed development site. Office rental rates in Duncanville, Vereeniging Central, and Three Rivers were investigated. The following table provides the average rental rates for each of the aforementioned areas.

Table 8: Average rental rates (Rand per square meter per month)

Area	Average rental rate (R / m² / month)
Vereeniging Central	R61.52
Three Rivers	R68.58
Duncanville	R14.29

Source: Property 24, 2020

The average rental price in Three Rivers is higher compared to other areas. The average rental rate in Three Rivers is R68.58 per square meter per month, whereas the average rental rate for Central Vereeniging is R62.52, and R14.29 in Duncanville.

5.3.3. Capitalisation Rates

The capitalisation (cap) rate indicates the rate of return of real estate property investments. It is measured by dividing the net income by the property's asset value. The capitalisation rate is the expected operating income for year 1. The rate is expressed as a percentage. The following table indicates the capitalisation rate of office buildings within the Vaal Triangle.

Table 9: Capitalisation rate of office buildings

Location	Quarter	Grade A: Multi-tenant			Grade A: Leaseback			Grade B: Multi-tenant			Grade C: Multi-tenant		
		Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Vaal Triangle	3/2019	11.3	0.7	2	10	-	1	11.1	-	1	11.7	1	1

Source: Rode's report, 2020

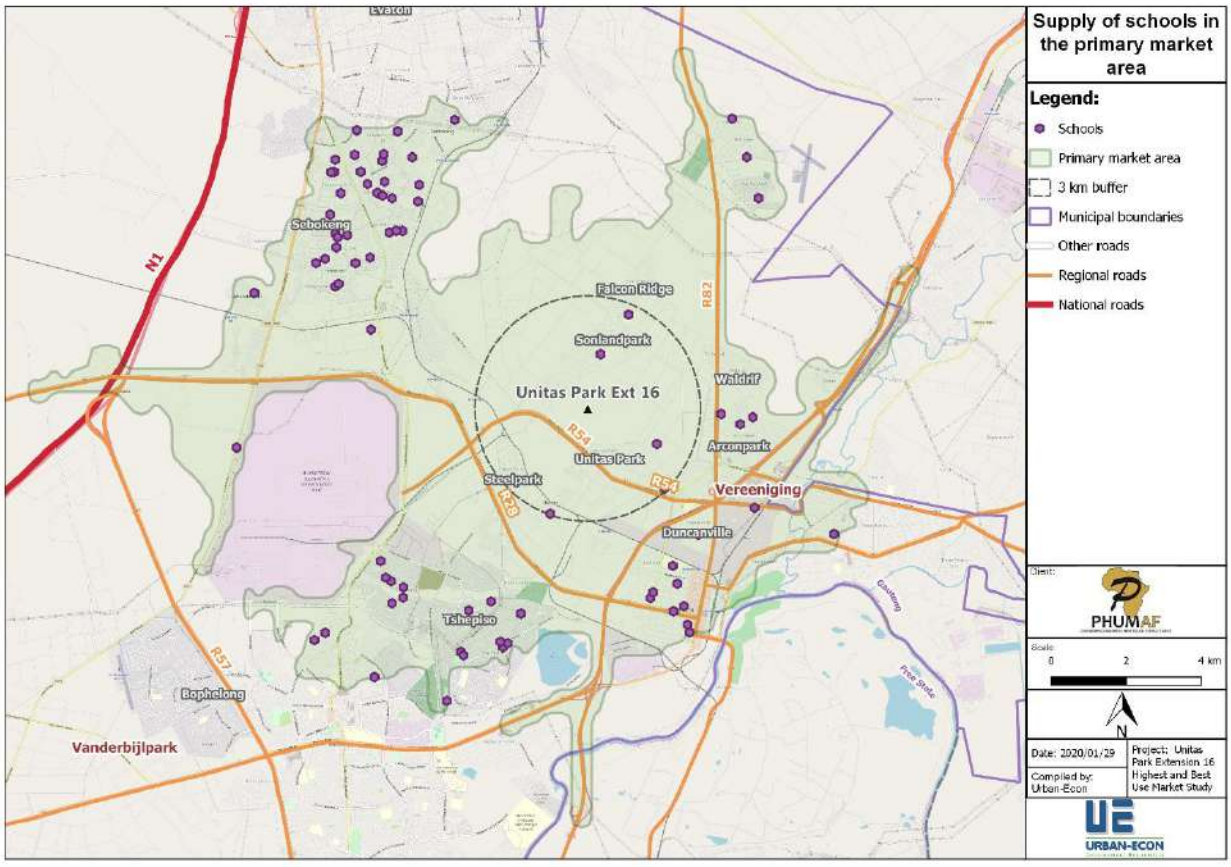
Because the area is not popular for office development, it is recommended that office space only be considered as an auxiliary land use and should target small businesses or consider office space for government departments.

5.4. Education

5.4.1. Schools

This sub-section provides an overview of schools within the study area. The map below illustrates the distribution of schools within the primary market area and also highlights the schools within 3 km from the proposed development site.

Map 8: Distribution of schools in the primary market area



Source: Data derived from the Department of Basic Education modified with QGIS, 2020

The data used for the compilation of the map above were obtained from the School Master List as provided by the Department of Basic Education. Sonlandpark Primary is the school closest to the proposed development site and is approximately 3.5 km from the site.

Additionally, a total of 77 schools are situated within the primary market area. The schools provided in the map above include both public and independent schools as well as primary, secondary, and intermediate schools.

The following table provides a breakdown of schools in the primary market area.

Table 10: Schools located in the primary market area

Schools	Learners	Educators	Number of schools	Ownership	
				Independent	Public
Primary schools	39 723	1 240	50	5	45
Secondary schools	17 811	704	22	1	21
Combined schools	1 664	110	4	4	0
Intermediate school	83	15	1		
	59 281	**2 069**	**77**		
Learner-educator ratio	**28:1**				

Source: Department of Basic Education, 2020

There are currently 50 primary schools, 22 secondary schools and four combined schools within the primary market area. In total, there are 77 schools, 2 069 educators and 59 281 learners within this market area. Moreover, there are ten independent (private) schools and 66 public schools when looking at the primary, secondary, and combined schools. Based on the data provided in the table above, the average learner-educator ratio of all schools within the primary market area is 28.1. This means that on average, there are 28 learners for each educator.

The following table provides a breakdown of the average learner-educator ratio of the different schools within the primary market area as well as the average learner-educator ratio based on the OECD Indicators. The OECD Indicators are used to provide an indication of expected learner-educator ratios.

Table 11: Learner-educator ratio (LER)

Schools	Learner-educator ratio (LER)	Average OECD Indicators[13]
Primary schools	32:1	19:1
Secondary schools	25:1	28:1
Combined schools	15:1	

The data provided in the table above show that the learner-educator ration of primary schools in the market area is higher than the average OECD indicator, whereas the learner-educator ratio for secondary schools is lower compared to the average OECD Indicators.

Based on the findings provided in this sub-section, most schools in the primary market area are primary schools. It is also evident that the demand for primary education is high due to the learner-educator ratio being higher than the average as per the OECD Indicators.

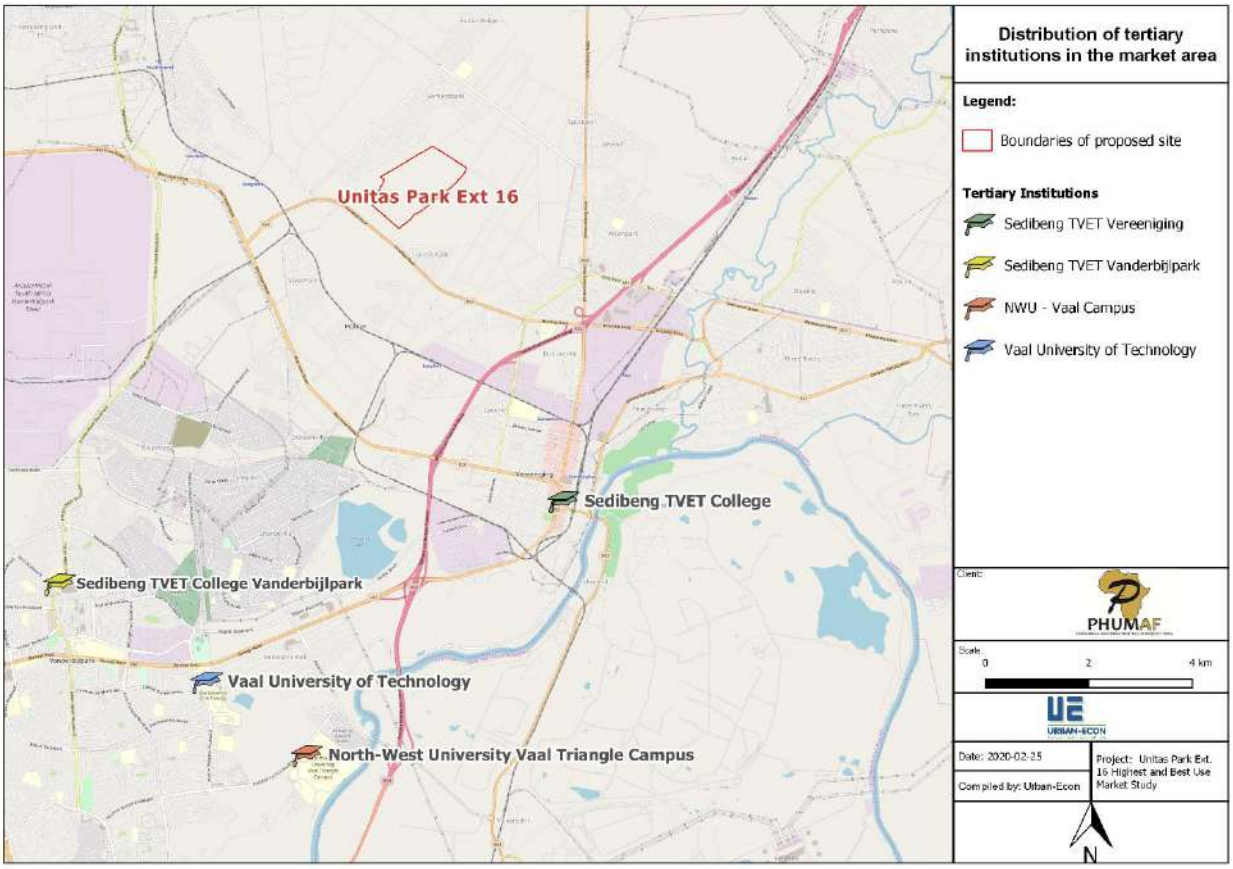
[13] OECD, Education at a Glance 2014 OECD Indicators: OECD Indicators, p. 446-452

5.4.2. Tertiary Education and demand for student housing

5.4.2.1. Locations of Tertiary Educational Institutions

This sub-section aims to provide an overview of student enrolment trends and student accommodation for various tertiary institutions within the market area. The map indicates the distribution of tertiary educational facilities within the market area.

Map 9: Distribution of tertiary institutions in the market area



Source: QGIS, 2020

The map above indicates the location of the main tertiary institutions within the market area. Two of these institutions, the Vaal University of Technology and the North-West University Vaal Campus are located in Vanderbijlpark, whereas Sedibeng TVET College has two campuses; one in Vanderbijlpark and the other in Vereeniging. The following table provides the four main tertiary institutions within the market area and the distance of each of these institutions from the proposed development site.

Table 12: Tertiary institutions and distances from the proposed development site

Tertiary Institutions	Distance from the proposed site
Vaal University of Technology	Approximately 16 km
North-West University (Vanderbijlpark Campus)	Approximately 17 km

Tertiary Institutions	Distance from the proposed site
Sedibeng TVET College (Vereeniging Campus)	Approximately 10 km
Sedibeng TVET College (Vanderbijl Campus)	Approximately 16 km

Tertiary institutions are located within reasonable proximity to the proposed development, indicating that the proposed development site could include student housing as part of the mixed-use development.

5.4.2.2. Enrolment and Student Accommodation

This sub-section elaborates on the number of full-time students enrolled at each of the tertiary institutions and the number of beds provided. Further, additional student accommodation facilities are also identified and included as part of the supply.

North-West University (NWU) – Vaal Campus

The following table shows the student growth for the NWU Vaal Campus over a period of five years. It should be noted that only full-time contact students were included in this study as they are the key drivers of student housing demand.

Table 13: Enrolment at NWU Vaal Campus

	2014	2015	2016	2017	2018
Number of student enrolments	6 353	6 507	6 748	7 123	7 365
Percentage growth		2%	4%	6%	3%

Source: Management Information Report: Student Statistics of the NWU Vaal Triangle Campus, 2017

The data provided in the table above indicates that the number of full-time contact students increased with almost 16% from 6 353 in 2014 to 7 365 in 2018. The average annual growth for this period is 4%. NWU Vaal Campus has 877 beds available on campus for students in Vanderbijlpark. These units are currently 100% occupied[14].

Vaal University of Technology

The following table shows the student growth for the Vaal University of Technology (VUT). It should be noted that only contact students were included in this study as they are the key drivers of student housing demand.

Map 10: Vaal University of Technology number of student enrolments

	2014	2015	2016	2017	2018
Number of students enrolled	19 096	17 489	19 079	19 218	19 250
Percentage growth		-8%	9%	1%	0.2%

Source: Quantec, 2020

[14] Communication with Mr. Steyn from NWU Vaal Campus (Director Business and Enterprise Development).

The number of students enrolled at the Vaal University of Technology increased with 0.8% from 19 096 in 2014 to 19 250 in 2020. The average annual growth for this period is 0.4%.

The Vaal University of Technology provides student accommodation for approximately 1 000 students through accommodation facilities situated around the campus. It is expected that the Vaal University of Technology will contribute an additional 1 800 student accommodation in Vanderbijlpark by 2021[15]. This means that the projected total supply of student accommodation provided by this institution adds up to 2 800 beds.

Sedibeng TVET College

Sedibeng TVET College has two campuses in the demarcated market area: the Vanderbijlpark Campus, and Vereeniging Campus. The following table shows the number of students enrolled at Sedibeng TVET College.

Table 14: Number of students enrolled at Sedibeng TVET College

	2013[16]	**2016**	**2020[17]**
Number of student enrolments	9 941	11 000[18]	10 598
Average annual growth rate		4%	-1%

Sedibeng TVET College experienced a slight decrease of 1% from 11 000 registered students in 2016 to 10 598 in 2020. However, in general, the average annual growth rate (from 2013 to 2020) is 1%. Sedibeng TVET College does not provide any accommodation facilities on campus for students.

Considering the student growth trends of all the above-mentioned institutions, there is a general increase in the number of students within the market area, which indicates that there is a growing demand for student housing.

Additional Student Housing Supply

The following table provides additional student housing supply and the number of units for each of these accommodation facilities.

Table 15: Additional student housing supply

Student Accommodation	Number of units
Bedworth Lake Student Accommodation	Approximately 700
Five Star Student Accommodation	Approximately 16

[15] New Student Residence Vaal Univiersity of Techonlogy. Available at: https://www.l2b.co.za/Project/New-Student-Residence-Vaal-University-of-Technol/14822
[16] Data for 2013 were obtained from the 2013/14 Sedibeng TVET College Annual Report. Available at: http://www.sedcol.co.za/wp-content/uploads/2016/09/Sedibeng-TVET-College-Annual-Report-for-2014.pdf
[17] Data for 2020 were obtained through personal communication with Mrs. Seipati from Sedibeng TVET ollege.
[18] Data for 2016 were obtained from Sedibeng TVET College website. Available at: http://www.sedcol.co.za/college-profile/

Student Accommodation	Number of units
Granada Student Accommodation	Approximately 30
Buhle student houses	Approximately 450
	Approximately 1 196

It should be noted that only some of the major student accommodation facilities within the study have been listed above and does not represent all available accommodation in the study area.

The working of NSFAS

NSFAS is a government entity under the Department of Higher Education, Science and Technology established according to the NSFAS Act (Act no. 56 of 1999) to provide financial support to disadvantaged students who wish to futher their studies at public universities or TVET colleges.

The NSFAS bursary covers student expenses on the following categories:

- Accommodation
- Transport
- Living allowance
- Personal care

This differs for Universities and TVET Colleges.

The qualification metrics for NSFAS is as follows:

- All South African citizens
- All SASSA grant recipients qualify for funding
- Appllicants whose combined households income is not more than R350 000 per annum
- A person with a disability: combined household income must not be more than R600 000 per annum
- Students who started before 2018 whose household income is not more than R122 000 per annum.

Funding students are either provided directly to the student via NSFAS Waller or via the respective institution to the student.

The Department of Higher Education and Training released the latest guidelines for the allocation of NSFAS grants in January 2020. The following table indicates the guidelines for NSFAS grants.

Table 16: NSFAS Grant Allocation

Item	Cost
Travel (60% if bursary beneficiaries)	R7 350 per annum
Personal Care (100% of bursary beneficiaries)	R2 900 per annum
Accommodation (40% of bursary beneficiaries)	R15 750 (rural) per annum R18 900 (peri-urban) per annum R25 200 (urban) per annum

For the purposes of this study, the cost of accommodation will fall within the urban category (R25 200 per annum) due to the location of the proposed development.

Generally, there is an increase in the number of student enrolments. Based on the data provided above, it appears that there is a shortage of supply for student accommodation, which indicates that there is a growing demand for student housing.

5.5. Health Care

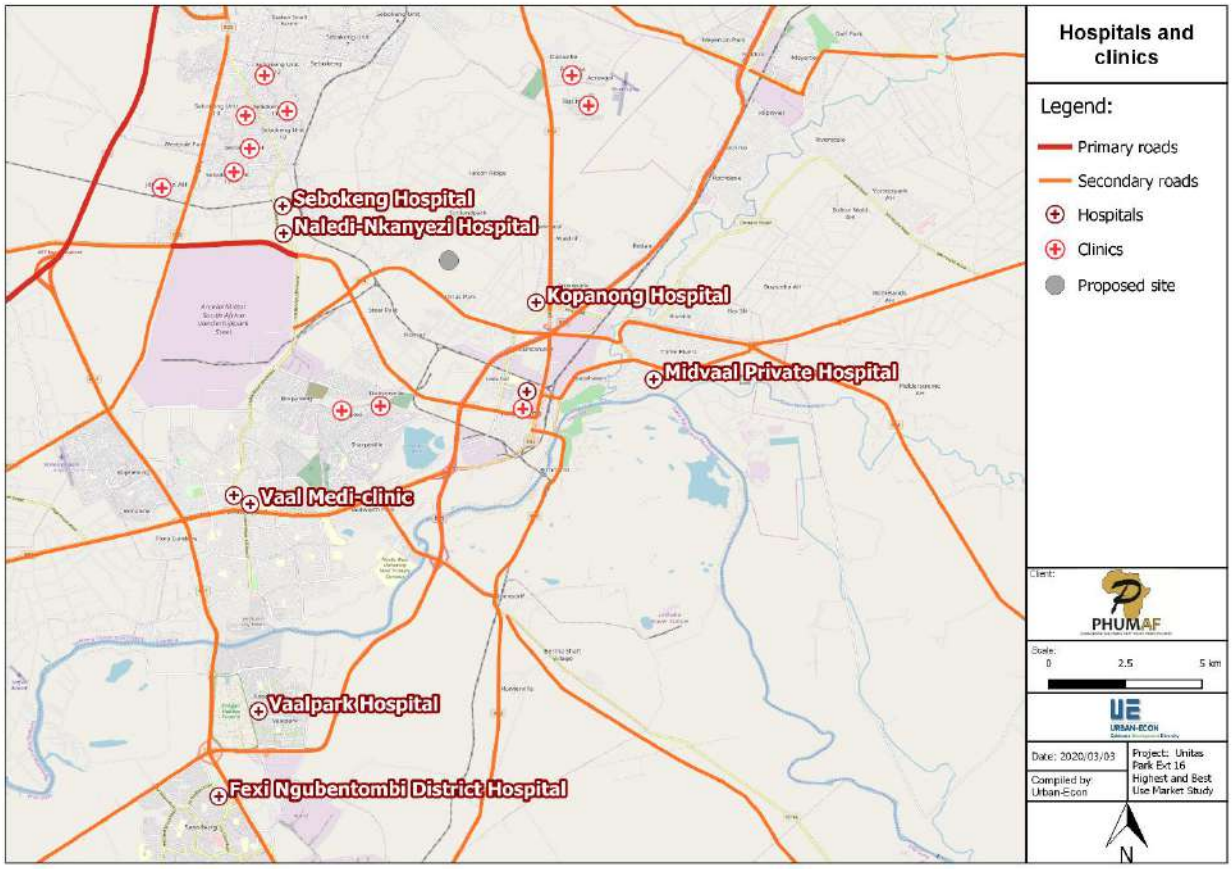
This sub-section provides an overview of the hospitals and clinics identified in the primary market area. According to the Emfuleni Integrated Development Plan (IDP) 2019/20, primary health care services provide comprehensive health care services to residents of the local municipality.

The local municipality currently has 18 clinics, of which five are structurally suitable to provide comprehensive health care services. The remaining 13 clinics are limited by structural constraints and are therefore not able to provide comprehensive primary health care services, as set out by the National Health Norms and standards.

The main issue experienced is overcrowded clinics, which makes infection control problematic. The department has identified a need to address structural constraints and has, therefore also prioritised the upgrading of health care clinics.

The following map illustrates the distribution of hospitals and clinics within the primary market area.

Map 11: Distribution of key health care facilities



Source: Data derived from Mapable and modified in QGIS, 2020

The majority of clinics are located near the borders of the primary market area. A total of 11 clinics are identified in this market area, with most of these clustered in Sebokeng. Other areas with clinics include Tshepiso, Dickonsonville, Duncanville, and Roshnee.

The clinic closest to the proposed development is the Vaal Men and Women's clinic in Duncanville and is located approximately 8.6 km from the proposed development site. Rust Ter Vaal clinic in Roshnee is located approximately 9.6 km from the proposed site and Tshepiso clinic approximately 10.5 km from the site.

A total of seven hospitals are identified in the market area. The closest hospital is Kopanong Hospital and located approximately 4.3 km from the proposed site.

The lack of clinics within 8 km of the proposed development site indicates the need for a clinic to serve the population, especially in Unitas Park and Sonland Park. The nearest hospital is located approximately 4.3 km from the proposed site.

5.6. Innovation and Inubation Hub

This sub-section dicusses the potential for developing an innovation and incubation hub as a central point of the proposed development. In addition to this, two The opportunities associated with this type of development are also explored.

5.6.1. Innovation Hub

An Innovation Hub can be seen as a concentration of innovative enterprises that enable each other in a mutually beneficial way. These hubs can also be used to address issues of unemployment and other socio-economic issues. Innovation hubs can also be defined as cluster systems with complimenting services dedicated to innovation. These centres are usually a reflection of the human and social capabilities of the communities in which they thrive. They function as a supporting structure for development throughout the community, providing knowledge and industry capacity valuable to start-up businesses, educational institutions and innovators alike. This is achieved by the concentrated information sharing space provided by these centres. The guiding principles for these centres are:

- Innovation
- Collaboration
- Community revitalization
- Economic growth
- Sustainable development
- Entrepreneurship

These principles are realised in the interactions, application, expertise and diversity of networks involved in innovation for the community. These networks usually include specific role players and features that ensure the effective functioning of the system.

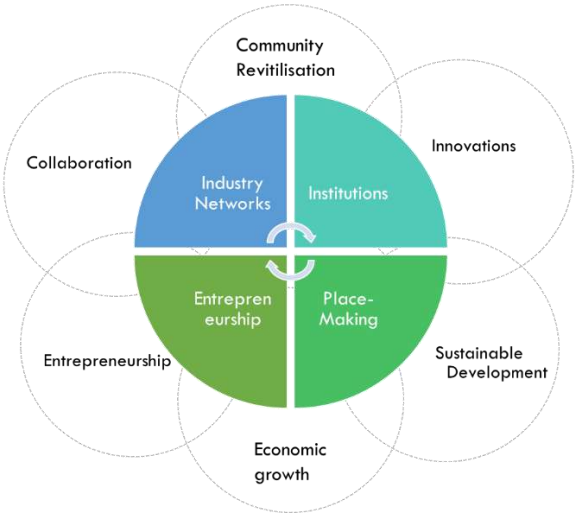
The science park network is based on relationships with the governments, universities, large and medium-sized firms, venture firms and associated institutes (endogenous networking). Cooperative networking between the local government and the park management helps to enhance the park's performance and it is, therefore, crucial that these relationships are also prioritised.

There are several key characteristics common to innovation-centred developments.

The key characteristics of innovation centres are the following:

- Institutions
- Industry Networks
- Entrepreneurship
- Place-making

Figure 21: Innovation Hub



Institutions have the ability to attract and support talent in the community. In the context of innovation centres there has to be a relationship between the existing and desired institutional services.

Industry networks are represented in multi-disciplinary teams that are responsible for the support and growth of innovation in the community. They encourage partnerships and information-sharing in a variety of sectors, all inclined by the principles, to support and grow the use and value of the centre. These networks usually include well-established professionals as well as local young talent that encourages interaction amongst users and helps develop specialized services that will support local business and encourage cross-industry partnerships.

Entrepreneurship fosters the business and commercial aspects of innovation. Entrepreneurship allows for opportunities that develop markets and business through ideas and therefore develop the economy. These skills can be nurtured both within the training and knowledge aspects of the centre as well as in the exhibition and sales of products, thereby having potential influence in the science and technology market.

Altogether the synergy of these components allow for exchanges in critical and diverse services that can effectively attract and support investment in the community. To capture the use of these services and maximize the shared value in the public realm, there are key spatial attributes synonymous with innovation centres. These include the walkability of the space, the mixture in land use and activity, and the imagery and availability of public spaces.

5.6.2. Case Studies

This section provides more detail on two South African case studies which include Pretoria Innovation Hub and Riversand Incubation Hub. The case study approach discuss fundamental attributes defining innovation centres of various kinds. The local case studies of Pretoria's Innovation Hub and Riversand Incubation Hub are specifically investigated as applicable best practice examples.

5.6.2.1. The Innovation Hub (Pretoria)

The Innovation Hub of Pretoria is a wholly owned subsidiary of the Gauteng Growth and Development Agency (GGDA), which was established by the Gauteng Provincial Government through its Department of Economic Development (DED) to encourage and support innovation. It is strategically located in Pretoria East, Tshwane, Gauteng.

With Tshwane as South Africa's executive capital and Gauteng as the 'smart' province, The Innovation Hub has become a regional centre of innovation and knowledge creation in the surrounding communities. Its locational advantages can, therefore, be categorised locally and provincially, with a cumulative regional influence. Established in 2001, the science and technology park has since then supported the growth of innovative companies across the Biosciences, smart industries and green and sustainable energy sectors. As an agglomeration of successful, innovative companies, the Innovation Hub, is Southern Africa's first internationally accredited Science and Technology Park.

VISION

To model a science park and the innovation agency of choice for fostering socio-economic development and competitiveness in Gauteng.

STRATEGIC OBJECTIVES

- **Skills Development**

Drive focused skills development to address skills deficit and industry needs

- **Enterprise Development**

Accelerate enterprise development to support the establishment and growth of knowledge based enterprises

- **Innovation**

Strengthen multi-helix collaboration and foster innovation

- **Enabling Spaces**

Establish and manage enabling innovation spaces and targeted value added services

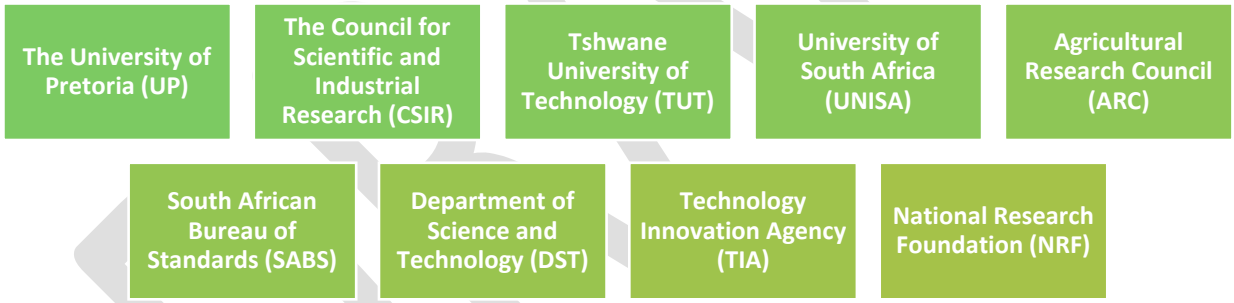
- **Organisational**

Be a value based sustainable organisation with a distinctive brand; that is an employer of choice.

5.6.2.1.1. Links to Surrounding Uses

The Innovation hub is well located on a provincial and city-scale to contribute to the business and information networks that are already prevalent. Some of its key advantages is the surrounding uses that include information-based activities. As the business and administrative capital of the country, Pretoria is synonymous with commercial and industrial development. Some of the key land uses indicative of this sectoral dominance include the following government, education and research institutions:

Figure 22: Key facilities surrounding Pretoria's innovation hub



In respect of the surrounding uses, the Innovation Hub is, therefore, a well-located connective agent for government, research and educational activity. It is able to integrate these sectors and their respective values for innovative purpose. Furthermore, the Hub has the ability to connect the intellect of these sectors into profitable revenue for community revitalisation. There is a clear market for its unique services.

The services offered are that of value-added business support and development, intellectual property management, innovation programs, innate collaboration and networking, and office space.

5.6.2.1.2. Services

The services promote business support and development, intellectual property management, innovation programs, collaboration and networking, and office space.

Business Support and Development

These services enable residents to focus on innovative activities, free entrepreneurs from back-office and administrative tasks and provide access to a business centre and provide access to conference venues and advisory services.

Intellectual Property Management

The objective of the Intellectual Property (IP) office is to provide leadership in IP related issues and services ensuring effective IP management and commercialisation of technology innovations. It is essential for all businesses to have knowledge of IP to run your business successfully.

Innovation Programs

Innovation programs are used to increase collaboration across all economic sectors. These programs include:

- Maxum Business Incubation
- CoachLab
- Green and Sustainable Development Projects
- Climate Innovation Centre
- mLab
- OpenIX (Innovation Exchange)

Collaboration and Networking

The Hub has a well-developed program of events and initiatives designed to enhance synergy between industry, government, funders, academic and research institutions.

Office Space

High-quality office space is provided to knowledge-based enterprises in a number of multi-tenant buildings. Communal facilities, such as a reception and meeting rooms, are available for all residents to use.

5.6.2.1.3. Sectors

The active partnerships with the business, government, research and education sectors are integral to its success and is part of an ongoing program to leverage investment, technical capacity, marketing, expertise and information value that can support both local and provincial economies.

The Hub's criteria require resident companies to operate in the technology-led and research-based sectors of Biosciences, Information and Communication Technology (ICT), Green Technologies and Industrials. Some of the existing accommodated sectors include the following:

- Biosciences
- Industrial and Engineering
- Information and Communication Technology (ICT)
- Business (Incubators)
- Service (Professional)
- Research and Development

The variety of resident companies displays positively on the commitment to collaboration and innovation, as well as financial investment in the Innovation Hub as a professional business model.

5.6.2.1.4. Design and Place-Making Attributes

Creating spaces that are visually and functionally supportive to the purpose of the structure is essential. The Innovation Hub provides high-quality interior design and supporting exterior for both residents and visitors. The development is 121,000m² in size, accommodating businesses like information and communication technology, electronics, life sciences, and advanced materials and manufacturing.

The hub provides shared facilities useful for the intention of collaboration and interaction of the public. These facilities include:

- A knowledge centre
- Post office
- Auditoria
- Restaurants
- Boardrooms
- Meeting rooms
- Video conferencing
- Exhibition spaces

This analysis points to a fair interaction between the primary function of the building and aesthetic function. The interaction space both private and public allows for users that can be translated into opportunities for new ties.

With its provision of a competitive mix of knowledge and business opportunities, as well as a resourceful revenue stream in the leasing of space, the hub is able to integrate innovation and business sustainably. Some of the key strengths that can be analysed in the success of the Innovation hub include its strategic location, complimenting sectors and viable services. Furthermore, the extensive design of the Hub displays a high-quality enterprise along with innovative office and public spaces that promote interaction. There still exists an opportunity for higher levels of influence on regional, national and inclusion into the continental innovation market.

5.6.2.2. Riversands Incubation Hub

The Riversands development already encapsulates an existing Incubation hub, which is a starting point for a variety of entrepreneurs. The light industrial/mini-factories would provide a place for their businesses to continue to grow after the Incubation Hub was used as a stepping stone.

The Riversands Incubation Hub is set to generate entrepreneurial activities and will become an important link between small businesses and the corporate environment in Midrand. The development is a large-scale business incubator established in 2015 through a partnership between Century Property Developments and The Jobs Fund. The Hub is home to 150 small businesses when at full capacity, where 300 additional entrepreneurs are supported through business development and offered support services. It is located at the centre of the Riversands Commercial Park. The primary intention of the incubator is to create a strong, enabling ecosystem that fosters the development of high-potential enterprises.

Vision	Mission	Value Proposition
•A South African economy growing and thriving through successful small businesses, whose ownership reflects SA's population demographics, creating jobs and opportunity for all.	•To provide and facilitate access to a rich range of entrepreneur development and business growth support services that talented committed entrepreneurs can access to help them create and grow their businesses.	•Entrepreneurial training, business incubation and job creation with the Riversnads Commercial Park and broader commerce industry.

There are 150 mini-factories, retail, office spaces and horticultural and landscaping training space available for SME businesses and partner companies. These spaces provide an integrated manufacturing, training, commercial and retail environment in which SMEs have ample opportunity to trade.

The backbone of the Hub is the extensive learning centre, which offers the following facilities:

- Library for research;
- Two 98-seat lecture halls;
- A 480-seat auditorium;
- Fully equipped skill-specific training workshops;
- Meeting rooms and mentor rooms;
- Fully connected and enabled hot desks;
- Back-up marketing and printing facilities;
- State of the art IT and telephony;
- Business centre;
- Restaurant; and
- An amphitheatre with a capacity of for up to 4 000

The hub has the potential to create a number of job opportunities and play an essential role in economic growth and development.

6. Market Opportunity Analysis

To identify the most viable opportunities for Unitas Park Extension 16, Vereeniging, a preliminary opportunities analysis is conducted based on the findings provided in the previous section, Market Perspectives.

The preliminary opportunity analysis assesses the potential of each of the identified property types by considering prevalent economic and market trends in the study area. The findings of the preliminary opportunity analysis identify the property types with the highest development potential for further analysis. The opportunity analysis acts as a fatal flaw assessment to identify key factors that may have a direct negative impact on the development potential of a specific land use. Therefore, opportunity analysis acts as an elimination tool for properties that may not be well-supported by the local market. The preliminary opportunity analysis will investigate the following land uses:

- Residential
- Office
- Industrial
- Retail
- Educational
- Hotel
- Community amenities

The performance of various economic sectors drives each property sector. The performance of each economic sector will thus influence different property markets in the study area. Therefore, it is important to analyse each economic sector as a means of identifying property market trends specific to the study.

6.1. Opportunity Analysis

The preliminary opportunity analysis considers the findings of the macro-economic and socio-economic property market trends and spatial analysis. This enables the identification of land uses with the highest development potential under current market conditions. The table below presents an overview of the preliminary opportunity analysis and indicates which land uses will be further investigated by this market research report.

Table 17: Preliminary Opportunity Analysis Matrix

Land Use	Market Indicator	Positive	Negative	Total Score	%
Office	**Office space availability** • Limited offices available • Area not considered a conducive environment for office development		√	3/5	60%
	Quality of existing stock • No stock in the immediate vicinity	√			
	Socio-economic indicators • Job creation	√			

Land Use	Market Indicator	Positive	Negative	Total Score	%
	Economic growth • Slow economic growth		√		
	Surrounding land uses • Residential and agricultural holdings	√			
Residential	**Existing residential stock** • Large number of stock in immediate area • Most homeowners in area own house for 11 years / more • Additional land uses could increase demand for housing	√		3/5	60%
	Quality of existing stock • Mostly old houses in the immediate vicinity • Need for new stock		√		
	Socio-economic indicators • Moderate population growth rate	√			
	Economic growth • Low economic growth		√		
	Surrounding land use • Residential and agricultural holdings	√			
Retail	**Existing retail stock** • Small retail facilities exist in immediate area • Limited medium to larger retail facilities operates in the immediate area. • The nearest retail centre is approximately 4 km from the proposed site.		√	5/6	83%
	Quality of existing stock • Small existing retailers in the immediate vicinity of poor quality	√			
	Socio-economic indicators • Job creation	√			
	Location of site	√			

Land Use	Market Indicator	Positive	Negative	Total Score	%
	• Surrounded by residential units and agricultural holdings				
	Economic growth • Generate revenue	√			
	Surrounding land use • Residential and agricultural holdings	√			
Education	**Existing educational stock** • Four schools within 3 km radius • High learner-educator ration for primary schools	√		4/4	100%
	Location of site • Ideally located in residential area	√			
	Socio-economic indicators • Increasing population	√			
	Surrounding land use • Residential and agricultural holdings	√			
Student Housing	**Existing tertiary education institutions** • Sedibeng TVET College located in Vereeniging • NWU (Vanderbijl Park Campus) and Vaal University of Technology is located in Vanderbijl Park.	√		4/4	100%
	Location of site • Ideally located for students of Sedibeng TVET College • Majority of students located in Vanderbijl Park. • Could also serve students studying in Vanderbijl Park.	√			
	Existing student accommodation stock • Insufficient student housing stock in Vereeniging	√			
	Economic Growth • Generate revenue • Facilitate local economic growth	√			

Land Use	Market Indicator	Positive	Negative	Total Score	%
Hospitals and Clinic	**Existing stock** • No clinics within the immediate vicinity, only on further ends of primary market area • Overcrowded	√		4/5	80%
	Location of site • In a residential neighbourhood	√			
	Socio-economic indicators • Job creation	√			
	Economic growth • Slow economic growth		√		
	Surrounding land use • Residential and agricultural holdings	√			

6.2. The Way Forward

The land uses identified with the highest development potential include the following:

- Residential
- Student housing
- Retail
- Clinic
- School
- Office

7. Market Potential Analysis

The market potential analysis of the different land uses is done separately since the drivers of each land use differ. The following sub-section relays the calculations for the residential models and the key findings for residential demand.

7.1. Residential

This sub-section elaborates on the market potential analysis for residential development for the proposed site. The development gap within the market area is calculated using the Net Effective Demand (NED). The following figure illustrates the equation used to calculate residential demand. The NED indicates the potential of the local market to support additional residential development within the given area.

Figure 23: Residential Net Effective Demand

The residential demand model uses population projections, the number of households, and income distribution trends to quantify the demand for residential development. The market demand assessment considers the following important demand drivers:

- Growth in the number of households
- Household income
- Affordability of residential units

An equilibrium demand modelling technique is used, which assumes that the demand for bonded and rental housing in the market area is null in the base year (2019) as the local population is fully served in terms of bonded and rental accommodation. Although it is known that the population is not fully served at the base year, the equilibrium model enables the calculation of the starting point for the demand generation due to the immeasurable supply and the large market area. For this study, 2019 is used as the base year, which enables the determination of the bonded and rental housing demand for 2020 onwards.

7.1.1. Household Features

The projected household figures for both the primary and secondary market areas are used as a basis for the demand equilibrium model. The population growth projections are based on a five-year historic growth rate of 0.42% per annum and a household growth of 0.99% for both the market areas.

Table 18:Population and household growth

	2020	2021	2025	2030
Primary Market Area Population	318 195	319 531	324 932	331 812
Primary Market Area Household	98 875	99 855	103 872	109 123
Secondary Market Area Population	513 824	515 982	524 704	535 814
Secondary Market Area Household	163 698	165 320	171 971	180 663

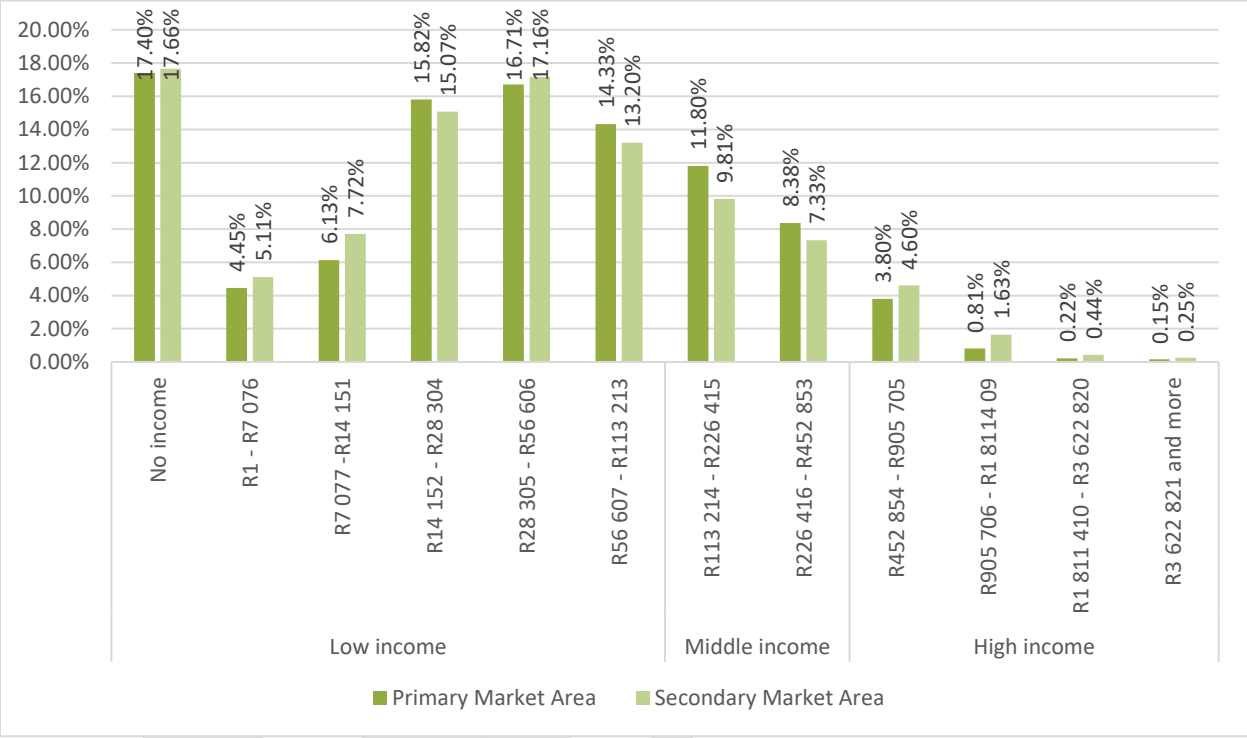
URBAN-ECON
Celebrate Development Diversity
Urban-Econ Development Economists
eduan@urban-econ.com
Tel: 012 342 8686

Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

7.1.2. Household Income

The viability of any development depends on the household income levels of the market area. The household income profile provides an indication of disposable income and property of the local population and is used to measure and calculate the demand for housing.

Figure 24: Annual household income



Source: Stats SA Census 2011 Data via Quantec Easy Data, 2020

As indicated earlier in the report, a large portion of the population falls within the low-income brackets, indicating that residents in both the primary and secondary market areas, do not have necessarily have access to capital to purchase a house.

7.1.3. Affordability Ranges

This sub-section provides a breakdown of the housing qualification bands for bonded and rental developments. The following table indicates the housing qualification categories for subsidised, FLISP, affordable, and middle- and high-income housing.

Table 19: Income categories for bonded developments

Income categories for bonded development		
	Min	**Max**
Subsidised	-	R 42 000
FLISP	R 42 000	R 264 000

Income categories for bonded development		
	Min	**Max**
Affordable Housing	R 108 000	R 264 000
Middle Income	R 264 000	R 600 000
High Income	R 600 000	+

The table below illustrates the average rental ranges for each rental housing qualification category as well as the average rental rates for middle- and high-income rental housing.

Table 20: Income categories for rental units

Income categories for rental developments		
	Min	**Max**
CRU	R 9 600	R 42 000
Social Housing Primary Market Area	R 18 000	R 66 000
Social Housing Secondary Market Area	R 66 000	R 180 000
Affordable Housing	R 108 000	R 264 000
Middle Income	R 264 000	R 600 000
High Income	R 600 000	+

7.1.4. Net Effective Demand

The demand for new residential development was determined by applying a set of residential indicators to the demand calculation model. This sub-section illustrates the effective demand for various housing typologies within the market area across all income categories until 2030. The household income ranges and the projected household numbers were used to calculate and project the demand for both bonded and rental development in the market area. The Net Effective Demand (NED) calculates the market gap for new housing development in the demarcated market area. The NED indicates the potential of the local market to absorb additional bonded and rental housing.

7.1.4.1. Injection Factor

An injection factor refers to the potential tenants who would relocate to the direct market area if an opportunity to do so was presented. To calculate a realistic and conservative demand estimate for a new residential development, a 20% injection factor was applied to the effective demand of the indirect market area.

7.1.4.2. Leakage Factor

A leakage factor refers to the net outflow of households from within the direct market area. Leakages are therefore potential tenants who would live within the direct market area and be willing to move to areas outside of these boundaries. To calculate a realistic and conservative demand estimation, a 35% leakage factor was applied to the direct market area to compensate for the migration of households from the direct market area to other neighbourhoods.

7.1.4.3. NED

The NED presents the development potential (market gap) for residential development within the demarcated market area in Vereeniging (see table below).

Table 21: NED for bonded housing

YEAR	BONDED					
	Subsidised	FLISP	Affordable Housing	Middle Income	High Income	Total
2020	535	248	106	112	15	1 017
2021	839	374	160	169	23	1 565
2022	1 238	501	215	227	30	2 211
2023	1 412	629	270	285	38	2 634
2024	1 702	759	326	344	46	3 177
2025	1 996	890	382	403	54	3 725
2026	2 293	1 022	439	463	62	4 278
2027	2 592	1 155	496	524	70	4 837
2028	2 895	1 290	554	585	78	5 401
2029	3 200	1 426	612	646	86	5 971
2030	3 509	1 564	671	709	95	6 547
2031	4 209	1 702	731	772	103	7 517

The data presented in the table above show the predicted demand for bonded housing from 2020 to 2031 and show that the housing market is growing and that there is a demand for new residential development. The greatest demand in the primary market area for bonded housing is subsidised and FLISP housing.

The following table shows the rental demand in the demarcated market area in Vereeniging, from 2020 to 2031.

Table 22: NED for rental housing

RENTAL							
YEAR	CRU	Social Housing		Affordable Housing	Middle Income	High Income	Total
		Primary Market	Secondary Market				
2020	90	112	72	57	61	8	400
2021	135	168	108	86	92	13	603
2022	181	226	145	115	123	17	807
2023	228	283	183	145	154	21	1 014

RENTAL							
YEAR	CRU	Social Housing		Affordable Housing	Middle Income	High Income	Total
		Primary Market	Secondary Market				
2024	275	342	220	175	186	26	1 223
2025	322	401	258	205	218	30	1 434
2026	370	460	297	236	250	35	1 647
2027	418	521	335	266	283	39	1 863
2028	467	581	374	298	316	44	2 080
2029	516	643	414	329	349	48	2 300
2030	566	705	454	361	383	53	2 521
2031	617	767	494	393	417	58	2 745

The data in the table above indicates that there is a greater demand for CRU and social housing. The demand for primary market social housing is estimated at 168 units in 2021 and is expected to increase to 767 units in 2031. The demand for CRU housing is 135 in 2021 and is expected to increase to 617 in 2031.

The majority of the population of both the primary (75%) and secondary (71%) market areas fall within the low-income household income category. The low household income category ranges from no income to R113 213 per annum. Based on these income categories for rental housing, there is a demand for CRU and social housing. The demand for CRU housing is expected to increase to 566 by 2030, whereas the demand for Social Housing (primary market) is expected to increase to 705 by 2030.

Given the income categories for bonded housing, there is a demand for subsided and FLISP housing. The demand for subsided housing is expected to reach 3 509 by 2030. The demand for social housing in the primary market area is expected to reach 705 by 2030.

7.2. Retail

This sub-section provides an analysis of the market potential of the proposed retail facility based on the market area delineation.

7.2.1. Methodology

The methodology used to calculate the market potential of a new retail development was developed based on a residual analysis technique that considers the demand and supply factors associated with the market area.

This process compares the relevant supply to the total demand within the market area. Both the supply and demand are measured in terms of floor area (square metres) and refers to the gross leasable area (GLA). This process calculates the net effective demand (NED) or market gap in terms of the GLA for the proposed retail component within the demarcated market area which informs the feasibility of the

proposed retail development. The figure below demonstrates the methodology followed in order to calculate the NED for additional retail space in the market area.

Figure 25: Retail Net Effective Demand

The purpose of the demand analysis is to calculate the market gap for a retail facility. The demand calculation model is based on the interaction between the following dynamics:

- Population growth rates
- Number of households
- Leakages and injections
- Household income

The result of the demand analysis presents an effective demand for the proposed development.

7.2.2. Population Profile

The population profile presents the household and population size in the demarcated market area. The population figures were used as a basis for the residual demand model. Annual population and household growth were calculated based on a five-year average growth rate.

Table 23: Population profile and growth

	2020	2021	2025	2030
Primary Market Area Population	318 195	319 531	324 932	331 812
Primary Market Area Household	98 875	99 855	103 872	109 123
Secondary Market Area Population	513 824	515 982	524 704	535 814
Secondary Market Area Household	163 698	165 320	171 971	180 663

The growth in the number of households in both the primary and the secondary market areas indicates a growth in the demand for retail space.

7.2.3. Trading Densities

Trading densities can be broadly defined as the annual turnover per square metre that an enterprise should receive to remain viable. Each retail category requires a certain amount of income per square meter to remain sustainable. The annual turnover required by a tenant to remain viable is determined by their profit margins and operational costs. Expenditure is a monetary value that needs to be converted to square metres to measure the potential effective demand for the proposed development. Therefore, trading densities are incorporated into the demand calculation model to calculate the desired GLA (m^2) for each retail category.

The appropriate trading densities were applied to the relevant expenditure categories to calculate the effective demand for retail floor space in the delineated market area.

7.2.4. Leakages and Injections

Leakage and injection factors were applied to the retail demand calculation model in order to avoid an overestimation of the potential consumer pool that would use retail facilities located within the primary market area.

Leakages

Leakages can be described as the outflow of purchasing power from the primary market area. Leakages are potential consumers who reside in the primary market area but prefer goods outside the primary market area.

The leakage factor is applied to the demand calculation model to calculate the effective demand for retail floor space within the primary market area based on the current spending patterns of households. A leakage factor of 40% is applied to ensure a realistic and conservative demand estimation. It is therefore assumed that 40% of the population in the primary market area will travel to retail facilities located outside the primary market area. However, due to the nature of the development, it is anticipated that the retail facility will be able to capture a large portion of the population in the primary market area.

Injection

Injection takes place when potential customers who do not reside in the primary market area opt to use retail facilities in the primary market area. An injection is an external contribution to the economy of the primary market area. A conservative approach is applied to ensure a realistic outcome that does not overestimate the significance of the proposed retail development. Therefore, an injection factor of 18% was applied to the retail model calculations.

The region outside the secondary market was not taken into consideration when calculating the external injections.

7.2.5. Supply Analysis

The supply analysis refers to the investigation of the existing and future supply of retail facilities of similar hierarchy in the market area that will act as potential market competitors to the proposed development. The purpose of the supply analysis is to get an understanding of the existing supply in the primary market area and in doing so, identify the potential competitors.

Competitive supply refers to retail facilities that are located in the primary market area. The table below represents all competitive retail facilities in the primary market area.

Table 24: Retail supply in the primary market area

Name	Anchor stores[19]	Distance from the proposed site (km)	GLA (m^2)
Mandela Square Shopping Centre (Boitumelo)	• Pick n Pay	15.4	6 399
Checkers Hyper Arcon Park	• Checkers	5.5	10 573
Thabong Shopping Centre (Sebokeng)	• Pick n Pay • Spar	15.2	41 145

[19] South African Council of Shopping Centres: Shopping Centre Directory, 2019

Name	Anchor stores[19]	Distance from the proposed site (km)	GLA (m^2)
	• Mr. Price • Pep • Clicks		
President Hyper Vanderbijlpark	• President Hyper Vanderbijlpark	14.2	26 000
Sebokeng Plaza	• Shoprite Checkers	12.5	11 422
Shoprite Checkers Centre - Three Rivers	• Shoprite Checkers • Pep	10.5	6 164
Bedworth Park Value Centre	• Pick n Pay • Builders Warehouse	13.8	83 942
Markpark	• Shoprite • Pep • Ackermans • Jet • Clicks	9.6	22 355
		Total:	**208 000**

From the data provided in the table above, it is clear that there are a number of retail supply in the market area. However, there are no retail centres within the immediate vicinity of approximately 5 km from the proposed development; this indicates the need and demand for a retail facility.

7.2.6. Demand Analysis

The factors mentioned above are applied to the demand calculation model in order to determine the effective demand for a new retail facility located in the demarcated market area. It should be noted that the effective demand calculations do not consider any supply factors and will be incorporated into the net effective demand (NED) calculations.

The demand calculation model calculated the total effective demand for retail floor space and is expressed as GLA (m^2). The demand model is based on the interaction between the following factors:

- Population and number of households
- Household income and expenditure
- Leakages and injections
- Trading densities

The following table presents the NED retail floor space in the primary market area.

Table 25: NED for retail space in the primary market area (cumulative demand in m^2)

	2020	2022	2025	2028	2030
NED	14 900	17 700	22 006	26 441	29 472

The table above shows that the NED is expected to increase to reach 22 006 m^2 by 2025 and 29 472m^2 by 2030.

7.3. Office

This sub-section provides an overview of the office market within the market area to determine the market gap for additional office space. The net effective demand (NED) for office space is calculated to express the potential for additional commercial facilities in terms of square metres. A variety of influential factors are analysed to assist in the determination of the total office space needed, which can ultimately be supported by the market population.

The demand calculation model assumes that the demand for office-related floor space increases annually based on the economic sector's annual employment growth rate. The growth projections are then applied to office standard industrial parameters, which allows for the calculation of the total increase in effective demand for office floor space required per annum to sustain the office sector's growth in the market area.

The following table provides the NED for office space in the primary market area.

Table 26: NED for office space (m^2)

	2020	2022	2025	2026	2028	2030
NED	1 354	2 773	7 292	8 880	12 182	15 662

The data presented in the table above show that the NED for the office space in the primary market is expected to increase to reach a demand of 15 662m^2 office space by 2030.

7.4. Education

7.4.1. Schools

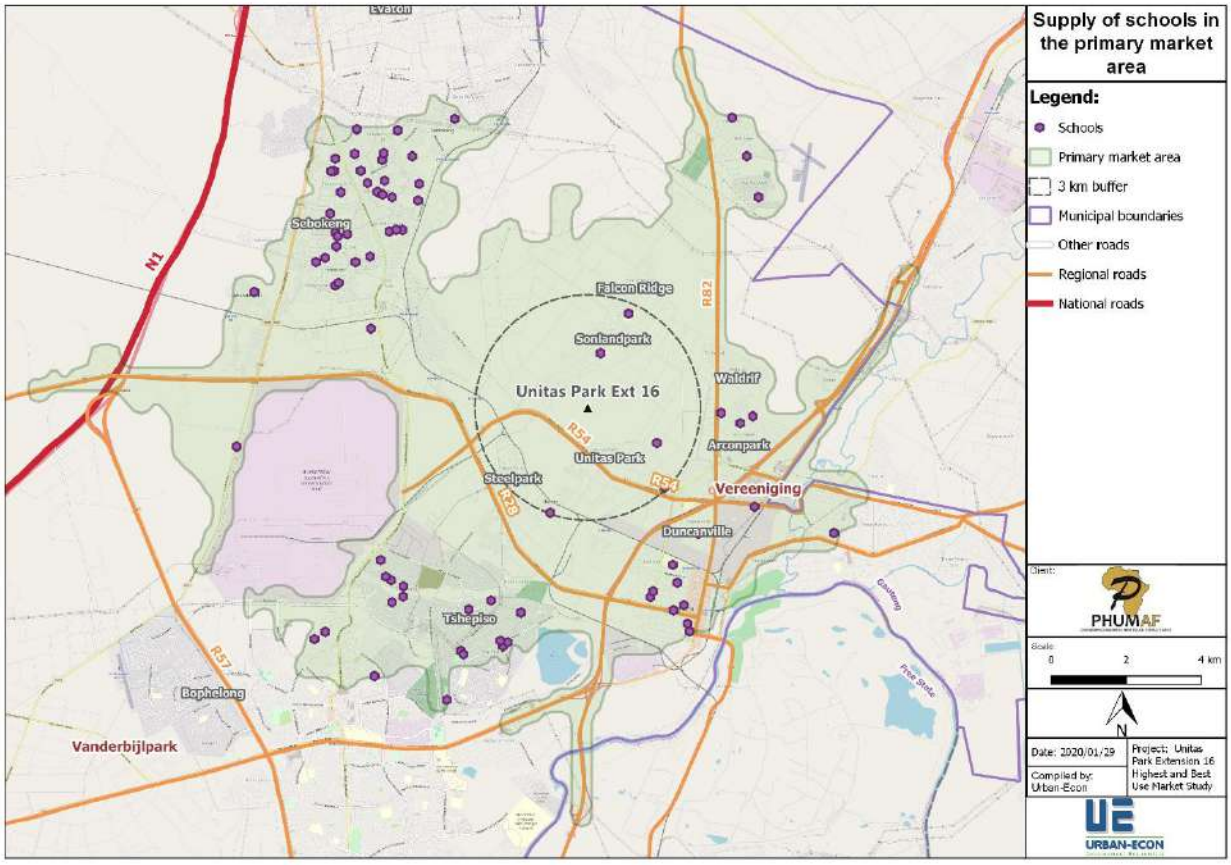
This sub-section discusses the calculations for determining the demand for educational institutions in the demarcated market area. The main factors considered for determining the demand for schools are the supply of schools in the market area, the population numbers, and the learner-educator ratios. The following table provides the expected growth in population and the number of households in both the primary and secondary market areas.

Table 27: Population and household growth in the primary and secondary market areas

	2020	2021	2025	2030
Primary Market Area Population	318 195	319 531	324 932	331 812
Primary Market Area Household	98 875	99 855	103 872	109 123
Secondary Market Area Population	513 824	515 982	524 704	535 814
Secondary Market Area Household	163 698	165 320	171 971	180 663

The table indicates that the number of households and the population figures are expected to increase in both the primary and secondary market areas. The following map indicates the distribution and supply of existing schools in the primary market area.

Map 12: Existing supply of schools in the primary market area



Source: Data derived from the Department of Basic Education modified with QGIS, 2020

The map above shows that the majority of schools are clustered in Sebokeng. Other areas where a large number of schools are clustered includes Tshepiso and Duncanville. The closest school is located approximately 3.5 km from the proposed site. The data presented in the table below indicate the average learner-educator ratio and the average OECD indicators.

Table 28: Learner-educator ratio

Schools	Learner-educator ratio (LER)	Average OECD Indicators[20]
Primary schools	32:1	19:1
Secondary schools	25:1	28:1

From the data presented above, it is clear that the learner-educator ratio for primary schools is higher compared to that of the OECD indicators, which, therefore, also indicates the demand for additional schools.

[20] OECD, Education at a Glance 2014 OECD Indicators: OECD Indicators, p. 446-452

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The minimum norms and standards was used to identify the threshold population for determining the demand for both primary and secondary schools and nurseries / crèches.

Table 29: Threshold population

Educational facility	Threshold Population
Crèche/nursery	2 400 – 3 500
Primary Schools	2 200 – 6 600
High School	4 000 – 10 000

To calculate the demand and institutional capacity for various educational facilities, the expected total population was divided by the respective threshold population. The following table presents the calculated demand and the number of educational facilities for 2021, 2023, 2025, and 2028.

Table 30: Institutional capacity

Year of full potential	2021	2023	2025	2028
Crèche/nursery	3	5	7	10
Primary schools	3	5	8	11
Secondary / High school	2	3	4	6

The demand for nurseries is expected to increase from three nurseries in 2021 to ten nurseries in 2028. The demand projections for primary schools is three schools by 2021 and eleven schools by 2028 whereas the demand projections for secondary schools are two schools by 2021 and six schools by 2028.

7.4.2. Student Housing

The purpose of this sub-section is to determine and to quantify the need for student accommodation. The Net Effective Demand (NED) of student accommodation is calculated through the following model:

Figure 26: Student housing demand model

It is assumed that any growth in student enrolment in the market area is indicative of the growing demand for student accommodation.

7.4.2.1. Supply

The supply of student accommodation includes accommodation in Vereeniging as well as Vanderbijlpark as both falls within the demarcated market area. The supply for student accommodation considered accommodation on campus, accommodation provided off-campus by tertiary institutions, and other larger and popular student housing. Future developments for student accommodation are also included in the table below.

Table 31: Student housing supply

Student Accommodation	Number of units
NWU - Vaal Campus	877
Vaal University of Technology	1 000
	1 800[21]
Additional student accommodation supply	
Bedworth Lake Student Accommodation	700
Five Star Student Accommodation	16
Granada Student Accommodation	30
Buhle student houses	450
Total additional student accommodation supply	**1 196**
Total supply	**4 873**

The table above indicates that the Vaal University of Technology is expected to contribute an additional 1 800 student beds. The number of students enrolled at the campus is expected to reach 8 225 by 2021, indicating a demand for more beds.

The number of students enrolled at the Vaal University of Technology is expected to reach 19 346 by 2021. The current on-campus accommodation provides 877 beds, which indicate that there is a great demand for additional beds.

Other student accommodations within the market area include Buhle student houses, Five Star Student Accommodation, and Bedworth Lake Student Accommodation. This additional supply adds up to approximately 1 196 beds in the market area. It should be noted that due to time constraints, not all student accommodation facilities are included in this report. Based on the data provided above, the total supply of student accommodation in the market area adds up to **4 873 beds** within the market area.

7.4.2.2. Demand

The following table provides the estimated projected student enrolments at the various tertiary institutions.

[21] Additional future supply of 1 800 beds.

Table 32: Student accommodation demand

	2021	2022	2025	2028	2030
North-West University Vaal Campus	8 225	8 533	9 529	10 642	11 455
Vaal University of Technology	19 346	19 378	19 475	19 572	19 638
Sedibeng TVET College	10 756	10 918	11 417	11 938	12 299

The table above indicates that the number of students within the market area is expected to increase until 2030.

7.4.2.3. Interceptor Factor

The interception factor refers to the portion of demand within the market areas that the proposed student accommodation development will be able to capture.

A conservative approach is applied in order to ensure a realistic outcome that does not overestimate the significance of the proposed development. Therefore, an interceptor factor of 15% was used to calculate the effective demand in terms of the number of beds. The interception factor represents the students who study in the market area and willing to reside in the proposed student accommodation.

The following table provides the student accommodation demand based on a 15% interceptor factor.

Table 33: NED for student accommodation based on 15% interceptor factor

	2021	2022	2025	2028	2030
Number of students	38 327	38 829	40 421	42 152	43 392
Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED	3 703	3 810	4 140	4 497	4 751

Based on a 15% interceptor factor, the NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030.

7.4.2.4. Minimum Norm and Standards for Student Housing at Public Universities

There are minimum norms and standards for student housing at public universities as set by the Department of Higher Education and Training in the Gazette of 29 September 2015.

The following norms and standards must be adhered to:

- Site of residences:
  - The housing facility must preferably be situated within the campus security perimeter
  - Student housing sites must be within a radius of no more than 20 km of the campus
- Design of residences:
  - Designs must accommodate a maximum of two students per room
  - Single rooms no smaller than 8m^2 and double rooms not smaller than 14 m^2

- The minimum standards and norms for ablution facilities are presented in the table below:

Table 34: Minimum norms and standards for ablution facilities

Wash basins	1 per 4 student residents
Shower cubicle	1 per 7 student residents
Lavatories	1 per 5 student residents

- Shower and lavatory cubicles must be designed in such a way that individual privacy is provided
- Telephones and alarm bells must be placed in accessible and strategic locations so that students with disabilities are not disadvantaged
- Social spaces should be provided
- Residences should be designed to be either self-catering or non self-catering

- All health and safety certificates of compliance should be acquired
- The minimum furnishings and fittings required for each room type or area within a student housing facility are detailed in the Room Specification Manual.

According to the minimum norms and standards as set out by the Department of Higher Education and Training, student housing sites must be within a radius of no more than 20 km of the campus. The proposed development site is located within 20 km of various tertiary institutions (as discussed previously). It is suggested that an agreement is established with tertiary institutions in order to secure a sustainable number of students for the proposed student housing development.

7.4.2.5. Number of Units Required

This sub-section aims to calculate the number of units required for the development of Unitas Park Extension 16.

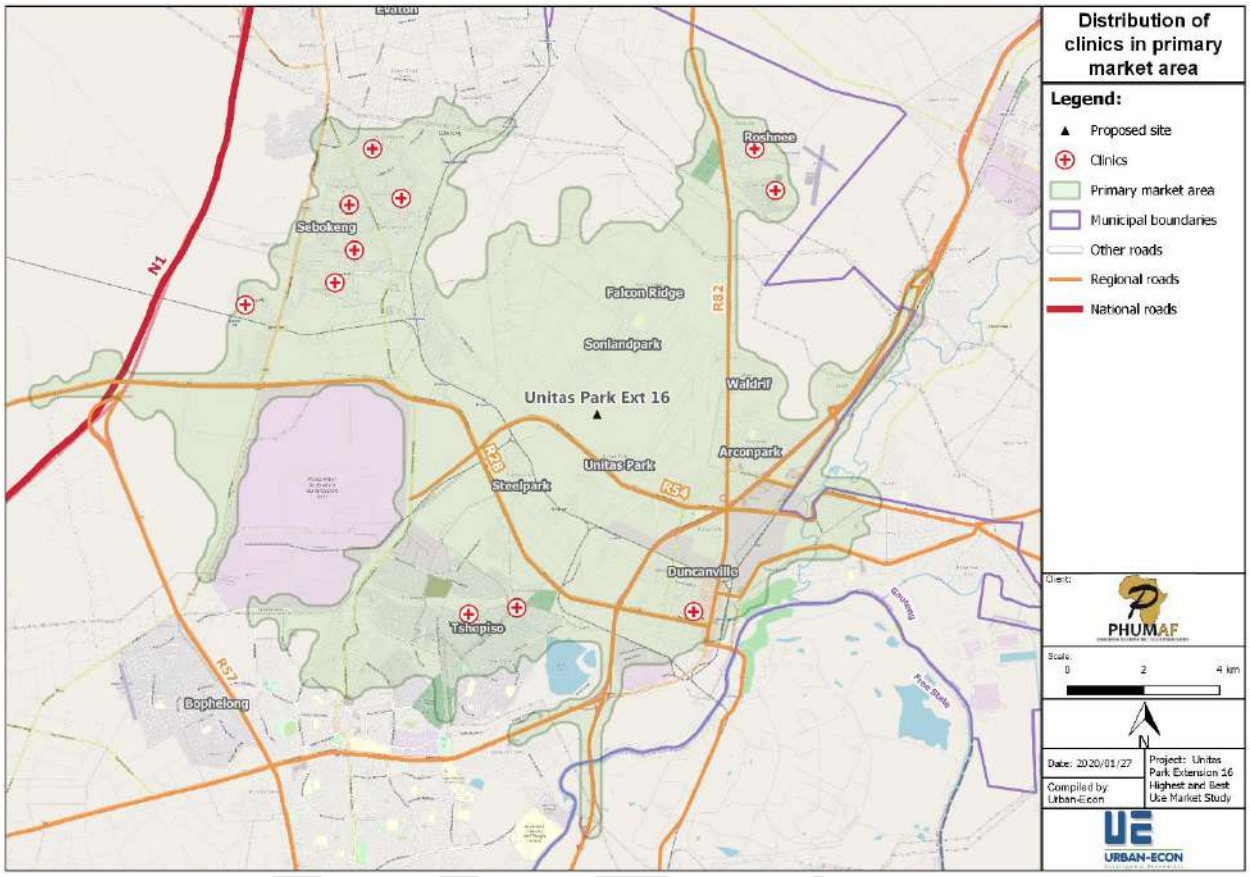
By calculating the number of units required for student accommodation, it is recommended that each unit accommodate four students (beds). The table below presents the future demand in terms of the number of units. This is based on the NED provided in sub-section 7.4.2.2.

	2021	2022	2025	2028	2030
Number of students	38 327	38 829	40 421	42 152	43 392
NED (number of beds)	3 703	3 810	4 140	4 497	4 751
NED (number of units)	926	953	1 035	1 124	1 188

7.5. Clinic

This sub-section discusses the calculations for determining the demand for clinics in the defined market area. The demand model considered the supply of existing clinics and the location of existing clinics and also highlighted discussions from the Emfuleni Integrated Development Plan 2019/20. The following map indicates the supply and distribution of clinics in the primary market area.

Map 13: Distribution of clinics in the primary market area



Source: Data derived from Mapable and modified in QGIS, 2020

The data provided in the map show that there are no clinics within the immediate area of the proposed development site. Most of the clinics are clustered in Sebokeng. The clinic closest to the proposed development is the Vaal Men and Women's clinic in Duncanville and is located approximately 8.6 km from the proposed development site. Rust Ter Vaal clinic in Roshnee is located approximately 9.6 km from the proposed site and Tshepiso clinic approximately 10.5 km from the site.

This illustrates the need for a clinic to serve the population in the primary market area (especially the population in Unitas Park and Sonland Park).

Table 35: Institutional capacity

Year of full potential	2021	2023	2025	2028	2031
Clinic	1	2	3	5	4

The table above indicates the anticipated demand for the number of clinics required in the primary market area. Based on this data, five clinics will be required by 2028 to serve the growing population in this area.

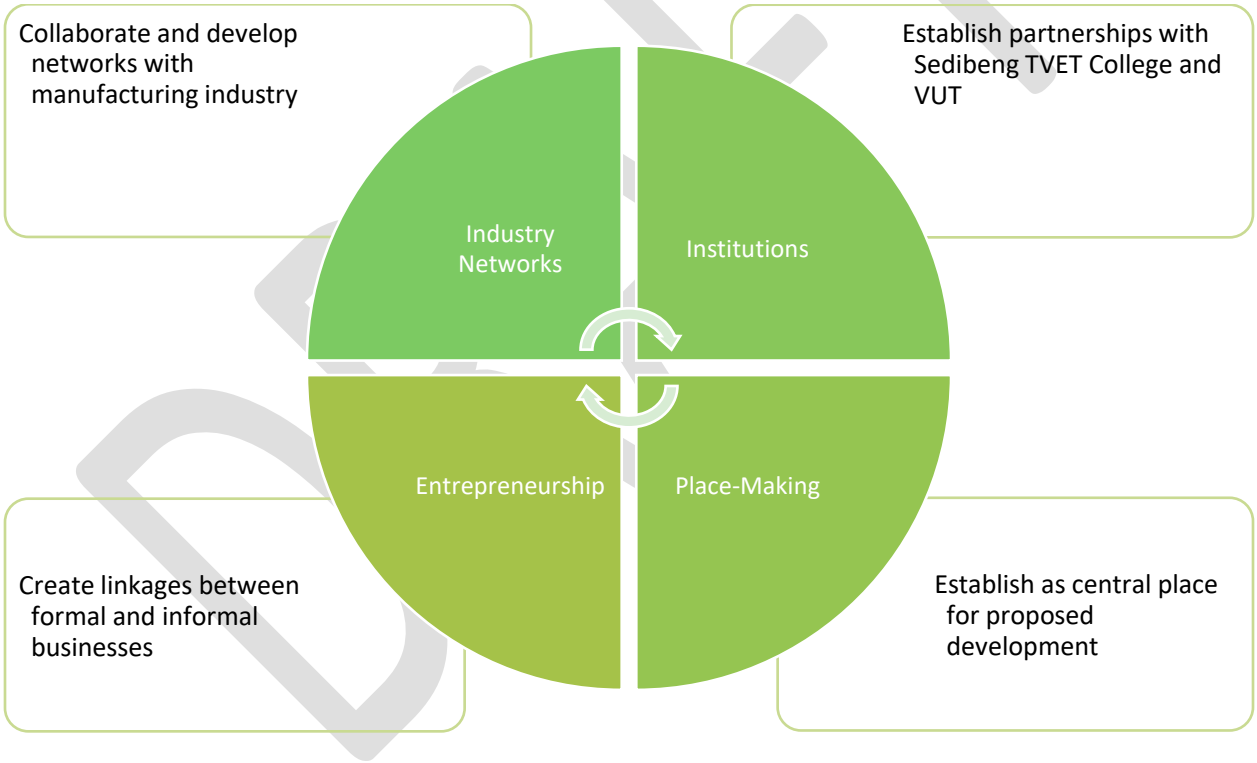
7.6. Unitas Park Innovation Hub Concept

The proposed innovation and incubation hub aim to stimulate growth in the local economy, through job creation, and creating more opportunities for innovation, businesses and networking. The hub is envisioned to incorporate the local workforce and to facilitate skills development related to various sectors and industries, and to create an enabling environment for SMMEs through linkages and networking.

As mentioned previously, the core components of an innovation and incubation hub includes the following:

- Institutions
- Industry networks
- Entrepreneurship
- Place-making

The following figure provides a summarises the core initiatives and objectives for the proposed incubation hub for Unitas Park Extension 16.



7.6.1. Institutions

It is suggested that the proposed innovation hub form partnership with existing tertiary institutions in the area (as identified earlier). These institutions could include the following:

- Sedibeng TVET College
- Vaal University of Technology
- NWU Vaal Campus

This proposed site for such a development is well located for forming these partnerships and can, therefore, make use of these educational and research institutions.

7.6.2. Industry Networks

Collaboration with larger industries such as the manufacturing industry could be considered for the proposed innovation hub. These collaborations could be used as part of mentorship programmes and for building relationships with other key industry role players.

7.6.3. Entrepreneurs

Partnerships between the formal and informal business sector could be facilitated through the innovation hub. Representatives of large-scale formal businesses could act as mentors and assist entrepreneurs of small and medium businesses. The hub could also provide a platform for skills development and could also create opportunities for networking sessions which allows various businesses to interact and establish potential partnerships and thereby creating a more dynamic and competitive business and entrepreneurial environment.

7.6.4. Place-Making

The proposed innovation hub could be developed in such a way to be the central place for Unitas Park Extension 16 mixed-use development and can be linked with student activities and services associated with the proposed development.

The innovation and incubation hub can play an important role in establishing networks, partnership and an integrated mixed-use development space. It can also facilitate economic growth and create job opportunities through skills development and mentoring programmes. These skills can be implemented and used in various small businesses and various industries. Partnerships with various institutional and educational facilities can be established in thereby driving research programmes, can provide innovative inputs within various programmes run by the hub.

8. Supplementary Land Uses

This section relays the population threshold according to the minimum norms and standards. The population threshold provides an indication of the number of people required to sustain a particular facility. These threshold indicators are also used to identify additional land uses most suitable within the market area.

8.1. Thresholds

The following table provides the population threshold and access distances for schools and other social facilities[22].

Table 36: Threshold and access distances

Facility Type	Typical population threshold (number of people)
Early childhood development centres (such as day-care centres, nursery schools, playschools and after-school care facilities) • Number of children: 6 – 150 children • Ages: younger than 5 years	2 400 – 3 500
Primary schools • Education facilities for Grade R to 7 (aged 5 to 12) • Small schools required a population threshold of 1 000 people	2 200 – 6 600
Secondary schools • Education facilities for Grade 8 to 12 • Ages 13 to 17	4 000 – 10 000
Primary health care clinics: Permanent facilities (public or private) providing a range of primary health care services	5 000 – 60 000
Libraries	5 000 – 25 000
Community centres	5 000 – 60 000
Religious centres	2 000
Post office	10 000 – 20 000
Police station	10 000 – 60 000

[22] It should be noted that the minimum threshold population was used to determine the required demand for social amenities.

Facility Type	Typical population threshold (number of people)
Government departments' offices Government departments providing access to specified services for a particular department	
Department of Home Affairs	20 000 – 200 000
Department of Labour Offices	
SASSA Offices	30 000 – 120 000

Source: Department of Human Settlements: Minimum norms and standards, 2019

8.2. The Way Forward

This section uses the population threshold figures and the analysis of previous sections to identify the key land-use demands and requirements for the proposed development site. The following additional land uses have identified for the proposed development site of Unitas Park Extension 16, Vereeniging:

- Schools
- Clinics
- Government department offices

9. Conclusion and Recommendations

This section provides concluding remarks for the key topics discussed in this report as well as the recommendations for future development on the proposed site.

9.1. Conclusion

This sub-section relays the key findings from each section presented in this report.

Spatial Analysis

- The proposed development is located in Vereeniging (Emfuleni Local Municipality) and situated 60 km south of Johannesburg.
- Some major towns within close proximity include Vanderbijlpark (approximately 17 km) and Sasolburg (approximately 32 km).
- The major land uses surrounding the proposed development site include residential development, open spaces, and agricultural holdings. There are also a number of churches in the area with some small retail facilities in the area.
- The proposed development will be a mixed-use development with the potential to add significant value to the area. The proposed mixed-use development will complement the existing urban fabric by providing supplementary services, activities, and other complementary land uses.

Macro-Economic Analysis

- The manufacturing sector makes the largest contribution (28%) to the total GVA of Emfuleni LM, followed by general governance contributing 17% to the total GVA of the local municipality.
- GVA trends indicate that general government, finance, insurance, real estate and business services, and wholesale and retail trade, catering and accommodation experienced growth from 2006 to 2018. Manufacturing (the largest contributor to the municipality's GVA) has shown a notable decline indicating that the industry is struggling. This will affect the local economy and also employment opportunities within the industry.
- The manufacturing sector, a leading economic sector in the LM, is expected to decline as a result of increasing electricity prices and costs of other raw materials. This already had a major impact on the local economy in terms of employment, revenue generated through manufacturing, and other industries depending on this sector.
- The General Government sector contributes 17% to the total GVA of Emfuleni LM. Potential land uses for the general government sector could be considered and incorporated into the proposed development.
- The current interest rate stands at 9.25%, which is down by 0.75% since the beginning of 2019. This is a good indication of home affordability since a decline in the interest rate enables better bond affordability and household expenditure.
- The current inflation rate stands at 3.7%. A lower inflation rate decreases financial pressure on households, which bodes well for home affordability as households have more disposable income.

Socio-Economic Analysis

- The population in the market area is expected to increase in the next decade which is a good indication of the demand for housing.
- The total potentially active (PEA) population accounts for approximately 70% of the total population. Due to this high percentage of PEA population, a large portion of the population is open to employment and to generate personal income.
- A moderate portion of the population is below the age of 15 years; therefore, it can be assumed that the demand for various goods and services will increase as the younger portion of the population become economically active.
- The industries making the largest employment contribution are community, social and personal services, and wholesale and retail trade. These are the most prominent industries in the area; therefore, additional land uses related to these industries can be considered. Some of these facilities include offices for public administrative services, human health activities, and educational services.
- Of the total population in the primary market, 38% are employed, 21% are unemployed, 3% are discouraged work-seekers and 38% are other not economically active population. This indicates that the majority of the working-age population is not employed or economically active and therefore have a low disposable income and does not have access to capital to buy a home.
- The unemployment rate in the local municipality is increasing, which means that people have less disposable income. The impact on the housing market is that people have less money available and, therefore, may not be able to purchase a house or may encounter bond repayment issues.

Market Perspective

- Freehold properties are highest in demand, but this could also be an indication of a market that requires higher densities.
- The declining house prices in areas surrounding the proposed development site can be an indication of a residential market that is in an oversupply of houses to buy.
- The number of students within the given market area is expected to increase to 43 392 students by 2030. The estimated student accommodation supply within the market area is 3 873[23].
- Eight shopping centres and malls are identified in the primary market area, the majority of which are located close to the borders of the primary market area. The closest shopping centre is located 5.5 km from the proposed site and therefore indicates that there is no retail centre serving the population of Unitas Park and Sonland Park.
- The primary market area consists of approximately 208 000 m^2 gross leasable area (GLA) of retail space.
- The major anchor shops are Shoprite Checkers, Pick n Pay, and PEP. This suggests that these stores capture and appeal to the local market and could be considered as anchor stores for a newly developed retail centre.

[23] Student accommodation supply provided here includes only some of the major student accommodation facilities within the demarcated market area.

- The identified area is not popular in terms of office space, and due to the low number of offices in the primary market area, it is suggested that office space for the proposed mixed-use development be limited to a small portion of the development site.
- The majority of schools in the primary market area are primary schools. It is also evident that the demand for primary education is high due to the learner-educator ratio being higher than the average as per the OECD Indicators. The closest primary school are located approximately 3.5 km from the proposed site.
- The nearest clinic is located approximately 8.6 km from the proposed site. The lack of clinics within the immediate area of the proposed development indicates the need for a clinic to serve the population, especially in Unitas Park and Sonland Park.

Market Opportunity Analysis

- The various potential land uses were analysed to identify those with the highest development potential and the highest probability to succeed. These land uses include residential, student housing, retail, clinics, schools and office.

Market Potential

- The majority of the population of both the primary (75%) and secondary (71%) market areas fall within the low-income household income category.
- Based on the income categories for rental housing, there is a demand for CRU and social housing. Given the income categories for bonded housing, there is a demand for subsided and FLISP housing.
- The number of students along with the current and future supply of student accommodation in the market area were used to determine the NED for student accommodation in the market area.
- A 15% interceptor factor was applied to the student accommodation demand model. The interceptor factor represents the students who study in the market area and willing to reside in the proposed student accommodation.
- Based on the 15% interceptor factor, the effective demand for student beds are expected to reach 4 140 by 2025 and 4 751 by 2030.
- By calculating the number of units required for student accommodation, it is recommended that each unit accommodate four students. Therefore, the number of units required by 2025 is expected to be 1 035 and 1 188 by 2030.
- The Net Effective Demand (NED) for retail development is expected to increase to reach 22 006 m^2 by 2025 and 29 472m^2 by 2030.
- The NED for office space in the primary market is expected to increase to reach a demand of 15 662m^2 by 2030.
- The learner-educator ratio for primary schools is higher compared to that of the OECD indicators and, therefore, also indicates the need for additional primary schools.
- The threshold population figures suggest that primary schools are higher in demand in the market area, compared to crèches and secondary schools.
- Five clinics will be required by 2028 to serve the growing population in this area.
- The innovation and incubation hub can play an important role in establishing networks, partnership and an integrated mixed-use development space. It can also facilitate economic growth and create job opportunities through skills development and mentoring programmes.

These skills can be implemented and used in various small businesses and various industries. Partnerships with various institutional and educational facilities can be established in thereby driving research programmes, can provide innovative inputs within various programmes run by the hub.

The following table summarises the income categories and desired densities for each bonded housing type category. A ten-year housing demand forecast is also provided for each category.

Table 37: Bonded income categories, housing typologies, densities and forecasts

Income Categories	Housing Type	Density	2021	2023	2025	2028	2031
0 – R42 000	Subsidised	High	839	1 412	1 996	2 895	4 209
R42 000 – R108 000	FLISP	High	374	629	890	1 290	1 702
R108 000 – R264 000	Affordable Housing	Medium to high	160	270	382	554	731
R264 000 – R600 000	Middle Income	Medium to high	169	285	403	585	772
R600 000 +	High Income	Medium to low	23	38	54	78	103

The following table summarises the income categories and desired densities for each rental housing type category. A ten-year housing demand forecast is also provided for each category.

Table 38: Rental income categories, housing typologies, densities and forecasts

Income Categories	Housing Type	Density	2021	2023	2025	2028	2031
R 9 600 – R42 000	CRU	High	135	228	322	467	617
R18 000 – R66 000	Social Housing Primary Market	High	168	283	401	581	767
R66 000 – R180 000	Social Housing Secondary Market	Medium to high	108	183	258	374	494
R108 000 – R264 000	Affordable Housing	Medium to high	86	145	205	298	393
R264 000 – R600 000	Middle Income	Medium to low	92	154	218	316	417
R600 000 +	High Income	Medium to low	13	21	30	44	58

Supplementary Land Uses

- In addition to housing development, the most viable supplementary land uses have been identified as student housing, retail, schools, clinics, and government department offices.

9.2. Recommendations

The recommendations provide two different scenarios that incorporate development potential and requirements for residential units, retail space, office space, and additional social amenities. Scenario one considers all residential units within a given year whereas scenario two excludes CRU and subsidised housing.

9.2.1. Scenario One

Scenario one looks at the requirements and the demand for various facilities for the proposed mixed-use development. The residential demand and requirements include all residential categories for both bonded and rental housing. The following table provides a breakdown of the residential demand and requirements for 2021, 2023, 2025, 2028, and 2031.

Table 39: Bonded requirements and demand for scenario one

BONDED					
	2021	**2023**	**2025**	**2028**	**2031**
Subsidised	839	1 412	1 996	2 895	4 209
FLISP	374	629	890	1 290	1 702
Affordable Housing	160	270	382	554	731
Middle Income	169	285	403	585	772
High Income	23	38	54	78	103
Total	**1 565**	**2 634**	**3 725**	**5 401**	**7 517**

The data presented in the table above show the predicted demand for bonded housing from 2021 to 2031. The housing market is growing and there Is a demand for new residential development. The greatest demand in the primary market area for bonded housing is subsidised and FLISP housing.

The following table provides a breakdown of the demand and requirements for rental housing.

Table 40: Rental requirements and demand for scenario one

RENTALS					
	2021	**2023**	**2025**	**2028**	**2031**
CRU	135	228	322	467	617
Social Housing Primary Market	168	283	401	581	767
Social Housing Secondary Market	108	183	258	374	494
Affordable Housing	86	145	205	298	393
Middle Income	92	154	218	316	417

RENTALS					
	2021	**2023**	**2025**	**2028**	**2031**
High Income	13	21	30	44	58
Total	**603**	**1 014**	**1 434**	**2 080**	**2 745**

There is a greater demand for CRU and social housing. The demand for primary market social housing is estimated at 168 units in 2021 and is expected to increase to 767 units in 2031. The demand for CRU housing is 135 in 2021 and is expected to increase to 617 in 2031.

The NED for student housing was calculated using a 15% interceptor factor. The following table provides the number of students, existing supply of student accommodation (number of beds), the NED (number of beds and the demand for the number of units.

Table 41: NED for student accommodation based on 15% interceptor factor

	2021	**2022**	**2025**	**2028**	**2030**
Number of students	38 327	38 829	40 421	42 152	43 392
Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED (number of beds)	3 703	3 810	4 140	4 497	4 751
Number of beds per unit	4	4	4	4	4
Demand (number of units)	926	953	1 035	1 124	1 188

Based on a 15% interceptor factor, the NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030. By calculating the number of units required for student accommodation, it is recommended that each unit accommodate four students (beds). Therefore, the projected demand for units is 926 for the year 2021 and is expected to grow to 1 188 units by 2030.

It is suggested that an agreement is established with tertiary institutions in order to secure a sustainable number of students for the proposed student housing development.

The following table provides a breakdown of the number of social amenities required for each year, given the number of housing.

Table 42: Demand and requirements for social housing for scenario one

Year of Full Potential	**2021**	**2023**	**2025**	**2028**	**2031**
Crèche/nursery	3	5	7	10	7
Primary Schools	3	5	8	11	8
High School	2	3	4	6	4
Clinic	1	2	3	5	4

Year of Full Potential	2021	2023	2025	2028	2031
Libraries	1	2	3	5	4
Community Centre	1	2	3	5	4
Religious Centre	4	6	8	12	9
Post Office	1	1	2	2	2
Police Station	1	1	2	2	2

The following table indicates the retail and office space requirements for each respective year until 2031.

Table 43: Future retail and office space demand (m^2) for scenario one

	2021	2023	2025	2028	2031
Total retail space demand	16 294	19 122	22 006	26 441	30 995
Total office space demand	1 354	2 773	7 292	8 880	12 182

It is recommended that the retail and office space is student-orientated to ensure that the student housing development is supported with the necessary retail and office services and thereby making the provision of student housing more sustainable.

9.2.2. Scenario Two

Scenario two looks at the requirements and the demand for various facilities for the proposed mixed-use development. The residential demand and requirements exclude CRU and subsidised housing. The following table provides a breakdown of the residential demand and requirements for 2021, 2023, 2025, 2028, and 2031.

Table 44: Bonded requirements and demand for scenario two

BONDED					
	2021	2023	2025	2028	2031
FLISP	374	629	890	1 290	1 702
Affordable Housing	160	270	382	554	731
Middle Income	169	285	403	585	772
High Income	23	38	54	78	103
Total	**726**	**1 222**	**1 729**	**2 507**	**3 308**

The greatest demand in the primary market area is FLISP and affordable housing. The demand for FLISP housing is expected to increase to 1 702 by 2031 whereas the demand for affordable housing is expected to increase to 731 by 2031.

The following table provides a breakdown of the demand and requirements for rental housing.

Table 45: Rental requirements and demand for scenario two

RENTALS					
	2021	**2023**	**2025**	**2028**	**2031**
Social Housing Primary Market	168	283	401	581	767
Social Housing Secondary Market	108	183	258	374	494
Affordable Housing	86	145	205	298	393
Middle Income	92	154	218	316	417
High Income	13	21	30	44	58
Total	**467**	**787**	**1112**	**1613**	**2129**

The greatest demand in terms of rental housing is social housing. The demand for social housing in the primary market area is expected to increase to 767 by 2031.

The NED for student housing was calculated using a 15% interceptor factor. The following table provides the number of students, existing supply of student accommodation (number of beds), the NED (number of beds and the demand for the number of units.

Table 46: NED for student accommodation based on 15% interceptor factor

	2021	**2022**	**2025**	**2028**	**2030**
Number of students	38 327	38 829	40 421	42 152	43 392
Number of beds	4 873	4 873	4 873	4 873	4 873
Interceptor factor	15%	15%	15%	15%	15%
NED (number of beds)	3 703	3 810	4 140	4 497	4 751
Number of beds per unit	4	4	4	4	4
Demand (number of units)	926	953	1 035	1 124	1 188

Based on a 15% interceptor factor, the NED for student housing is expected to increase from 3 703 beds in 2021 to 4 751 beds in 2030. By calculating the number of units required for student accommodation, it is recommended that each unit accommodate four students (beds). Therefore, the projected demand for units is 926 for the year 2021 and is expected to grow to 1 188 units by 2030. It is suggested that an agreement is established with tertiary institutions in order to secure a sustainable number of students for the proposed student housing development.

The following table provides a breakdown of the number of social amenities required for each year, given the number of housing.

Table 47: Demand and requirements for social housing for scenario two

Year of Full Potential	**2021**	**2023**	**2025**	**2028**	**2031**
Crèche/nursery	1	2	3	5	7

Year of Full Potential	2021	2023	2025	2028	2031
Primary Schools	1	3	4	6	8
High School	1	1	2	3	4
Clinic	1	1	1	2	3
Libraries	1	1	1	2	3
Community Centre	1	1	1	2	3
Religious Centre	2	3	4	6	8
Post Office	1	1	1	1	1
Police Station	1	1	1	1	1

The following table indicates the retail and office space requirements for each respective year until 2031.

Table 48: Future retail and office space demand (m^2) for scenario two

	2021	2023	2025	2028	2031
Total retail space demand	16 294	19 122	22 006	26 441	30 995
Total office space demand	1 354	2 773	7 292	8 880	12 182

Based on the calculations done in the retail model, the three retail categories identified as those in highest demand and most likely to be viable include the following:

- Food and non-alcohol beverages (24.1%)
- Clothing and footwear (10.5%)
- Recreation and culture (38.1%)

The percentages provided above indicate the suggested share of GLA that each of these retail facilities can contribute to the total retail space in the market area. In order to support and effectively establish a student oriented living space, it is recommended that retail is aimed at providing to the needs of students. These can include retail shops with affordable clothing, footwear and assecories as well as student oriented recreational and cultural space.

The top three office space categories as calculated using the office demand model include the following:

- Wholesale and retail trade, catering and accommodation (25.68%)
- Finance, insurance, real estate and business services (18.15%)
- Community, social and personal services (18.92%)

The categories provided above, indicate the major industries within the market area and it is therefore also recommended that the office space developed for Unitas Park Extension 16 be used for these industries. With the development of a student-orientated living space, it is recommended that office space are mainly focused on providing essential services to students and thereby creating a student-friendly environment.

APPENDIX C10

Agricultural Agro-Ecosystem Specialist Assessment

TerraAfrica

SOIL. AGRICULTURE. ENVIRONMENT.

Agricultural Agro-Ecosystem Specialist Assessment for the proposed Residential and Mixed-Use Development in Unitas Park Extension 16

Version 1 Report

Submitted by TerraAfrica Consult cc
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(MSc. Environmental Science)
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22 October 2020

DOCUMENT AND QUALITY CONTROL

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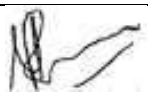
Version 1	Mariné Pienaar	Report Author		22/10/2020

DECLARATION OF INDEPENCE OF THE SPECIALIST

Details of Specialist

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Fields of registration: Soil Science
Agricultural Science

Declaration of Independence

I, Mariné Pienaar, hereby declare that TerraAfrica Consult, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

I further declare that I was responsible for collecting data and compiling this report. All assumptions, assessments and recommendations are made in good faith and are considered to be correct to the best of my knowledge and the information available at this stage.

TerraAfrica Consult cc represented by M Pienaar
22 October 2020

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1. INTRODUCTION

GCS Water and Environmental Consultants (Pty) Ltd appointed TerraAfrica Consult cc to conduct the Agricultural Agro-Ecosystem Specialist Assessment as part of the Environmental Impact Assessment (EIA) process for the proposed development of residential and mixed land uses as part of the Gauteng Rapid Land Release Programme (GRLP) (from here onwards also referred to as the proposed development).

The proposed development is located on approximately 154ha of land on Portion 222 of the Farm Houtkop 594 (also referred to as Unitas Park Extension 16) (Figure 1). For the purpose of the report, this area is also referred to as the proposed development area or study area. The study area is located within the Emfuleni Local Municipality and the Sedibeng district municipalities and is part of an area that is known as Unitas Park. The town of Vereeniging is located approximately 5.1 km south-east of the site.

2. PURPOSE AND OBJECTIVES

The overarching purpose of the Agricultural Agro-Ecosystem Assessment that will be included in the Environmental Impact Assessment report, is to ensure that the sensitivity of the site to the proposed land use change (from agriculture to residential and mixed land use) is sufficiently considered. Also, that the information provided in this report, enables the Competent Authority to come to a sound conclusion on the impact of the proposed project on the food production potential of the site.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool.
- It must contain proof of the current land use and environmental sensitivity pertaining to the study field.
- All data and conclusions are submitted together with the Environmental Impact Assessment report for the proposed development.

According to GN320, the Agricultural Agro-Ecosystem Assessment that is submitted must meet the following requirements:

- It must identify the extent of the impact of the proposed development on the agricultural resources.
- It has to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources.

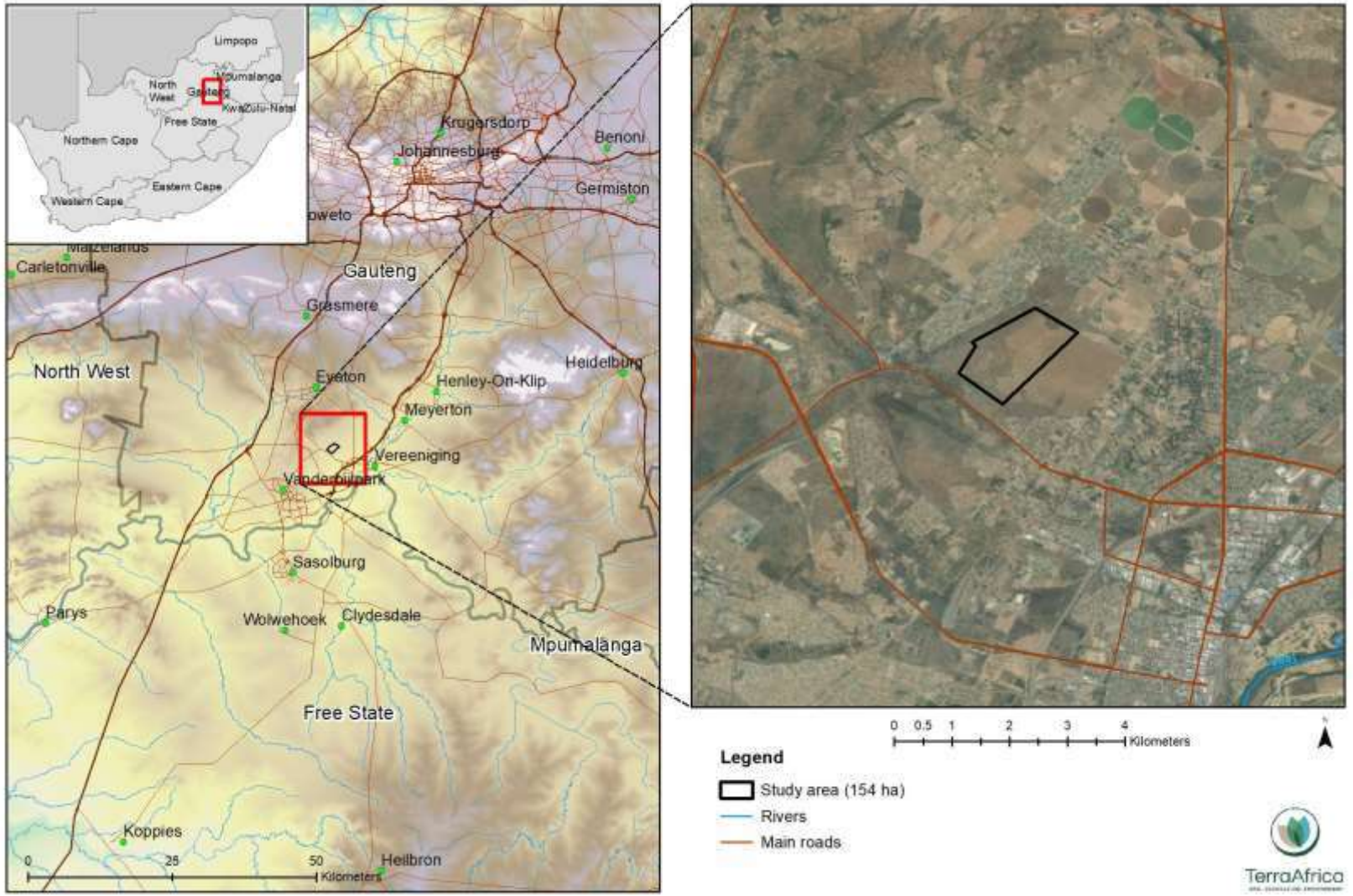

Figure 1: Locality map of the proposed Unitas Park Extension 16 development area

3. TERMS OF REFERENCE

In addition to the requirements stipulated in GN320, the following Terms of Reference as stipulated by GCS applies to the Agricultural Agro-Ecosystem Specialist Assessment:

- Consider all the baseline data that was gathered during the site survey together with all the relevant spatial data to understand the in-situ soil properties and agricultural production value of the site.
- Identify and assess potential impacts on both agricultural potential as well as soil, resulting from the proposed residential and mixed land use development.
- Identify and describe potential cumulative soil, agricultural potential and land capability impacts resulting from the proposed development in relation to proposed and existing developments in the surrounding area.
- Recommend mitigation, management and monitoring measures to minimise impacts and/or optimise benefits associated with the proposed project.

4. LEGISLATIVE FRAMEWORK FOR THE ASSESSMENT

Since the proposed development site has high sensitivity for agricultural resources, the report follows the protocols as stipulated for agricultural assessment in Government Notice 320 of 2020 (GN320). This Notice provides the procedures and minimum criteria for reporting in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (No. 107 of 1998) (from here onwards referred to as NEMA). It replaces the previous requirements of Appendix 6 of the Environmental Impact Assessment Regulations of NEMA.

In addition to the specific requirements for this study, the following South African legislation is also considered applicable to the interpretation of the data and conclusions made with regards to environmental sensitivity:

- The Conservation of Agricultural Resources (Act 43 of 1983) states that the degradation of the agricultural potential of soil is illegal. This Act requires the protection of land against soil erosion and the prevention of water logging and salinisation of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.
- Section 3 of the Subdivision of Agricultural Land Act 70 of 1970 may also relevant to the development.
- In addition to this, the National Water Act (Act 36 of 1998) deals with the protection of water resources, including wetlands. The soil assessment therefore also focused on the identification of any hydromorphic soil forms with wetland functionality that may be present in the study area.

5. SENSIVITY ANALYSIS OF THE SITE ACCORDING TO THE ENVIRONMENTAL SCREENING TOOL

The result of screening the proposed site with the Environmental Screening Tool of the Department of Environmental Affairs, showed that the area has high combined agricultural sensitivity (
Figure **2**). For sites with high agricultural sensitivity, an Agricultural Agro-Ecosystem Assessment is required.

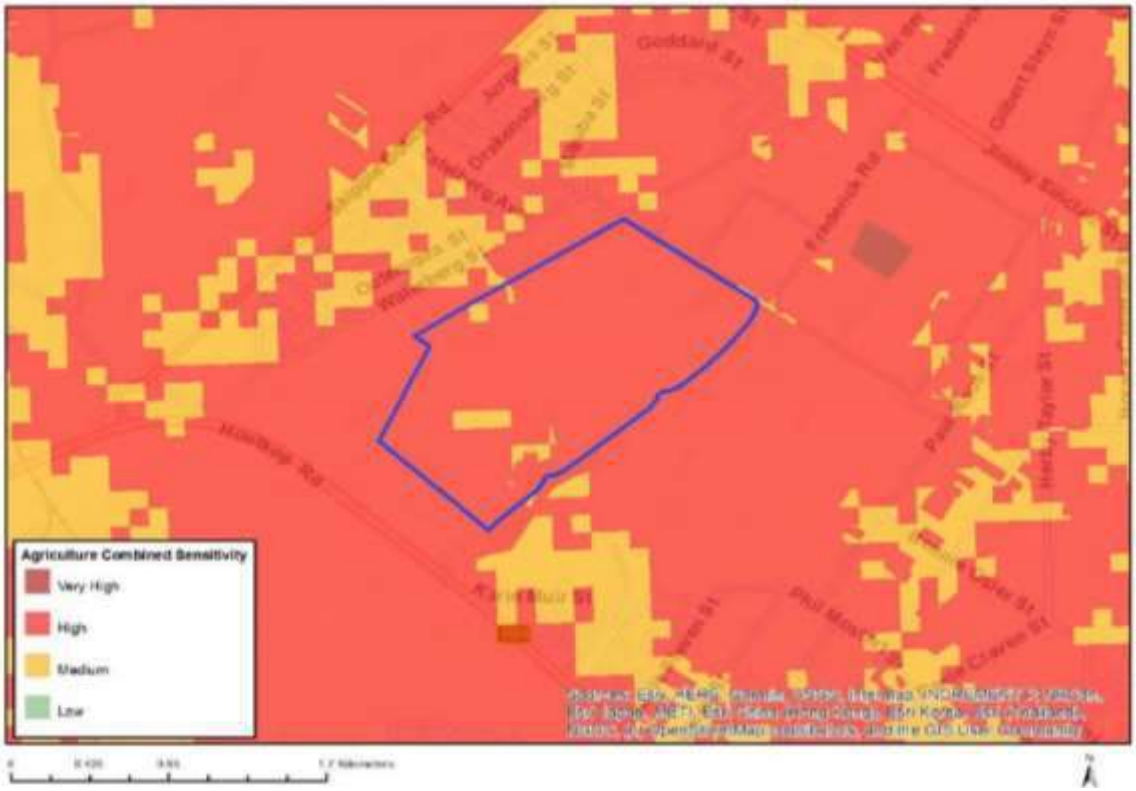

Figure 2 Visual depiction of the proposed development site's agricultural combined sensitivity

6. METHODOLOGY

6.1 Desktop analysis of aerial imagery and other spatial data

Satellite imagery accessed on Google Earth, was analysed to determine areas of existing impact and land uses within the study area as well as the larger landscape. It was also scanned for any areas where crop production and farming infrastructure may be present.

Prior to the site assessment, the study area boundary was superimposed on available spatial data layers. The following was analysed:

- The newly released National Land Capability Evaluation Raster Data Layer was obtained from the Department of Agriculture, Forestry and Fisheries (DAFF) to determine the land capability classes of the development area according to this system. The new data was developed by DAFF to address the shortcomings of the 2002

national land capability data set. The new data was developed using a spatial evaluation modelling approach (DAFF, 2017).

- The long-term grazing capacity for South Africa 2018 was also analysed for the area within which the proposed development area falls. This data set includes incorporation of the RSA grazing capacity map of 1993, the Vegetation type of SA 2006 (as published by Mucina L. & Rutherford M.C.), the Land Types of South Africa data set as well as the KZN Bioresource classification data. The values indicated for the different areas represent long term grazing capacity with the understanding that the veld is in a relatively good condition.
- The Gauteng Field Boundaries (November 2019) was analysed to determine whether the proposed Vaalbank industrial area project infrastructure falls within the boundaries of any crop production areas. The crop production areas may include rainfed annual crops, non-pivot and pivot irrigated annual crops, horticulture, old fields, smallholdings and subsistence farming. This data was also used to allocate a sensitivity rating for the proposed development area as well as a 50m buffer area around it.

6.2 Site assessment

The proposed development area was visited on 2 March 2020 (summer) for a site assessment that included a soil classification survey. The season has no effect on the outcome of the assessment. The soil profiles were examined to a maximum depth of 1.5m or the point of refusal using a hand-held soil auger. Observations were made regarding soil texture, structure, colour and soil depth at each survey point. A cold 10% hydrochloric acid solution was used on site to test for the presence of carbonates in the soil. The soils are described using the S.A. Soil Classification: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018). For soil mapping of the areas assessed in detail, the soils were grouped into classes with relatively similar soil characteristics.

6.3 Analysis of soil samples

Eight soil samples were collected from five modal soil profiles in the study area. Soil samples were sealed in clean soil sampling plastic bags and sent to Eco Analytica Laboratory at North-West University for analyses. Samples taken to determine baseline soil fertility were analysed for electrical conductivity (EC), pH (KCl), phosphorus (Bray1), exchangeable cations (calcium, magnesium, potassium, sodium) and texture classes (relative fractions of sand, silt and clay).

6.4 Impact assessment methodology

Below are the tables with the steps followed to do the impact rating according to the method prescribed by GCS (Pty) Ltd.

Table 1 Severity

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3

Highly significant / harmful	4
Extreme significance/ extremely harmful / within a regulated sensitive area	5

Table 2 Spatial scale

Area specific (at impact site)	1
Whole site (entire surface right)	2
Local (within 5km)	3
Regional / neighboring areas (5km to 50km)	4
National	5

Table 3 Duration

One day to one month / immediate	1
One month to one year / Short term	2
One year to 10 years / medium term	3
Life of the activity / long term	4
Beyond life of the activity / permanent	5

Table 4 Frequency of the activity

Improbable / almost never / Annually or less	1
Low probability / Very seldom / 6 monthly	2
Medium probability / Infrequent / Temporary / Monthly	3
Highly probable / Often / semi-permanent / Weekly	4
Definite / Always / permanent / Daily	5

Table 5 Frequency of the incident/impact

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 6 Legal issues

No legislation	1
Fully covered by legislation	5

Table 7 Detection

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4

Covered	5

Table 8 Rating classes

Rating	Class
1 - 55	Low Risk (L)
56 - 169	Moderate Risk (M)
170 - 600	High Risk (H)

Table 9 Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance/Risk = Consequence X Likelihood

7. DATA LIMITATIONS, ASSUMPTIONS AND STUDY GAPS

- At the time of submission of the Version 1 report, no data has been obtained from the farmer(s) that cultivate the land on any historical production figures of the project area for the past five years. It is likely that this data will become available as the public participation process commences.
- No anticipated employment figures has yet been received from the developer and will be included in the report when available. Similarly, it is expected that the farmer who leases the land from the Gauteng Department of Human Settlements will be identified during the public participation process. He will then be asked to discuss the current employment opportunities created by his farming activities on the property.
- It was also assumed that the desktop grazing capacity and field crop boundary data obtained from DAFF, has high correlation with the actual conditions on site.
- No other uncertainties and gaps have been identified that may affect the conclusions made in this report.

8. RESPONSE TO CONCERNS RAISED BY INTERESTED AND AFFECTED PARTIES

Thus far, no concerns were raised by I & APs during the Public Participation Process pertaining to the continuation of existing land uses in the surrounding area. Should any comment be received, it will be addressed in this report.

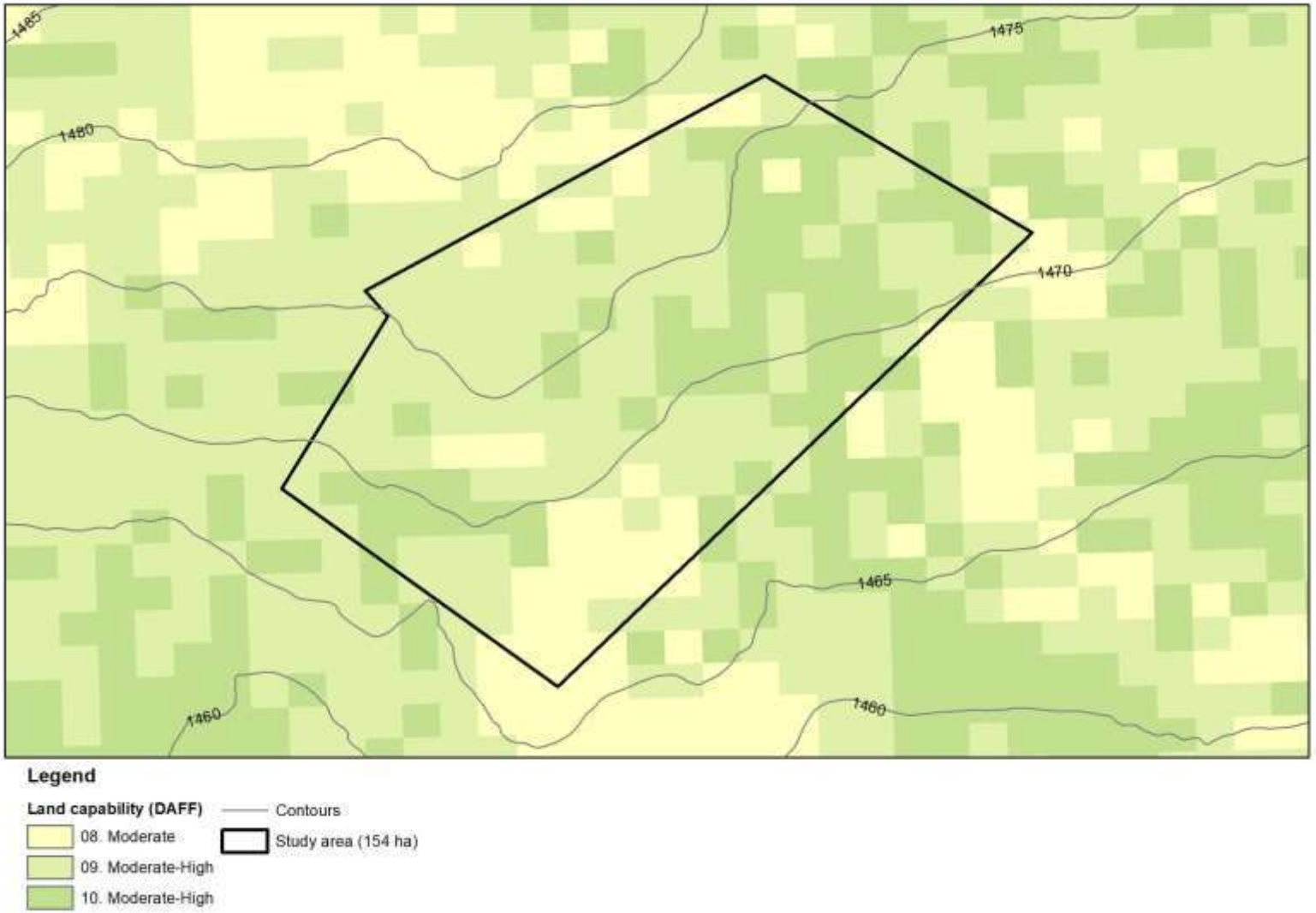

Figure 3 Land capability classification of the proposed development area and surrounding area (data source: DAFF, 2017)

Figure 4 Locality of field crop boundaries in the larger area around the proposed development area (data source: DAFF, 2019)

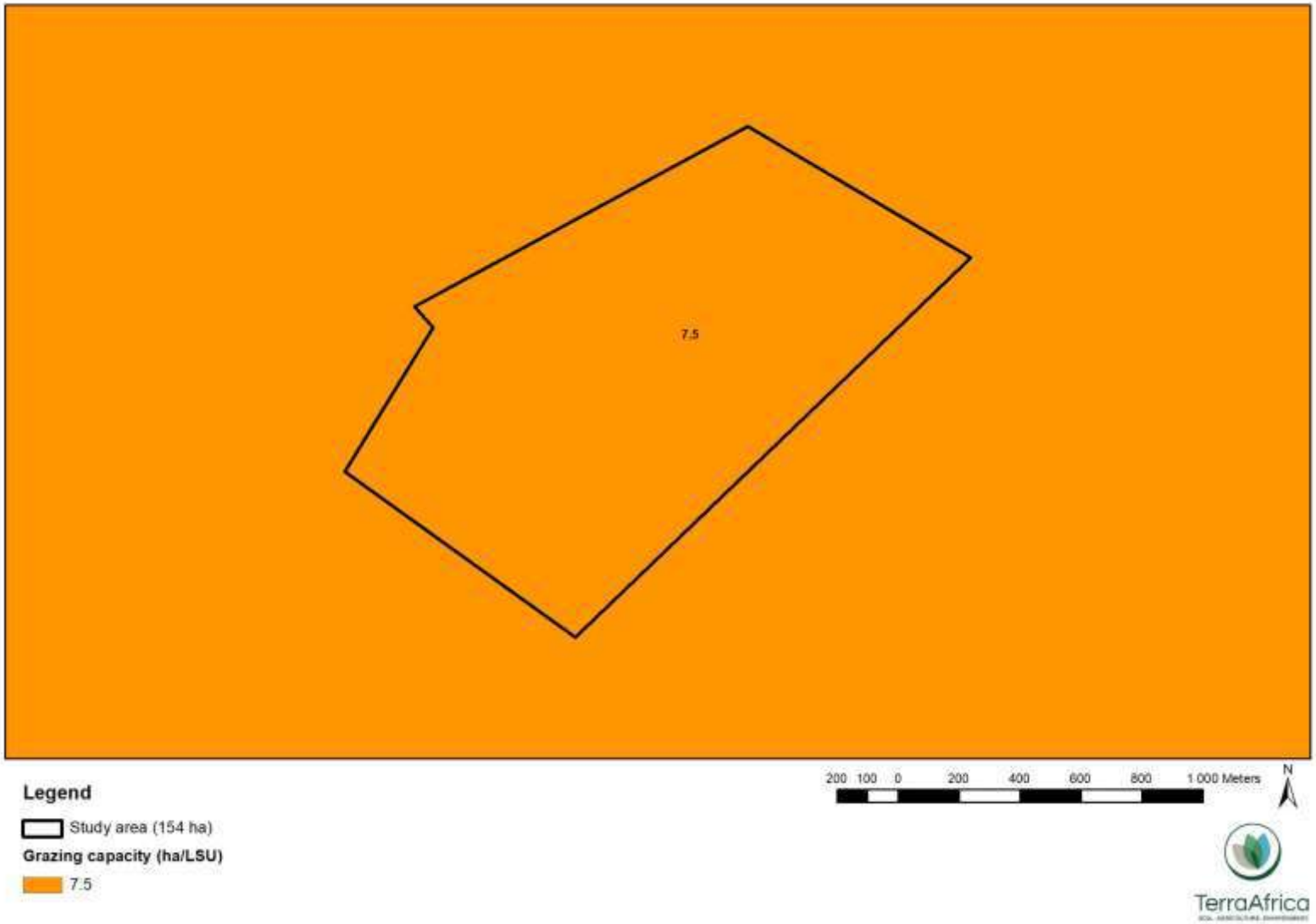

Figure 5 Long-term grazing capacity of the proposed development area and surrounding area (data source: DAFF, 2018)

9. RESULTS OF THE DESKTOP ASSESSMENT

9.1 Land capability

The proposed Unitas Park Extension 16 development area includes three different land capability classes according to the land capability raster data layer (DAFF, 2017). The three classes are Class 08 (Moderate), Class 09 (Moderate – High) and Class 10 (Moderate – High) with higher land capability located more towards the north-eastern corner of the site. Figure 3 indicates the estimated position of the different classes in the landscape.

9.2 Field crop boundaries

Following the field crop data layer for the Gauteng Province (DAFF, 2019), a large portion of the site consist of fields with rainfed annual crop cultivation and planted pastures. An area from the middle of the study area towards the north-western corner, has no field crops. Rainfed annual crop cultivation and planted pastures are also present along the north-eastern, south-eastern as well as the north-eastern and north-western boundaries of the site. Small holdings are located further away along the south-eastern and north-eastern site boundaries. Only one small area located north-east of the study area, is indicated as an area with horticultural crops. The position of field crops within and around the proposed development area is illustrated in Figure 4.

9.3 Grazing capacity

Following the metadata layer obtained from DAFF, the entire proposed development area as well as the surrounding area, has grazing capacity of 7.5 ha/LSU (Figure 5). When converting this figure to Small Stock Units (SSU), the area has grazing capacity of 1.9 ha/SSU.

10. SITE ASSESSMENT RESULTS

10.1 Soil forms

Six different soil forms (Carolina, Cullinan, Dresden, Glencoe, Lichtenburg and Mispah) were identified within the proposed development site. Both the Cullinan and Carolina soil forms are newly described soil forms of the new Natural and Anthropogenic Soil Classification System of South Africa (Soil Classification Group, 2018). The natural soil forms identified on site include soil of the Carolina, Dresden, Glencoe, Lichtenburg and Mispah forms while the Cullinan form is an anthropogenic soil form. The position of each of the soil forms as well as the average soil depth of the area, is illustrated in Figure 6 and summarised in Table 10.

Table 10 Summary of the soil classification results

Soil form/group	*Area (ha)*	*Percentage of development area (%)*	*Average soil depth (m)*
Carolina	3.9	2.53	1.2 – 1.5
Cullinan	19.0	12.34	0.15 – 0.45
Dresden	1.0	0.65	0.4 – 0.6
Glencoe	32.8	21.30	1.0 – 1.5+
Lichtenburg	58.9	38.25	1.0 – 1.5+
Mispah	38.4	24.94	0.10 – 0.35

Approximately 95.6ha of the 154ha study site consists of yellow-brown and red sandy-clay-loam soil profiles of the Carolina, Glencoe and Lichtenburg forms with soil depth of 1m or deeper than 1m. These soil profiles are located in the northern, eastern, south-eastern and centre of the study area. A small portion (1ha) of shallow Dresden soil profiles are located in the south of the study area. More than 95% of the areas of Carolina, Dresden, Glencoe and Lichtenburg soil forms have been used for maize cultivation the past growing season (2019 – 2020).

The western section of the proposed development area consist of shallow Mispah profiles with soil depth between 0.1 and 0.35m where evidence of a derelict old farmhouse was found. Two areas of previous soil excavations are present in the western section of the site (Cullinan form). The Cullinan form soil form has been described as large, exposed excavations without backfilling (Soil Classification Working Group, 2018).

Soil textural analysis of modal soil profiles indicate that soil is dominated by the sand fraction (ranging between 66.5 and 83.2% sand) with the clay fractions ranging between 8.5 and 25.1% clay particles. The silt fraction ranges between 6.0 and 19.2% clay (see Appendix 1).

10.2 Soil fertility

The purpose of establishing baseline chemical composition of soil on a site before development commences, is to determine whether there is any deterioration in soil fertility and what the nutrient status of the soil is associated with the natural vegetation. Should the chemical content of the soil be drastically different once rehabilitation commences, the chemical composition might have to be amended by the addition of fertilizers or organic matter. The analyses results obtained from the laboratory is attached as Appendix 1.

The pH levels of the analyzed soil samples in the study area ranges indicate that the soil present tend to be acidic, with all the pH(KCl) levels below 5. The lower pH range (between 3.95 and 4.86) may be a result of the continuous application of acidifying fertilizer for the purpose of crop production. For successful crop production, a pH of between 5.8 and 7.5 is optimum and crops produced in soils with lower pH may suffer aluminum (Al) toxicities if toxic levels of Al are present. The danger of Al toxicity only exists when the pH (KCl) is lower than 4.5.

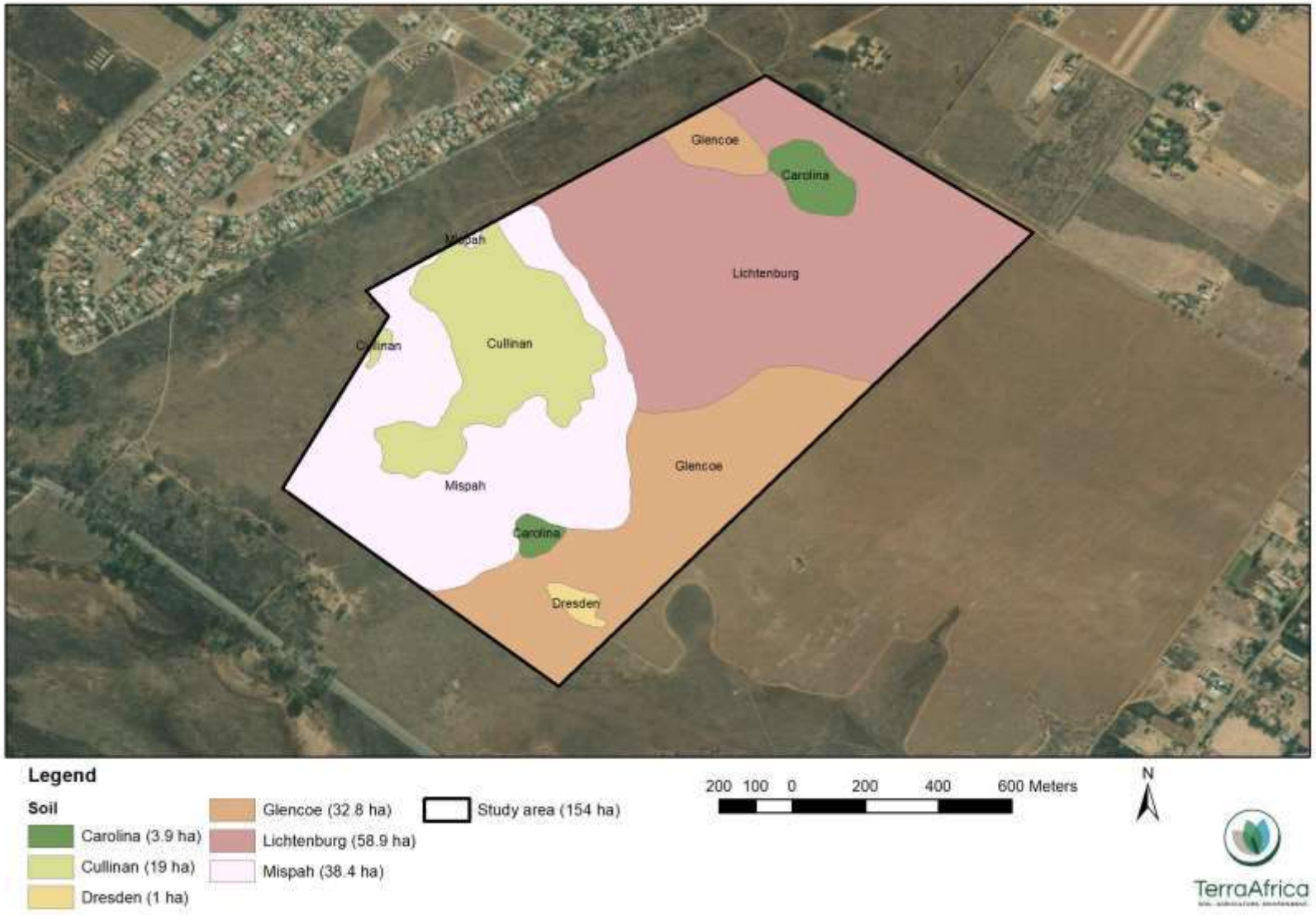

Figure 6 Soil classification map of the proposed development area

Figure 7 Land capability classification of the proposed development area

Plant-available phosphorus levels (as determined with a Bray 1 extract) range between 2.4 and 17.0 mg/kg. For the purpose of crop production, calcium and magnesium levels range between slightly deficient (115.4 mg/kg) to sufficient (507.6 mg/kg) for calcium, and between low (28.8 mg/kg) and sufficient (127.0 mg/kg) for magnesium. The potassium levels range between low (2.6 mg/kg) and high (197.3) for crop production. Of the four macro plant nutrients, the low plant-availability of phosphorus and potassium in some of the areas, may be a limiting factor to crop production. However, the nutrient deficiencies can be corrected by the precisions application of fertilizer.

The electrical conductivity (EC) of the soil samples range between 12 mS/m and 35 mS/m, indicating that the presence of any soil salinity is highly unlikely. The plant-available sodium levels range between 0.5 and 3.4 mg/kg which is low enough to assume that soil sodicity are not currently present on site.

10.3 Land capability classification

Using the soil classification data, the project site can be divided into three different land capability classes i.e. soil with either Moderate-High (Class 10), Moderate (Class 08) and Moderate-Low (Class 07) land capability. The largest portion of the proposed development area consist of soil with Moderate-High (Class 10) land capability with medium-high to high potential for rainfed crop production.

The highest land capability is 9.4 ha of land in the middle section of the site that has Moderate-High (Class 10) land capability. The shallower Glencoe profiles to the east has Class 09 land capability and the areas where the Hutton and Clovelly profiles have already been affected by anthropogenic activities, have Moderate (Class 08) land capability.

10.4 Land use and surrounding land use

During the site visit, evidence was found of a derelict farmstead surrounded by what may be the remains of a garden around the house. The current land use of the site largely consists of rainfed production of grains (maize was planted for the 2019-2020 growing season) as well natural veld that may be used for livestock production (will be confirmed when information is received from farmer who leases the property). Within the south-western section of the study site, there are evidence of two areas of previous soil excavation in where gravel and fractured rock was removed without any backfill or active rehabilitation of the area.

Land outside the proposed development site consist of a mixture of land uses, including residential areas and a school to the north-west of the site as well as rainfed crop production and farmsteads towards the north-east, east and south-east of the study site. The R54 (Houtkop Road) is located south of the study site.

10.5 Agricultural potential and activities

Following the soil and land capability classification of the site, it was found that 96.6ha of the 154ha study site, have high suitability for rainfed crop production of grains such as maize. It is estimated that the average yield in this area ranges between 6 and 9 ton/ha, therefore

contributing approximately 580 to 870 tons of maize per annum to the total crop volumes of Gauteng Province.

In addition to crop production, the remaining 57.4ha that is not cultivated can be used for livestock grazing at a long-term grazing capacity of 7.5ha/LSU. This area not used for crop cultivation can therefore provide feed to approximately 8 head of cattle. Although 8 head of cattle may not be a viable production unit by itself, the crop remains after harvesting are also used as feed supplement for cattle during the winter months and may therefore allow for a larger cattle herd.

The proposed development area borders on other areas with grazing veld and grain production and may therefore be part of a larger farming unit that produces food and provide agricultural employment. This section will be updated when more information has been received.

10.6 Verified site sensitivity

Table 1 of GN 320 section 2.5 requires an assessment of change in productivity of agricultural activities based on income in the past five years, change in employment figures for the past five years and alternative development footprints within the preferred site which would have medium or low sensitivity for agricultural resources. The agricultural resources on site (soil and climate) has previously been, and are still, used for production of grain crops and to a lesser extent, livestock farming (in the most western section of the site. The area where crops are produced consist of mostly of soil with high sensitivity to any soil disturbing or soil sealing activities (associated with residential development). Therefore, 96.6ha of land has high sensitivity to the proposed and development and 57.4 ha has low sensitivity

Figure 8 Agricultural and soil sensitivity to the impacts of the proposed development

11. IMPACT ASSESSMENT

11.1 Construction phase impacts

11.1.1 Loss of current land capability

Following the site survey, it was concluded that the proposed development area consists largely of land with Moderate-High, Moderate and Moderate-Low land capability. Once construction commences and soil is stripped, the current land capability of all areas where the surface infrastructure will be constructed, will be lost. The impact will remain the same throughout the operational phase and it is not expected that the infrastructure will be decommissioned.

	Without mitigation	**With mitigation / enhancement**
Status	Negative (-)	Negative (-)
Severity	4	3
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (100) -
Mitigation: • The mitigation measures are limited as the project infrastructure is considered to become a permanent feature of the landscape. • The project infrastructure footprint should be kept to the project layout as provided by the client.		

11.1.2 Loss of agricultural production and agricultural-related employment

The area has been identified as having high suitability for rainfed crop production. The area with lower suitability for crop production can be used for livestock production at a stocking density of 7.5 ha/LSU. It is anticipated that the impact on the agricultural production and agricultural-related employment will be high. It is expected that the impact will remain the same during the operational phase and there will be no decommissioning.

	Without mitigation	**With mitigation / enhancement**
Status	Negative (-)	Negative (-)
Severity	4	3
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (100) -
Mitigation: • The mitigation measures are limited as the project infrastructure is considered to become a permanent feature of the landscape.		

- The project infrastructure footprint should be kept to the project layout as provided by the client.

11.1.3 Loss of soil ecosystem services and soil fertility in areas where topsoil are stripped

Prior to construction, the available topsoil (a combination of all soil horizons above the underlying material such as fractured rock and hard plinthite hard plinthite) will be removed and stored elsewhere. The soil in the affected area provides the following ecosystem services:

- It provide soil nutrients that supports the vegetation growth of the area;
- The hydropedology of the in situ soil profiles of the entire landscape contributes to underground water volumes of the larger area in which the project area is located.
- It provides physical support to plants, animals and microorganisms by anchoring plant roots, providing shelter for small animals and a nutrient matrix for microorganisms.

Once the soil is stripped and transported from its original position, it becomes a new matrix with different physical and biological properties as a result of mixing of the soil horizons and storing it in stockpiles.

	Without mitigation	**With mitigation / enhancement**
Status	Negative (-)	Negative (-)
Severity	4	4
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (110) -

Mitigation:

- The mitigation measures are limited as the topsoil will necessarily be removed for the purpose of infrastructure construction.
- The project infrastructure footprint should be kept within the site boundaries as provided by the client.
- Any topsoil stockpiles must be protected against wind and water erosion until vegetation has established on the exposed topsoil surfaces.
- If it is observed that topsoil stockpile surfaces remain bare, natural vegetation must be established on the topsoil stockpiles.

11.1.4 Soil contamination with hydrocarbons and solid waste

The following construction activities can result in the pollution of soil with hydrocarbons and/or solid waste:

- Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the mechanical removal of vegetation during site clearing.
- Spills from vehicles transporting workers, equipment and construction material to and from the construction site.
- The generation of domestic waste by construction and operational workers.
- Spills from fuel storage tanks during construction.
- Polluted water from wash bays and workshops during the construction phase.
- Accidental spills of other hazardous chemicals used and stored on site.
- Pollution from concrete mixing.

	Without mitigation	With mitigation / enhancement
Status	Negative (-)	Negative (-)
Severity	3	2
Spatial Scale	1	1
Duration	4	2
Frequency of activity	4	4
Frequency of impact	5	3
Impact rating	Medium-low (72) -	Low (35) -

Mitigation:

- High level maintenance must be undertaken on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on;
- Site surface water and wash water must be contained and treated before reuse or discharge from site;
- Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;
- Spill kits should be available on site and should be serviced regularly;
- Waste disposal at the construction site and during operation must be avoided by separating, trucking out and recycling of waste;
- Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
- Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols.

11.1.5 Soil compaction and surface sealing

Where houses and surface roads will be constructed, soil will become permanently sealed-off from rainwater infiltration. Soil will also be compacted as part of civil engineering procedures to ensure the stability of the infrastructure. Soil compaction affects the soil porosity, thereby decreasing the water infiltration rate of soil. Compacted soil surfaces and sealed off areas increase stormwater runoff rates and can cause soil erosion in areas outside the site boundary.

	Without mitigation	With mitigation / management
Status	Negative (-)	Negative (-)
Severity	4	4
Spatial Scale	2	2
Duration	5	5
Frequency of activity	5	5
Frequency of impact	5	5
Impact rating	High (110) -	High (110) -

Mitigation:

- Restrict traffic and vehicle movement to access roads and within the site boundaries.
- Demarcate parking areas and monitor that vehicles and equipment are not parked outside of these areas in nearby fields during the construction phase.

11.2 Operational phase impacts

During the operational phase, the impacts on land capability and physical soil properties within the site boundary, will remain unchanged. However, solid wastewater generation, surface water run-off from road surfaces and wastewater systems, can result in soil contamination outside of the site.

11.2.1 Soil pollution of soil outside the site boundaries, including agricultural fields

Solid waste generation within the residential and mixed-land use areas, can result in soil pollution of nearby fields. Stormwater run-off from surfaced roads can also contain pollutants such as petroleum hydrocarbons that spilled on sealed surfaces inside of the site. Both solid waste and stormwater run-off can result in elevated levels of soil contaminants in nearby soil, including the agricultural crop-fields.

	Without mitigation	**With mitigation / enhancement**
Status	Negative (-)	Negative (-)
Severity	3	1
Spatial Scale	2	1
Duration	4	2
Frequency of activity	4	3
Frequency of impact	4	3
Impact rating	Medium-low (72) -	Low (30) -

Mitigation:

- Soil contamination levels must be monitored annually in a zone of 500m around the site.
- High level maintenance must be undertaken on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on;
- Site surface water and wash water must be contained and treated before reuse or discharge from site;
- Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material;
- Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and
- Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols.

11.3. Decommissioning and closure phase

It is expected that the infrastructure will remain on site and there will be no decommissioning and closure phases.

12. CONSIDERATION OF ALTERNATIVES

No alternative layouts of the proposed development project, were provided for comparative analysis of the anticipated impacts on the soil properties and agricultural potential of the site.

13. ACCEPTABILITY STATEMENT

The proposed Unitas Park Ext 16 development site consists of 95.6ha of deep to medium-deep soil characterised by red and yellow-brown apedal B1-horizons overlying either hard plinthite or fractured rock. Only 1ha of soil consist of shallow Dresden soil where an orthic A horizon overlies hard plinthite. The soil has moderate-high to moderate potential for rainfed crop production. During the site visit, it was evident that that maize are successfully produced on 96.6ha. The remaining 57.4 is covered with a mixture of veld grass and a few trees and shrubs. This area has the potential for feeding 8 head of cattle while maintaining the long-term grazing capacity.

No agricultural production figures for the past 5 years have been made available yet but from the observations made during the site visit, the following conclusions were reached:

- Rainfed crop production is present on site with an estimated yield of 6 to 9 tons/ha, depending on largely on the rainfall pattern and volumes of a production season.
- The current number of employment opportunities generated by the farming activities on the property, is not known at the moment. Similarly, the exact yield of the crop fields as well as the density of the livestock grazing in the surrounding grassland, is not known. It is expected that this information will become available during the next four weeks as the public participation process commences.

According to the applicant, the proposed development layout went through several layout and design considerations to optimise the area to be developed and limit impact on highly sensitive areas. However, the requirements for housing and infrastructure limits the possibility to completely avoid areas with high agricultural sensitivity. It is anticipated that the impact on the agricultural production of the study site will be high with the current infrastructure layout and that the crop production within the proposed development areas as well as in a 50m buffer area around the site, will not be able to continue.

14. REFERENCE LIST

Crop Estimates Consortium, 2019. *Field crop boundary data layer (NC province)*, 2019. Pretoria. Department of Agriculture, Forestry and Fisheries.

Department of Agriculture, Forestry and Fisheries, 2017. *National land capability evaluation raster data: Land capability data layer*, 2017. Pretoria.

South Africa (Republic) 2018. *Long-term grazing capacity for South Africa*: Data layer. Government Gazette Vol. 638, No. 41870. 31 August 2018. Regulation 10 of the Conservation of Agricultural Resources Act (CARA): Act 43 of 1983. Pretoria. Government Printing Works.

The Soil Classification Working Group (2018). *Soil Classification – Taxonomic System for South Africa.* Dept. of Agric., Pretoria.

APPENDIX 1 – RESULTS OF SOIL CHEMICAL ANALYSIS

NORTH-WEST UNIVERSITY
ECO-ANALYTICA

Eco Analytica
P.O. Box 19140
NOORDBRUG 2522
Tel: 018-285 2732/3/4

TERRA AFRICA (UNITAS PARK)

17/3/2020 **Nutrient Status**

Sample no.	Ca	Mg	K	Na	P	pH(KCl)	EC
	(mg/kg)						(mS/m)
1	302,1	50,7	39,8	1,8	4,9	4,63	26
2	270,5	63,7	2,6	2,5	3,5	4,50	17
3	266,7	50,5	75,5	2,9	5,8	4,73	35
4	115,4	28,8	90,7	2,0	4,8	3,95	23
5	312,6	127,0	3,7	1,2	2,4	4,86	12
6	136,0	28,7	87,4	1,1	17,0	3,92	20
7	420,6	61,8	3,2	3,4	3,3	4,76	30
8	507,6	96,5	197,3	0,5	5,0	4,66	27

Exchangeable cations

Sample no.	Ca	Mg	K	Na	S-value	pH(KCl)
	(cmol(+)/kg)					
1	1,51	0,42	0,10	0,01	2,03	4,63
2	1,35	0,52	0,01	0,01	1,89	4,50
3	1,33	0,42	0,19	0,01	1,95	4,73
4	0,58	0,24	0,23	0,01	1,05	3,95
5	1,56	1,05	0,01	0,01	2,62	4,86
6	0,68	0,24	0,22	0,00	1,14	3,92
7	2,10	0,51	0,01	0,01	2,63	4,76
8	2,53	0,79	0,51	0,00	3,84	4,66

HANDBOOK OF STANDARD SOIL TESTING METHODS FOR ADVISORY PURPOSES

Exchangeable cations: 1M NH_4-Asetaat pH=7 EC: Saturated Extraction

CEC: 1 M Na-asetaat pH=7 pH H_2O/KCl: 1:2.5 Extraction

Extractable, Exchangeable micro-elements: 0.02M $(NH_4)_2$ EDTA.H_2O Phosphorus: P-Bray 1 Extraction

17/3/2020 **Particle Size Distribution**

Sample no.	> 2mm (%)	Sand	Silt	Clay
		(% < 2mm)		
1	0,7	78,6	10,6	10,8
2	3,1	77,3	8,8	13,9
3	28,2	83,2	8,3	8,5
4	1,1	75,8	8,5	15,8
5	0,3	68,2	6,7	25,1
6	0,5	78,4	6,0	15,6
7	0,6	72,6	8,7	18,7
8	0,8	66,5	19,2	14,3

This laboratory participates in the following quality control schemes:
International Soil-Analytical Exchange (ISE), Wageningen, Nederland.
No responsibility is accepted by North-West University for any losses due to the use of this data

APPENDIX 2 - CURRICULUM VITAE OF SPECIALIST (Mariné Pienaar)

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Wolmaransstad,
South Africa

EXPERTISE

Soil Quality Assessment

Soil Policy and Guidelines

Agricultural Agro-Ecosystem Assessment

Sustainable Agriculture

Data Consolidation

Land Use Planning

Soil Pollution

Hydropedology

EDUCATION

MASTER'S DEGREE
Environmental Science
University of Witwatersrand
2010 – 2018

BACHELOR'S DEGREE
Agricultural Science
University of Pretoria
2001 – 2004

PROFESSIONAL PROFILE

I contribute specialist knowledge on agriculture and soil management to ensure long-term sustainability of projects in Africa. For the past thirteen years, it has been my calling and I have consulted on more than 200 projects. My clients include environmental and engineering companies, mining houses, and project developers. I enjoy the multi-disciplinary nature of the projects that I work on and I am fascinated by the evolving nature of my field of practice. The next section provide examples of the range of projects completed. A comprehensive project list is available on request.

PROJECT EXPERIENCE

Global Assessment on Soil Pollution

Food and Agricultural Organisation (FAO) of the United Nations (UN)

Author of the regional assessment of Soil in Sub-Saharan Africa. The report is due for release in February 2021. The different sections included:

- Analysis of soil and soil-related policies and guidelines for each of the 48 regional countries
- Description of the major sources of soil pollution in the region
- The extent of soil pollution in the region and as well as the nature and extent of soil monitoring
- Case study discussions of the impacts of soil pollution on human and environmental health in the region
- Recommendations and guidelines for policy development and capacitation to address soil pollution in Sub-Saharan Africa

Data Consolidation and Amendment

Range of projects: Mining Projects, Renewal Energy

These projects included developments where previous agricultural and soil studies are available that are not aligned with the current legal and international best practice requirements such as the IFC Principles. Other projects are expansion projects or changes in the project infrastructure layout. Tasks on such projects include the incorporation of all relevant data, site verification, updated baseline reporting and alignment of management and monitoring measures.

Project examples:

- Northam Platinum's Booysendal Mine, South Africa
- Musonoi Mine, Kolwezi District, Democratic Republic of Congo
- Polihali Reservoir and Associated Infrastructure, Lesotho
- Kaiha 2 Hydropower Project, Liberia
- Aquarius Platinum's Kroondal and Marikana Mines

PROFESSIONAL MEMBERSHIP

South African Council for Natural Scientific Professions (SACNASP)

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

Network for Industrially Contaminated Land in Africa (NICOLA)

LANGUAGES

English (Fluent)

Afrikaans (Native)

French (Basic)

PRESENTATIONS

There is spinach in my fish pond
TEDx Talk
Available on YouTube

♦

Soil and the Extractive Industries
Session organiser and presenter
Global Soil Week, Berlin (2015)

♦

How to dismantle an atomic bomb
Conference presentation (2014)
Environmental Law Association (SA)

PROJECT EXPERIENCE (Continued)

Agricultural Agro-Ecosystem Assessments

Range of projects: Renewable Energy, Industrial and Residential Developments, Mining, Linear Developments (railways and power lines)

The assessments were conducted as part of the Environmental and Social Impact Assessment processes. The assessment process includes the assessment of soil physical and chemical properties as well as other natural resources that contributes to the land capability of the area.

Project examples:

- Mocuba Solar PV Development, Mozambique
- Italthai Railway between Tete and Quelimane, Mozambique
- Lichtenburg PV Solar Developments, South Africa
- Manica Gold Mine Project, Mozambique
- Khunab Solar PV Developments near Upington, South Africa
- Bomi Hills and Mano River Mines, Liberia
- King City near Sekondi-Takoradi and Appolonia City near Accra, Ghana
- Limpopo-Lipadi Game Reserve, Botswana
- Namoya Gold Mine, Democratic Republic of Congo

Sustainable Agriculture

Range of projects: Policy Development for Financial Institutions, Mine Closure Planning, Agricultural Project and Business Development Planning

Each of the projects completed had a unique scope of works and the methodology was designed to answer the questions. While global indicators of sustainable agriculture are considered, the unique challenges to viable food production in Africa, especially climate change and a lack of infrastructure, in these analyses.

Project examples:

- Measurement of sustainability of agricultural practices of South African farmers – survey design and pilot testing for the LandBank of South Africa
- Analysis of the viability of avocado and mango large-scale farming developments in Angola for McKinsey & Company
- Closure options analysis for the Tshipi Borwa Mine to increase agricultural productivity in the area, consultation to SLR Consulting
- Analysis of risks and opportunities for farm feeds and supplement suppliers of the Southern African livestock and dairy farming industries
- Sustainable agricultural options development for mine closure planning of the Camutue Diamond Mine, Angola

PROFESSIONAL DEVELOPMENT

Contaminated Land Management 101Training
Network for Industrially Contaminated Land in Africa
2020

Intensive Agriculture in Arid & Semi-Arid Environments
CINADCO/MASHAV R&D Course, Israel
2015

World Soils and their Assessment Course
ISRIC – World Soil Information Centre, Netherlands
2015

Wetland Rehabilitation Course
University of Pretoria
2010

Course in Advanced Modelling of Water Flow and Solute Transport in the Vadose Zone with Hydrus
University of Kwazulu-Natal
2010

Environmental Law for Environmental Managers
North-West University Centre for Environmental Management
2009

PROJECT EXPERIENCE (Continued)

Soil Quality Assessments

Range of projects: Rehabilitated Land Audits, Mine Closure Applications, Mineral and Ore Processing Facilities, Human Resettlement Plans

The soil quality assessments included physical and chemical analysis of soil quality parameters to determine the success of land rehabilitation towards productive landscapes. The assessments are also used to understand the suitability for areas for Human Resettlement Plans

Project examples:

- Closure Planning for Yoctolux Colliery
- Soil and vegetation monitoring at Kingston Vale Waste Facility
- Exxaro Belfast Resettlement Action Plan Soil Assessment
- Soil Quality Monitoring of Wastewater Irrigated Areas around Matimba Power Station
- Keaton Vanggatfontein Colliery Bi-Annual Soil Quality Monitoring

REFERENCES

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APPENDIX C11

Socio-Economic Impact Assessment Study

UNITAS PARK EXTENSION 16

SOCIO-ECONOMIC IMPACT ASSESSMENT STUDY

APRIL 2020

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URBAN-ECON
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Celebrate Development Diversity

Celebrate Development Diversity.

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Brief profile: **Siyasanga** studied her undergraduate degree at UWC where she won the Golden Key in her second year for recognition of her academic performance. After completing her Honours Degree, she then studied applied economics at NMMU, there she was awarded a Merit Award for being a top Economics student in her class. After her postgraduate diploma, she interned at the City of Cape Town in the Organisational Policy and Planning Department in the Economic Research Unit where she was a research assistant intern. In 2018, she joined Urban-Econ. She has gained experience in conducting feasibility studies, monitoring and evaluation (M&E) projects, socio-economic impact assessment studies and assisting in economic research. She is currently pursuing a Master of Commerce in Development Economics at the University of Witwatersrand.

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ACRONYMS AND ABBREVIATIONS

CBD	Central Business District
EIA	Environmental Impact Assessment
ELM	Emfuleni Local Municipality
IDP	Integrated Development Plan
GDP	Gross Domestic Product
GGT	Growing Gauteng Together
GVA	Gross Value Added
NDP	National Development Plan
NGPF	New Growth Path Framework
NSDP	National Spatial Development Perspective
SDM	Sedibeng District Municipality
TOD	Transport Oriented Developments

1. INTRODUCTION

This document is prepared by **Urban-Econ Development Economists** in response to a request by **GCS Water and Environmental Consultants** on behalf of Phumaf Holdings Group to undertake a socio-economic impact study for the **Unitas Park Extension 16** mixed high-density development. The socio-economic impact study is conducted as part of the environmental impact assessment (EIA) process managed by **GCS Water and Environmental Consultants.**

1.1 Brief Description of the Project

The proposed development is a mixed high-density residential development consisting of 7 250 units. The site for the proposed development is in the Emfuleni Local Municipality and is located 6km north west of Vereeniging Central Business District (CBD) located between roads R54 and R42. The site can be accessed via Skippie Botha and Langraad Roads. The extent of the site is 151 Hectares and is owned by the Gauteng Provincial Government. The site is zoned "Farmland" and is currently vacant and it appears to not be yielding significant social or economic value or benefit. Figure 1-1 below provides a visual illustration of the proposed development.

Figure 1-1: Proposed development plan
(PHUMAF, 2020)

1.1 Scope and Purpose of the Study

The socio-economic impact assessment contains information that, together with that from other specialists, allows for the assessment of the project from a sustainable development perspective and assists in identifying "the most practicable environmental option" that provides the "most benefit and causes the least damage to the environment as a whole, at a cost acceptable to society", in the long term and the short term. Considering the above, and in line with the Environmental Impact Assessment (EIA) Regulations of 2014, the purpose of the socio-economic impact assessment is to assess the need and desirability of the project. It specifically aims

to ensure that the project, if approved, provides for justifiable social and economic development outcomes. As such, it aims to:

- determine the social and economic impact on the surrounding community,
- bring about a more sustainable and equitable biophysical and human environment.

Specifically, the study will identify and analyse the intended and unintended social and economic consequences, both positive and negative, of the proposed development, together with the ecological impact and propose management/mitigation strategies.

1.2 Methodology

Figure 1-2 below illustrates the methodology employed in the study.

Figure 1-2: Methodology

1. **Orientation:** The study started with the specialists gaining an understanding of the proposed project relating to the various stages of its lifecycle and the potentially affected environment.
2. **Data collection and policy review:** The policy review provides a brief description of the relevant policies. National, provincial and local government policies and strategic plans are reviewed to determine the alignment of the proposed project to the national, provincial and local government strategic objectives and whether the proposed project will contribute to the broader policy and strategic goals.
3. **Baseline profiling:** The baseline assessment provides the status quo of the study area to determine how the demographic dynamics of the area and their change over time will be impacted by the proposed development.
4. **Identifying anticipated impacts:** The step involves the identification of potential positive and negative impacts. The potential impacts are rated for significance and the proposed mitigation measures are provided.

1.3 Data gathering and consultation process

Primary data could not be gathered due to the effects of the Corona pandemic. Efforts to engage the project stakeholders telephonically were not successful, particularly because of people were not in their offices yet the majority of the contacts were office landlines. Also, a site visit could not be done because of the traveling restrictions emanating from the lockdown. The study therefore relied on available secondary data.

Secondary data gathering

Secondary data was sourced from the following databases and documents:

- Quantec Research Standardised Regional Data, 1993-2018
- Statistics South Africa Census, 2011
- Lightstone Reports, 2020
- National strategic documents
- Integrated Development Plan
    - Sedibeng District Municipality Integrated Development Plan
    - Emfuleni Local Municipality Integrated Development Plan
- Spatial Development Frameworks
    - Sedibeng Spatial Development Framework
    - Emfuleni Spatial Development Framework
- Gauteng Growth Management Perspective 2014

1.4 Assumptions, limitations and gaps in knowledge

The following section outlines the key assumptions, limitations and information gaps that may potentially have implications on the assessment and discussions of the study.

- In terms of the primary data, information could be gathered due Corona Virus pandemic and the lockdown that was announced on March 26, 2020.
- While all due care was taken to ensure that the assessment of impacts is accurate (and follows the conservative approach), provision of additional data could potentially impact the assessment of the significance of some impacts.
- Project-related information supplied by the team involved in the project for the purpose of the analysis is assumed to be reasonably accurate. Thus, all impacts are analysed based on this information. Any changes hereon cannot be accounted for in the analysis.
- The secondary data sources used to compile the economic baseline (dynamics of the economy and labour force), although not exhaustive, can be viewed as being indicative of broad trends within the study area.
- Possible impacts, as well as stakeholder responses to these impacts, cannot be predicted with complete accuracy, even when circumstances are similar, and these predictions are based on research and years of experience, taking the specific set of circumstance into account.

2. POLICY REVIEW

A policy review plays an integral role in the early stages of a project. The review provides a high-level indication of whether a project is aligned with the goals and aspirations of the developmental policy within a country and at a local level. Furthermore, the analysis indicates any red-flag or developmental concerns that could jeopardise the development of the project. This assists in amending and preventing costly and unnecessary delays.

The following government strategic documents applicable to the delineated study areas were examined:

National (South Africa):

- New Growth Path Framework (NGPF) (2010)
- National Development Plan (NDP) 2030 (2011 – 2030)
- National Spatial Development Perspective, 2006Housing Act, 1997 (Act 107 of 1997)

Regional (Gauteng province):

- Growing Gauteng Together (GGT), 2030

Local (City of Johannesburg Metropolitan Municipality):

- Sedibeng District Municipality Integrated Development Plan, 2018/19
- Sedibeng District Municipality Spatial Development Framework
- Emfuleni Local Municipality Integrated Development Plan
- Emfuleni Local Municipality Spatial Development Framework

2.1 Project alignment with national policies and strategic documents

The vision of the **New Growth Path Framework (NGPF)** is to ensure that jobs and decent work are at the centre of economic policy (Department of Economic Development, 2011). The framework states that public investment can create 250 000 jobs per annum in energy, transport, water, communications infrastructure and housing (Department of Economic Development, 2011). Five employment creation opportunities, or job drivers, have been identified by the NGPF, and these include: **(i)** infrastructure, **(ii)** main economic sectors, **(iii)** seizing potential of new economies, **(iv)** investing in social capital, and **(v)** public services and spatial development.

The proposed social development aligns with the NGPF job creation objectives. Fundamentally, the NGPF seeks to address socio-economic issues in low-income households by eradicating the income inequalities that exist within society. The measures it adopts place decent work opportunities as a key aspect to fight against inequality. Additionally, it includes measures that are aimed at enhancing local societies through skills development and small enterprise development. The framework considers basic and secondary education, and investment in health as critical components to achieve equality in the long run. The proposed development is anticipated to provide access to income through employment opportunities. It is also envisaged to contribute towards human capital development through the transfer of skills and knowledge

during the construction phase of the development, as well as the overall improvement of the standard of living in the medium to long run through sustained employment opportunities.

The proposed mixed-high density development is anticipated to create temporary employment opportunities during the construction phase as well as sustained medium to long-term employment opportunities during the operational phase of the development. Thus, the household income opportunities to be generated from the project will improve the standard of living of the individuals and households within the study area as they will have better access to goods and services.

The **National Development Plan (NDP) 2030** aims to address the South African development challenges of poverty and inequality by 2030. The Plan states that although South Africa has made strides into developing inclusive societies, the societies remain highly unequal due to poverty, lack of adequate employment, poor quality of education and the legacy of the apartheid spatial divide which dominates the landscape (National Planning Commission, 2011). Building capabilities, expanding opportunities and employment have been identified as key aspects of change that can enhance social cohesion through reducing poverty and raising living standards. As such, the plan prioritises three areas, raising employment through faster economic growth, improving the quality of education, skills development and innovation and building the capability of the state to play a developmental, transformative role (National Planning Commission, 2011).

The employment opportunities that are anticipated to occur as a result of the proposed mixed high-density development align with the NDPs' objective to expand employment opportunities in the economy. Employment opportunities created by the proposed development will provide individuals and households with access to income, enabling those individuals and households to access goods and services. Essentially, this contributes to the improvement of households' standard of living.

The **National Spatial Development Perspective, 2006** is an important tool for establishing coordinated government actions and aligning them to meet social, economic and environmental objectives. The NSDP highlights principles and mechanisms for guiding infrastructure investment and development decisions. These principles include:

- Rapid economic growth that is sustained and inclusive for achieving other policy objectives.
- The constitutional obligation of the government to provide all citizens with basic services such as water, electricity, health and education facilities wherever they reside.
- Government spending on fixed investment should focus on localities of economic growth and/or economic opportunities. Government fixed investment should prioritise economic growth to motivate private sector investment to stimulate economic activities and create long-term employment opportunities.
- Regarding low economic potential, government should in addition to providing essential services, prioritise human capital development by providing social transfers such as grants, education and training and poverty relief programmes.

- Future settlements and economic development opportunities should be channelled into activity corridors and nodes that are adjacent to or link the main growth centres to address the spatial distortions caused by apartheid.

The proposed development aligns with the NSDP by creating job opportunities and contributing towards the growth of the local and regional economy through anticipated business activities and transactions that will take place during the construction and the operational phase.

2.2 Project alignment with provincial policies and strategic documents

The **Growing Gauteng Together (GGT), 2030,** is a plan of action that reflects the collective vision for the Gauteng City Region and highlights priority actions in response to the global and domestic challenges confronting the Province. There are seven priority area that the GGT, 2030, seeks to address and these include: **(i)** economy, jobs and infrastructure **(ii)** education, skills revolution and health **(iii)** integrated human settlements, basic services and land release **(iv)** safety, social cohesion and food security **(v)** building a capable, ethical and developmental state **(vi)** a better Africa and better world and **(vii)** sustainable Development for future generation

The GGT, 2030, hopes to achieve a better economic outlook for South Africa which would primarily be driven by a best-case scenario of the performance of the Gauteng province termed "Nayi Le Walk". In this scenario, the outlook for the province includes the following dynamic impacts:

- Economic growth- the Gauteng economy is anticipated to more than double over the next 11 years
- Employment and unemployment- the provincial economy is anticipated to contribute 3,1 million jobs to total employment by 2030 and the unemployment rate is expected to decrease by half, from 31% to 15%.
- Per capita GDP- The GDP is expected to increase by 70%, from R68 000 to R115 000 in 2030
- Poverty rate- The Nayi Le Walk growth path is estimated to reduce the provincial poverty rate by 40% over the next decade.
- Income inequality- the inequality rate measured by the Gini index, is anticipated to decline the 8 percentage points over an 11-year period. it is expected to decline from 70% currently to 62% by 2030.
- Industrial restructuring- An increase in the primary and secondary sector output and employment is anticipated. The primary and secondary sector share is expected to increase from 2,3% and 21.3% to 4,2% and 35,3% respectively.

The growth path of the Gauteng Province is said to drive the growth of the other eight provinces over the next decade. The proposed mixed high-density development aligns with one of the priority areas such as the economy, job creation and infrastructure. Short term and sustainable employment opportunities are anticipated to occur as a result of the proposed development.

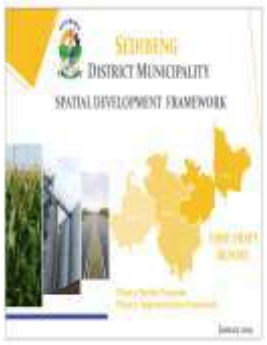
2.3 Project alignment with municipal policies and strategic documents

The **Sedibeng District Municipality Integrated Development Plan, 2019/20** is a strategic planning instrument that guides and informs all planning, budgeting management and decision-making processes in the district municipality over a five (5) year period. The IDP adheres to the constitutional mandate and the intended purpose of municipal integrated development planning which includes:

- To ensure sustainable provision of services
- To promote social and economic development
- To promote a safe and healthy environment
- To give priority to the basic needs of communities
- Encourage the involvement of communities

One of the key performance areas of the IDP is to contribute towards human capital by promoting low to high skills and building social capital by promoting united, non-racial, integrated and safer communities. The SDM intends to be a place where life-long learning is promoted and done in partnership with communities, educational institutions and the private sector.

The proposed mixed high-density development aligns with the IDP as it is anticipated to bring about social and economic benefits for the study area through employment creation and access to income. The promotion of human capital development is one of the anticipated features that the proposed development is anticipated to contribute towards. The recruitment of various skilled labour during the construction phase of the proposed development will open opportunities for skills and knowledge transfer.



The **Sedibeng District Municipality Spatial Development Framework** seeks to achieve:

- **Spatial sustainability** by creating a more consolidated settlement structure in the SDM to promote cost effective and sustainable provision of engineering and community services infrastructure and by ensuring sustainable use of land and other natural resources in the District
- **Spatial justice** through the inclusion of urban and rural communities previously excluded from services and facilities through processes of urban and rural restructuring and consolidation. As well as providing communities with access to economic and social resources to improve their living conditions.
- **Spatial efficiency** by ensuring that resources are channelled to areas in the SDM that display economic potential and development need.
- **Spatial resilience** by diversifying the district economy by focusing on agriculture, tourism, industry, mining and business development.

Land uses in the Sedibeng District Municipality comprise of towns and settlements, informal settlements, extensive agriculture, agricultural holdings, business, industrial, mining, and protected areas. These land uses are linked to movement networks in the SDM which include major national roads (N1, N12 and the N13) and provincial roads that transverse the municipal areas. The proposed mixed high-density development aligns with the current zoning of the site which is primarily characterised by towns and settlements.

The **Emfuleni Spatial Development Framework 2017- 2025** is a strategic land development document that provides the strategic direction of the municipality regarding spatial development. The vision for the spatial development of the Emfuleni Local Municipality (ELM) is to develop the Emfuleni Local Municipality into a public transport oriented structure that provides an efficient urban form that promotes equitable access opportunities, the cost effective provision and use of municipal services infrastructure and support the socio-economic development of local communities.

Essentially, the Emfuleni Local Municipality SDF vision deals with affordable housing development, nodal development, infrastructure development and public transport provision. The implementation of these aspects is aimed at achieving the broader developmental goals relating to sustainable development, poverty alleviation and the attraction of economic opportunities to the Emfuleni Local Municipality. The development objectives of the SDF entail:

- Creating an efficient urban form
- Increasing density and compactness
- Integrating land use and transportation
- Establishing sustainable socio-economic development
- Protection of open space and high potential agricultural soils
- Promoting urban renewal of established areas

The ELM SDF encourage land use densification in development corridors as well as Transport Oriented Developments. The proposed mixed high-density development aligns with the SDF in the promotion of densification in land uses and trannsport oriented developments as the site for the proposed development links to national and regional roads which enable mobility through the use of public transportation, thus promoting access to places of economic opportunity.

The **Emfuleni Local Municipality Integrated Development Plan, 2019/20** is a five-year plan that provides the local municipalities developmental visions and objectives. It is highlighted in the ELM IDP that the current urbanisation in the ELM is highly fragmented and therefore future urban developments and expansions within the local municipality should be done in a manner that achieves **urban consolidation, density and compactness.**

The ELM IDP prioritises the renewal of communities through the implementation of key deliverables including, the provision of basic services, regeneration of property development to improve the quality of living for all in the area of Emfuleni. One of the focus areas towards renewing communities involves changing the nature of housing delivery through the provision of basic services, **mixed housing developments**, developing comprehensive human settlement (formalisation of informal settlements) and hostel upgrading. The proposed mixed-high density development aligns with the IDP's focus on community renewal as mixed housing developments form part of the housing typologies in the provision of housing in the local municipality.

Synthesis

The national, provincial, and local policy framework focus on the broader objectives of economic development and job creation. More so, other key developmental aspects that all spheres of government promote include spatial redress, the provision of basic services and the overall improvement of lives. The proposed mixed high-density development speaks to these objectives. The ELM IDP prioritises mixed housing developments as one of the ways of changing the nature of housing delivery in the local municipality and also highlights that future urban developments and expansions in the ELM should seek to achieve urban consolidation, density and compactness. The proposed development therefore aligns with the ELM's objectives of achieving urban infill and consolidation.

3. SITE RELATED INFORMATION

This section provides the spatial context of the site and indicates the potential alignment of the proposed site to the current form of the study area. The site information includes the history, historical and cultural characteristics of the area, from a district and local perspective, the locational description of the site and an assessment of surrounding land uses.

3.1 Sense of place, history and cultural aspects

The study area falls in the Sedibeng District Municipality. The Sedibeng District Municipality is regarded as **category C**[1] and covers the southern part of the Gauteng Province and is comprised of three local municipalities: Emfuleni, Midvaal and Lesedi. The towns within the municipalities include Vereeniging, Vanderbijlpark, Meyerton and Heidelberg (Sedibeng District Municipality, 2020). Unitas Park falls under the Emfuleni Local Municipality and is one of the small settlements in Vereeniging and is within six kilometre-radius of six large peri-urban townships of Evaton, Sebokeng, Sharpville, Boipatong, Bophelong Tshepiso. The Emfuleni Local Municipality has a rich political history as it captures the South African War which led to the signing of the Peace Treaty in Vereeniging, the heritage assets such as the Sharpeville monument and the liberation struggle which is embodied by the signing of the Constitution of the Republic of South Africa (Act 106 of 1996) in Sharpeville (Emfuleni Local Municipality, 2020). Other significant historical events or developments that the area is associated with include:

- Having the highest number of political massacres during the apartheid era, including the Sharpeville massacre
- Vaal uprising
- Sebokeng zone 7 massacre
- Eikenhof shootings
- Boipatong massacre

3.2 Study area Delineation

Figure 3-1 below illustrates the primary and the secondary study areas. The primary study area which comprises the proposed project area, also includes areas such as Sebokeng, Falcon Ridge, Arconpark, Unitas Park, Duncoanville and Tshepiso. The secondary study area includes areas such as Evaton and Bophelong. The primary market area indicates the immediate catchment areas where immediate demand for the proposed development can be derived as these areas are relatively closer to the site. The secondary market area indicates the additional demand that can be captured by the development.

[1] A category C municipality is a municipality that has municipal executive and legislative authority in an area that includes more than one municipality, http://www.dac.gov.za/sites/default/files/chapter%207.pdf

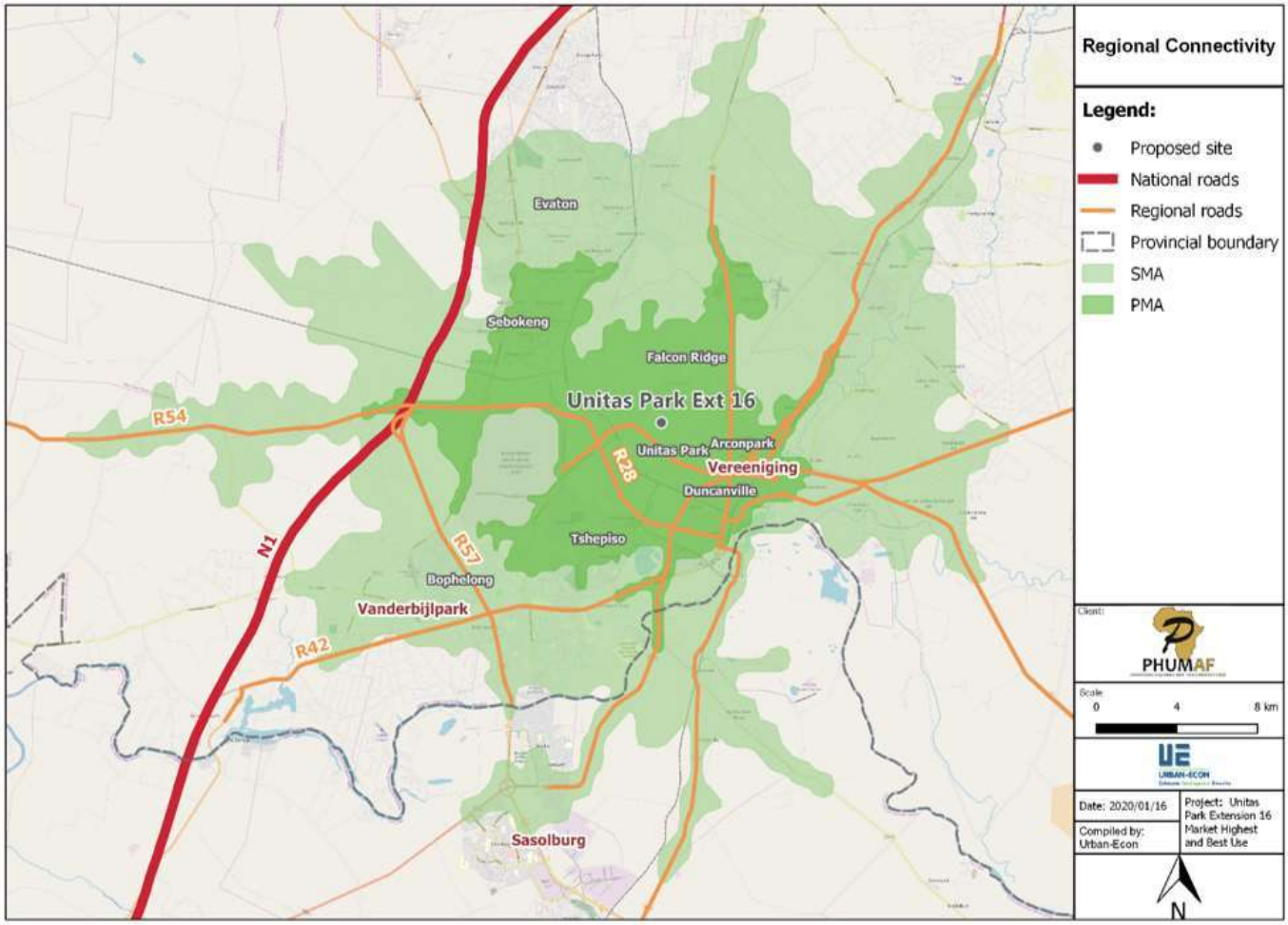


Figure 3-1: Study area delineation

Figure 3-2 illustrates the study areas connectivity to national, regional and other roads. Links to roads networks indicates the level of access or convenience to public transport system. The primary and secondary study areas are accessible through the N1 national road as well as regional roads including the R28, R57 and 54.

In terms of the connectivity of the overall Emfuleni Local Municipality, the Emfuleni local municipality is located south of Johannesburg and southwest of Ekurhuleni and is peripherally located withing Gauteng. Thus, the ELM is not well located in terms of access to core employment opportunities which are found within the region, mostly found within the triangle formed by the Johannesburg Central Business District, the Tshwane CBD and the OR Tambo International Airport. The ELM is, however, well connected to its neighbouring municipal areas by the N1 freeway and the R59 freeway and therefore provides access to these areas and the employment opportunities that exist therein (Emfuleni Local Municipality, 2017).

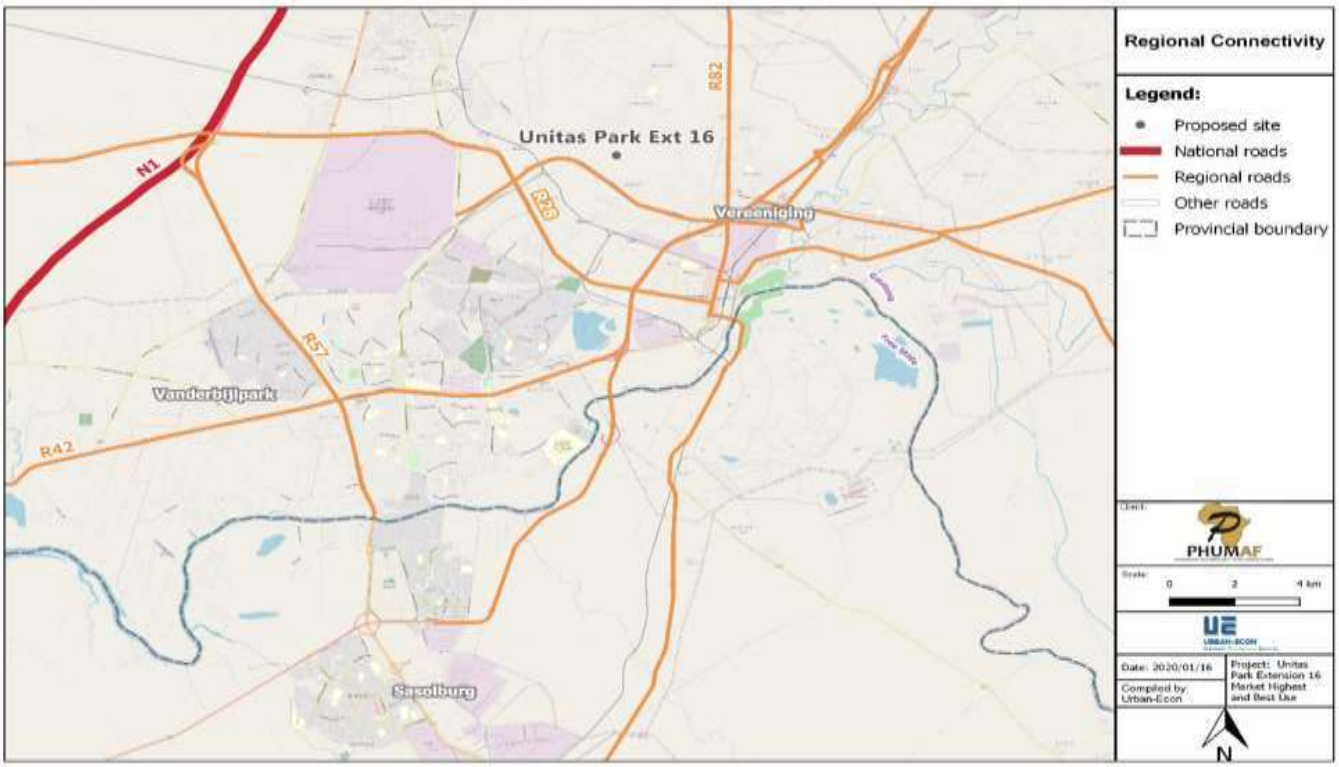


Figure 3-2: Regional connectivity

3.3 Land-use profile

Land uses surrounding the site as illustrated in Figure 3-3 indicate that the site is predominately surrounded by residential properties and open spaces as well as agricultural holdings. There are very limited commercial activities surrounding the site. There is also limited sports and recreation and education use surrounding the site. The ELM Spatial Development Framework proposes land use estimates for the ELM and provide the plans for urban expansion for areas in the local municipality for the periods 2017-2020 and 2020-2025. The land areas required for urban expansion in the ELM are calculated based on population growth and the existing backlog in the ELM. It is estimated that the ELM requires approximately 1900ha of land for **residential expansion** up to the year 2020 and an additional 1700ha of land for residential expansion up to 2025 (Emfuleni Local Municipality, 2017). In addition, further consolidation and **densification** of the development triangle situated between Vanderbijlpark, Sebokeng and Vereeniging CBD. Further densification of agricultural holding areas such as Mantevrede and **Unitas Park** for the period 2020 to 2025 is encouraged.

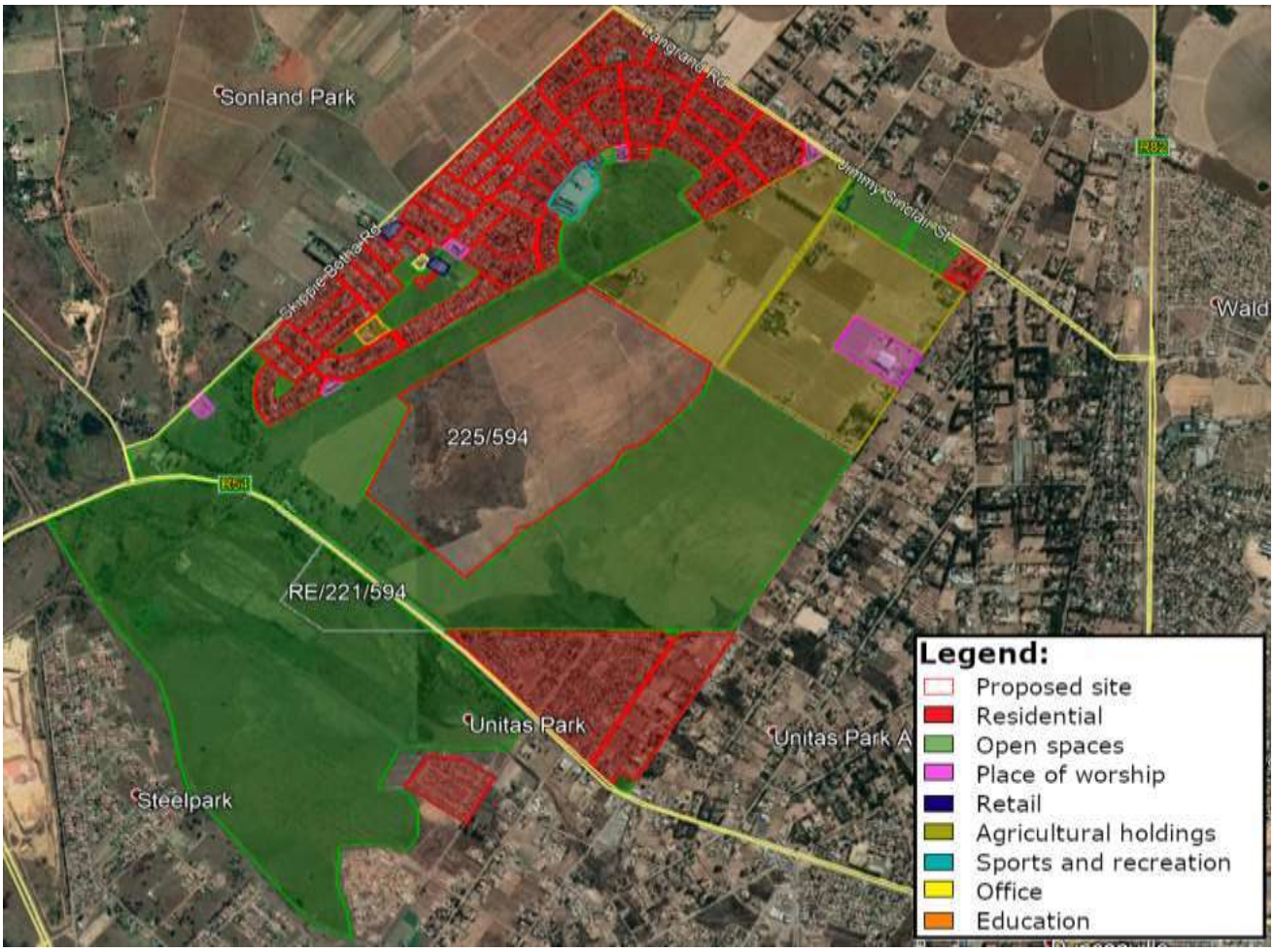


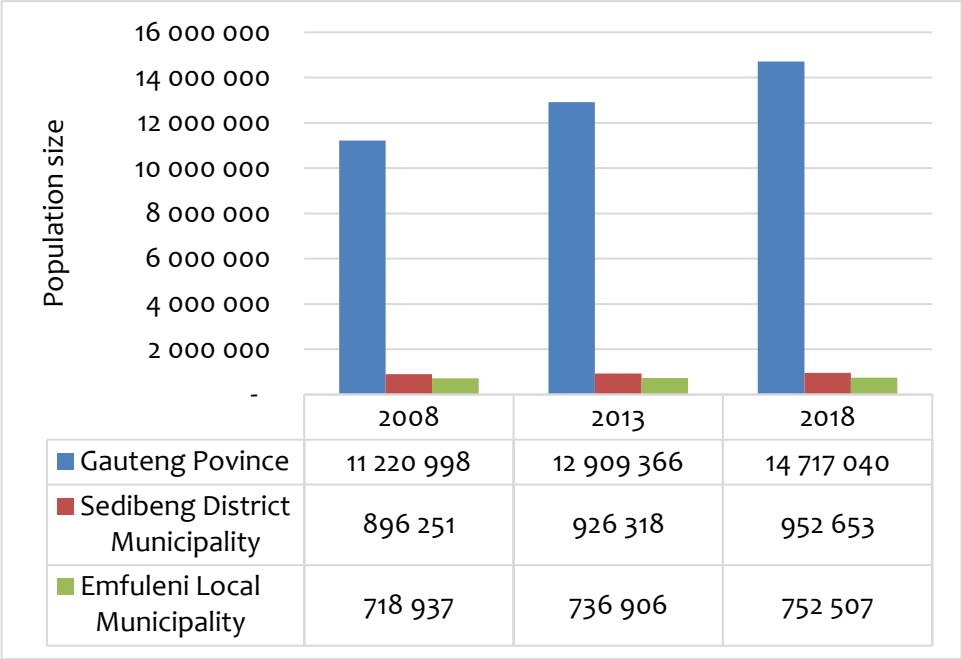
Figure 3-3: Surrounding land uses

4. BASELINE INFORMATION

This chapter examines key socio-economic characteristics of the study area, as per delineation provided in the previous chapter. The analysis of the status quo is essential as it provides both qualitative and quantitative data related to the communities and economies under observation, creating a baseline against, which the impacts can be assessed.

4.1 Demographic Profile

The demographic analysis provides the population characteristics of the study area and estimates the changes in the population and household size over time. The demographic analysis also indicates the characteristics and distribution of gender as well as age within the study area. Figure 4-1 below provides the population growth of the Gauteng Province, the Sedibeng District Municipality, and the Emfuleni Local Municipality in 2008, 2013 and 2018. The figure illustrates a consistent increase and provides an indication of how the population has increased potentially due to reproduction and immigration. Thus, the constant increase in the population size require the provision of housing, basic services as well as economic opportunities.



	2008	2013	2018
Gauteng Povince	11 220 998	12 909 366	14 717 040
Sedibeng District Municipality	896 251	926 318	952 653
Emfuleni Local Municipality	718 937	736 906	752 507

Figure 4-1: Population of the Province, District and Local Municipality (2008, 2013 & 2018) (Census data, 2011)

Figure 4-2 below illustrates the demographic profile of Unitas Park based on the 2011 Census data. Based on the 2011 Census data the total population in Unitas Park was 2 579 and consist of 717 households. The study area predominantly consists of females (50,9%) than males (49,1%) and the dominant gage group in the area are young people between 0 to 14 years as well as those aged 31 to 45 years.

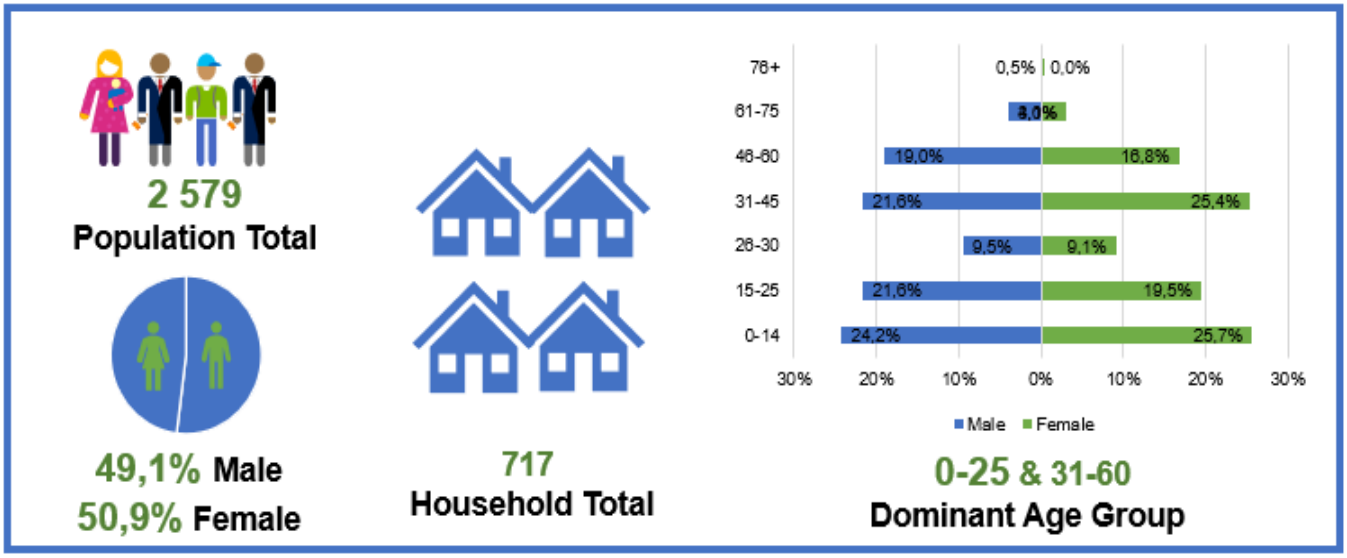


Figure 4-2: Demographic profile of Unitas Park
(Urban-Econ calculations based on Census, 2011 data)

The 2011 Census data is outdated and therefore does not provide a rather realistic view of the current population figures. The population and household figures have been augmented and estimated based on the average population and household growth rates of the Emfuleni Local Municipality and these figures are provided in the subsection below.

4.1.1 Population and Household Size

The population and household size provide an indication of how the area is growing and developing overtime. The increase in the population and household size also highlights a future need for housing, services, and amenities. Table 4.1 below provides the estimated population and household size of Unitas Park. The population size is anticipated to increase by 0,5% and the household size is anticipated to increase by 0,7% over ten-years. Shifts in the study area's population and household size will potentially lead to an increase need for housing. The development there provides a supply of housing stock in the study area which may potentially cater for the increasing population.

Table 4.1: Unitas Park Population and household size

	Average growth rate	2020	2025	2030
Population	0,5%	2 685	2 747	2 811
Household Size	0,7%	765	794	825
Average Household Size	3,5			

(Urban-Econ calculations based on Census 2011 and Quantec 2018 data)

Figure 4-3Figure 4-3 below illustrates the race profile for the study area in comparison to the provincial, district and local municipality. The race profile indicates that the study area predominantly consists of the Black African population (84%) as is the case provincially and within the district and local municipality.

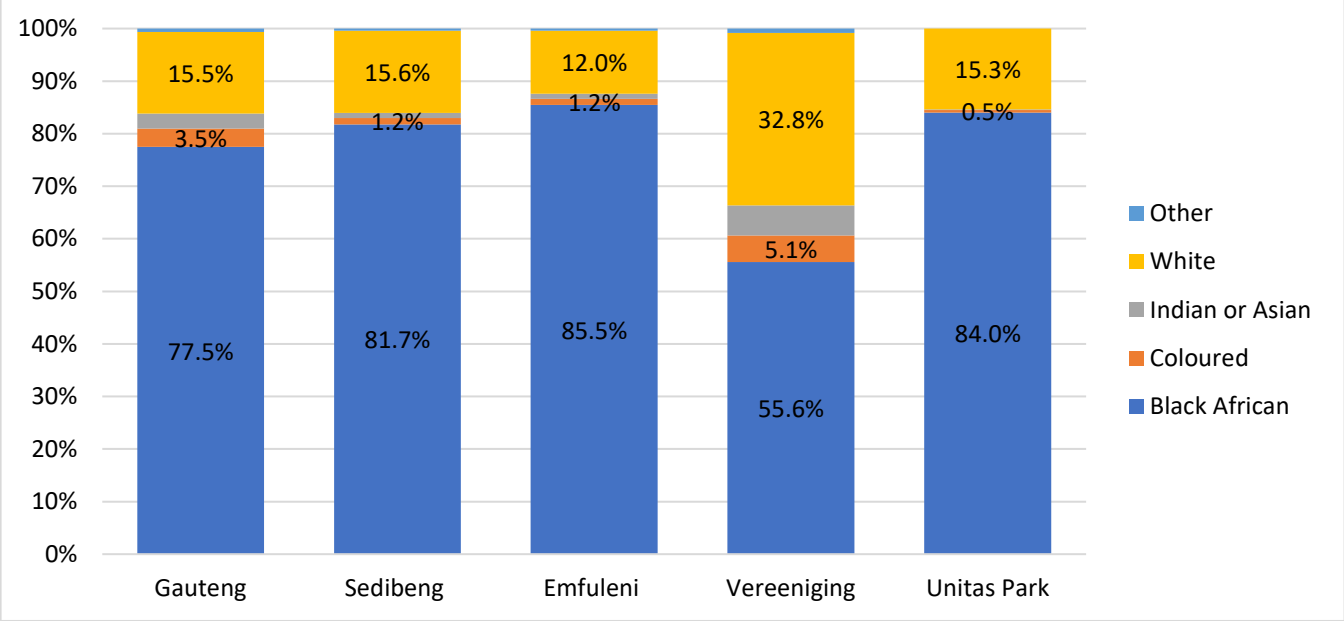


Figure 4-3: Study area race profile in 2011
(Urban-Econ calculations based on Census 2011 data)

4.2 Economy

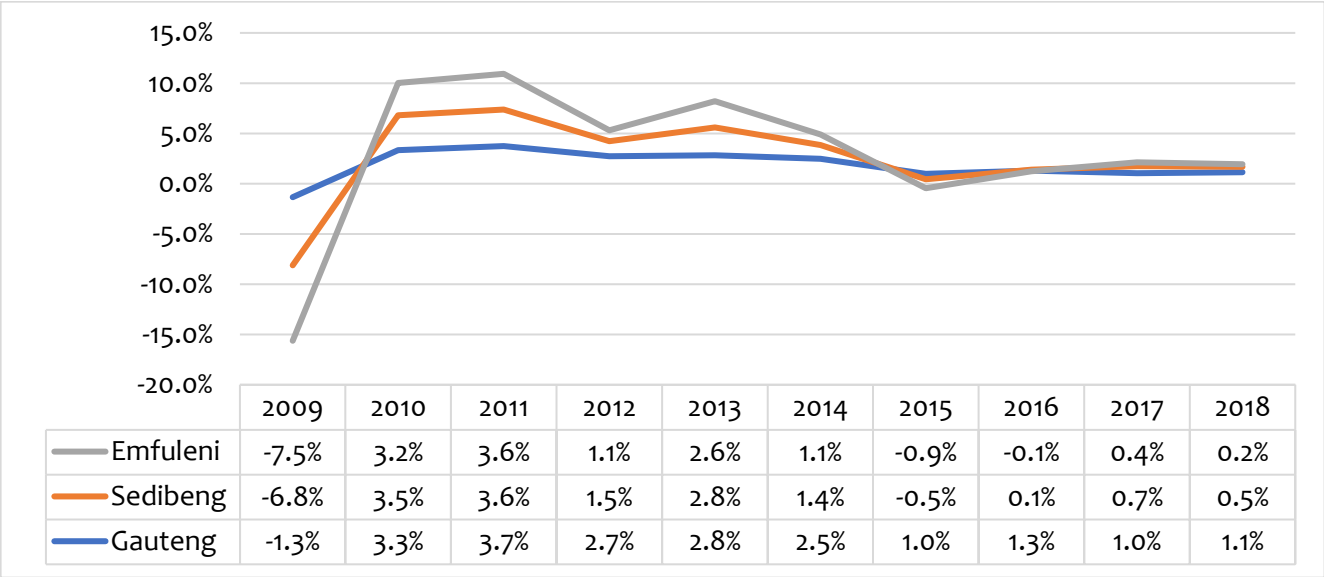
The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors. The economic analysis includes an analysis of the following:

- Local economy contribution to the national GDP
- Gross Value Added
- Sectoral contribution

4.2.1 Gross Value Added

The GVA measures the total output and income in the local economy, thus providing an indication of the total sum value of goods and services produced over a period of time. Figure 4-4 illustrates the GVA contribution of the Gauteng province, the Sedibeng district municipality and the Emfuleni local municipality between 2009 and 2018. The local district municipality's GVA moved in tandem with that of the Gauteng Province over the period 2009 to 2019. However, the Sedibeng District Municipality performed better than Gauteng province in 2010. The GVA in the province district and local municipality has decreased significantly over the ten-year period. In 2018 the Gauteng GVA was 1,1% while that of the Sedibeng District Municipality and the Emfuleni Local Municipality was 0,5% and 0,2% respectively. The provincial, district and local municipality economic performance reflects the overall performance of the national economy. The national Real Gross Domestic Product in the fourth quarter of 2019 declined by 1,4% and the decline was attributed to the negative contribution by the transport, storage and communication industry and the trade, catering and

accommodation sectors (Statistics South Africa, 2019).



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Emfuleni	-7.5%	3.2%	3.6%	1.1%	2.6%	1.1%	-0.9%	-0.1%	0.4%	0.2%
Sedibeng	-6.8%	3.5%	3.6%	1.5%	2.8%	1.4%	-0.5%	0.1%	0.7%	0.5%
Gauteng	-1.3%	3.3%	3.7%	2.7%	2.8%	2.5%	1.0%	1.3%	1.0%	1.1%

Figure 4-4: Study area GVA contribution, 2009-2018
(Urban-Econ calculations based on Quantec data, 2018)

4.2.2 Sectoral Contribution

Error! Reference source not found. indicates that the economy of the Emfuleni Local Municipality is predominately driven by the secondary and tertiary sectors. The top three economic sectors in the local municipality include, manufacturing, general government and the finance and business services sector. In 2018, the manufacturing sector contributed R10 158 000 to the local economy, while the general government and finance and business services sector contributed R6 266 million and R5 442 million respectively in the same year. The manufacturing sector also has a large presence in the Sedibeng District Municipality economy. The sector is however vulnerable to challenges such as electricity supply constraints and labour constraints (Sedibeng District Municipality, 2020).

Figure 4-5: Top economic sectors in the Emfuleni, 2018

Table 4.2 below provides the contribution of economic sectors to the Emfuleni local municipality in 2008, 2013 and 2018. The manufacturing sector had the largest contribution between the three-year period. However, the contribution of the manufacturing sector has since decreased over the period. The sector contributed 33,8% to the local economy in 2008 and decreased to 28,1% in 2018. On the other hand, the contribution of the construction increased within the stated years. The sector's contribution increased from 3,6% in 2008 to 4,5% in 2018. The construction sector in the local municipality is anticipated to be further developed through construction activities that are anticipated to take place during the construction phase of the development. Overall, the below sectors are anticipated to be positively impacted by the proposed mixed high-density development:

- Construction

- Wholesale, and retail trade, catering and accommodation
- Transport, storage and communication

Construction workers who come from other areas are anticipated to spend their disposable income on accommodation, retail goods and services during the construction phase, thereby contributing positively to the wholesale and retail trade sector of the area. The transportation of building material and equipment is anticipated to increase the activities in the transport sector of the local economy, thereby resulting in a positive impact on the transport sector.

Table 4.2: Sectoral contribution for 2008, 2013 and 2018

Economic sectors	2008	2013	2018
Agriculture, forestry and fishing	0,5%	0,5%	0,6%
Mining and quarrying	2,2%	2,5%	3,1%
Manufacturing	33,8%	29,8%	28,1%
Electricity, gas and water	3,8%	3,4%	2,8%
Construction	3,6%	4,3%	4,5%
Wholesale and retail trade, catering and accommodation	13,0%	14,4%	15,0%
Transport, storage and communication	7,3%	7,3%	7,3%
Finance, insurance, real estate and business services	13,2%	14,1%	15,1%
General government	17,2%	18,1%	17,3%
Community, social and personal services	5,4%	5,6%	6,1%

4.3 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being. The employment structure of the study area also includes an analysis of the formally employed labour in the study area.

4.3.1 Employment Status and level of skills

Error! Reference source not found. below illustrates the employment status of Unitas Park in 2018. In the study area, 54,2% of the working age population are employed, while 45,7% of the working age population includes those who are unemployed and economically inactive. The employment status in the study area is an important factor that indicates individuals or households' level of access to income and the ability to access goods and services. essentially, the employment status provides a significant indication of the standard of living in the study area.

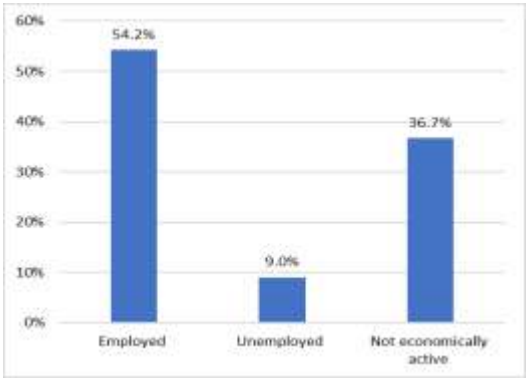


Figure 4-6: Employment status in Unitas Park, 2018

The proposed mixed high-density development is anticipated to create employment opportunities during the construction and operational phases. The employment of construction workers during the construction phase forms part of the direct employment creation that is anticipated to take place. Indirect employment will be realised through developers who will potentially require intermediate goods and services to utilise in the construction phase of the development. Suppliers are expected to employ labour to produce and provide these intermediate goods

and services. The operational phase of the development will also create employment opportunities, including permanent, temporal or contractual work. Employment during the construction phase includes the employment of, inter alia, building managers, cleaning and maintenance staff as well as security guards. Employment opportunities are anticipated to generate income for individuals and households. Individuals and households will spend this income on goods and services, and this is anticipated to have a positive effect on business profits and businesses may have an incentive to create more job opportunities. This is therefore anticipated to result in a multiplier effect and potentially improve the socio-economic status of Unitas Park.

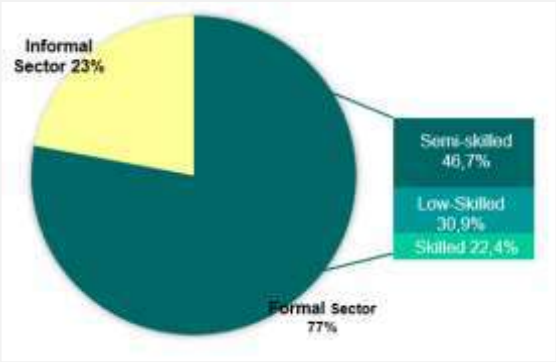


Figure 4-7: Level of skill in Emfuleni, 2018

Error! Reference source not found.Error! Reference source not found. illustrates the level of skill of the labourforce in the Emfuleni local municipality in 2018. The figure indicates that there are more people employed in the formal sector (77%) than in the informal sector (23%), with semi-skilled labour (46,7%) dominating the formal sector labour pool and 22,4% skilled labour.

4.3.2 Sectoral contribution to employment

Table 4.3 below provides the sectoral contribution to formal and informal employment in the Emfuleni Local Municipality in 2018. There is a significant percentage of semi-skilled labour in each of the economic sectors in the Emfuleni Local Municipality. The sectors that contributed to the employment of semi-skilled labour include, the mining and quarrying sector (64%), construction sector (63,7%) and the transport, storage and communication sector (62,3%). Community, social and personal services contributes significantly to the employment of low-skilled labour (66,7%). There is a relatively low contribution to the employment of skilled labour in each of the economic sectors in the study area. General government has the highest contribution to the employment of skilled labour in the study are (44,7%).

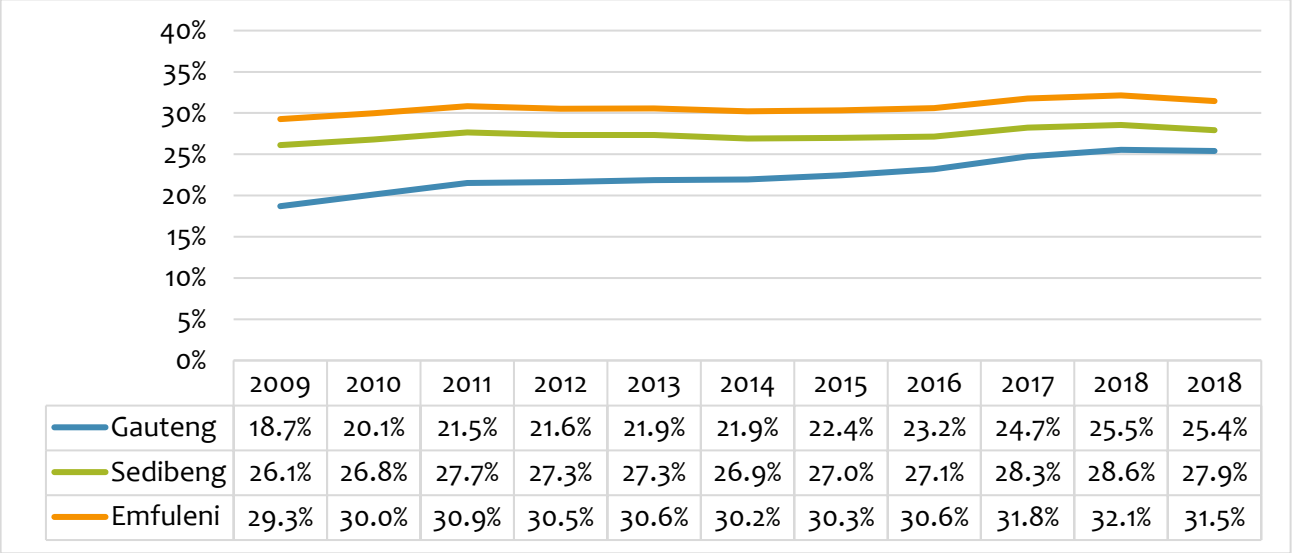
Table 4.3 : Sectoral contribution to employment in the Emfuleni Local Municipality in 2018

Economic Sectors	Formal sector: Skilled	Formal sector: Semi-skilled	Formal sector: Low skilled
Agriculture, forestry and fishing	8,4%	40,9%	50,7%
Mining and quarrying	10,7%	64,0%	25,3%
Manufacturing	16,0%	56,2%	27,8%
Electricity, gas and water	19,7%	57,1%	23,2%
Construction	14,8%	63,7%	21,4%
Wholesale and retail trade, catering and accommodation	19,5%	56,9%	23,6%
Transport, storage and communication	17,7%	62,3%	20,0%
Finance, insurance, real estate and business services	25,3%	52,1%	22,6%
General government	44,7%	38,3%	17,0%
Community, social and personal services	17,0%	16,3%	66,7%

(Urban-Econ calculations based on Quantec data, 2018)

4.3.3 Unemployment Rate

Employment is an important factor that determines individuals or households' access to income, which provides the means to access goods and services and therefore provides an indication of the standard of living in the particular area. Figure 4-8 below illustrates the provincial, district and local municipality's unemployment rate between 2009 and 2018. The Emfuleni Local Municipality has the highest unemployment rate throughout the ten-year period compared to the Gauteng Province and the Sedibeng District Municipality. The ELM unemployment rate was recorded at 31,5% in 2018. The high unemployment rate in the local municipality indicates low employment prospects in the local economy. Unemployment in the local area is above the national average. The national unemployment rate in the fourth quarter of 2019 was 29,1% and remined the same as the third quarter of 2019 (Statistics South Africa , 2019). The proposed development is anticipated to improve employment prospects within the local area through temporary employment opportunities during the construction phase of the development. Moreover, long-term and sustainable employment opportunities are anticipated to be realised during the operational phase.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018
Gauteng	18.7%	20.1%	21.5%	21.6%	21.9%	21.9%	22.4%	23.2%	24.7%	25.5%	25.4%
Sedibeng	26.1%	26.8%	27.7%	27.3%	27.3%	26.9%	27.0%	27.1%	28.3%	28.6%	27.9%
Emfuleni	29.3%	30.0%	30.9%	30.5%	30.6%	30.2%	30.3%	30.6%	31.8%	32.1%	31.5%

Figure 4-8: Unemployed rate for the period 2009 to 2018 (Urban-Econ calculations based on Quantec, 2018 data)

4.4 Household Income

Household income can be used as an important factor in assessing and determining households' access to goods and services as well as indicating the standard of living of the study area. Table 4.4**Error! Reference source not found.** outlines the household income distribution in Unitas Park and indicates that more than half of the households are low income earning households (55,9%), while there is an almost equal proportion of middle (22,5%) and high income earning households (21,6%). The proposed development is anticipated to contribute positively to household income. Employment opportunities generated by the proposed development will provide households with income which is anticipated to contribute to better access to goods and services and relatively improve the standard of living of the study area population.

Table 4.4: Household income for Unitas Park in 2011 adjusted based on 2020 Average Consumer Price Index

Unitas Park

No income	50,2%	55,9%	Low
R1- R7 282	4,4%		
R7 284- R14 597	0,8%		
R14 566- R29 373	0,5%		
R29 130- R57 869	3,6%	22,5%	Middle
R58 258- R114 781	3,2%		
R116 514- R219 200	6,8%		
R23 027- R233 027	8,9%		
R466 052- 840 458	12,5%	21,6%	High
R932 103- R1 680 916	6,9%		
R1 864 204- R3 361 832	2,0%		
R3 728 407- 6 391 721	0,2%		

(Urban-Econ calculations based on Census data, 2011, StatsSA 2019)

4.4.1 Household Expenditure

Figure 4-9 provides the expenditure of the households in the Emfuleni Local Municipality and indicates that a large portion of the household's disposable income is spent on food, beverage and tobacco (25%) as well as a combination of other goods and services[2] (40%). A notable percentage of the household income is also spent on rent (11%). The proposed development is anticipated to have a positive impact on household income, this is anticipated to also affect the level of spending. Households may potentially have more disposable income to spend on goods and services and potentially spend. Expenditure on rent potentially indicates the demand that may be captured from households who are willing to pay rent. The demand for the for the proposed mixed high-density development will potentially be influenced by household's disposable income, expenditure and affordability.

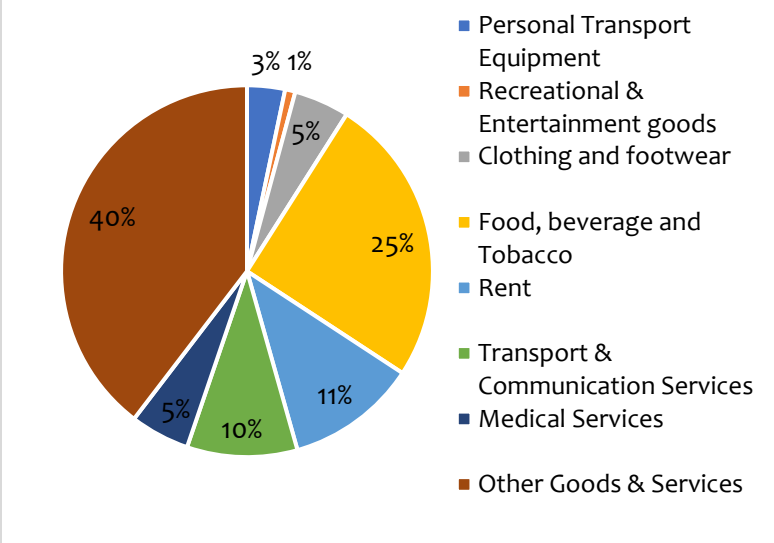


Figure 4-9: Household expenditure in The Emfuleni Local Municipality in 2018
(Urban-Econ calculations based on Quantec data, 2018)

[2] Other goods and services include, inter alia, household appliances, motor parts and accessories, medical products and services as well as recreational and educational services

5. ACCESS TO SERVICES AND STATE OF LOCAL BUILT ENVIRONMENT

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure is another indicator to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities further indicates the nature of the study area, which is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against, which the potential impacts of the proposed project can be assessed.

5.1 Access to basic services

Figure 5-1 below indicates the level of access to basic services in the Emfuleni Local Municipality in 2018 and indicates that:

- A significant portion of the households in the Emfuleni Local Municipality had access to electricity. Approximately 92,1% of the houses use electricity as a source of energy for lighting while the remaining 7,9% of the households use, paraffin, gas, solar, candles.
- Households in the Emfuleni Local Municipality have adequate access to water. An estimated 99,4% of the households have access to piped water. Piped water is either accessed inside a dwelling, inside a yard, or in a community stand less or more than 200 km from the dwelling. Approximately 0,6% of the household's access water from boreholes/rainwater tank or well, from a dam/river/stream or spring, from a water carrier/tanker or water vendor or from other unspecified sources.
- The majority of the households in the Emfuleni local municipality have access to sanitation services. Approximately 90,3% of the households have access to flush or chemical toilets while the remaining estimated 9,7% of the households use access to pit latrine, bucket latrine or none/unspecified sanitation sources.
- Approximately 90,7% of the households in the Emfuleni local municipality have their waste removed by the local municipality.

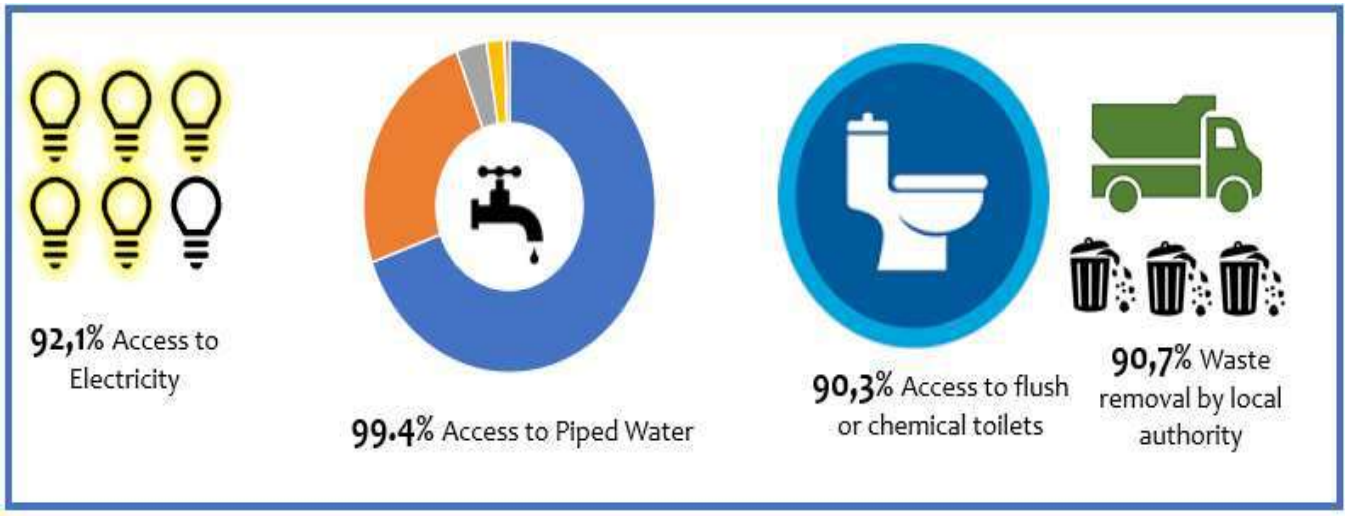


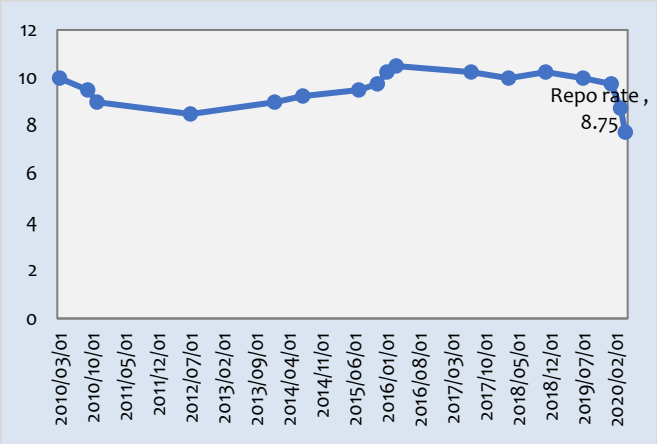
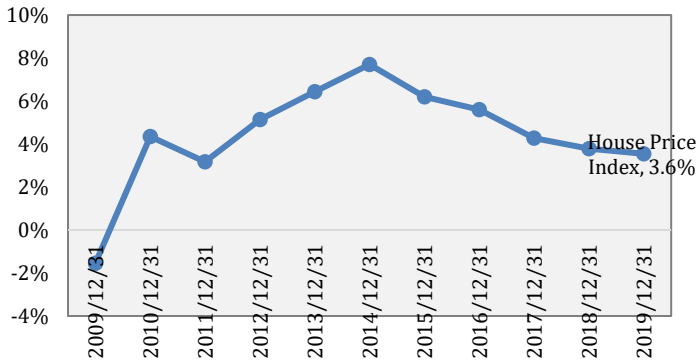
Figure 5-1: Access to basic services in Emfuleni Local Municipality in 2018 (Quantec data, 2018)

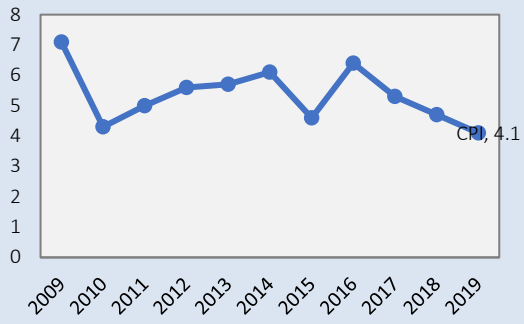
6. PROPERTY TRENDS ANALYSIS

6.1 National Macroeconomic determinants

Significant determinant factors that influence the demand for the property market should be considered as important in gauging the demand for the proposed mixed high-density development. Table 6.1 provides an overview the national key determinants for residential property.

Table 6.1: National macroeconomic determinants for property demand

Indicator	Trends	Implication
South African Interest Rates	 **Figure 6-1: National Prime Lending Rate for the period 2010 to 2020 (South African Reserve Bank, 2020)**	The prime lending rate is the rate at which commercial banks lend to people. The South African Reserve Bank decreased the prime lending rate from 8,75 percent in March 2020 to 7,75 percent in April 2020 The decrease in the prime interest rate brings relief to property owners and can encourage people to enter into the market since credit is more affordable
National House Prices Index (% growth year-on year)	 **Figure 6-2: National House Price Index for the period 2009 to 2019 (Statistics South Africa, 2020)**	The house price index is used to measure house prices and trends within a particular market. The house shows the trend in the South African house price index and indicates that the quarterly growth of the house price index in 2018 was 3,8 percent and declined to 3,6 percent in 2019, which potentially indicates slow growth in the national housing market.

Indicator	Trends	Implication
Inflation (Headline CPI – all urban areas)	 **Figure 6-3: Average Consumer Price Index for the period 2009 to 2019 (Statistics South Africa, 2020)**	The Headline CPI declined between 2018 and 2019, with the average CPI in 2018 measuring at 4.7 percent and 4,1 percent in 2019. The CPI is still within the SARB target of between 3.0 and 6.0 percent. Lower inflation rates can also contribute to more stabilised growth in house prices.

6.2 Study Area Housing Trends

This section provides an analysis of the residential market in Unitas Park. The analysis of the property trends in the study area include:

- Dwelling typology
- Tenure status
- Residential market stock
- Average house price
- Property ownership distribution

Dwelling types

Figure 6-4 illustrates the dwelling types in Unitas Park based on the Census 2011 data and indicates that the majority of the households in the study area primary reside in house or brick structure houses on a separate stand or yard (80%). The population also consists of a considerable percentage of households that reside in a house or flat in the backyard (17,6%)

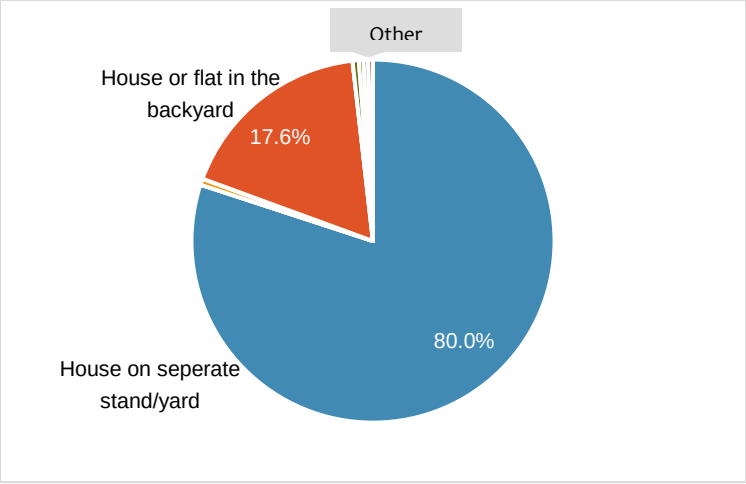


Figure 6-4: Dwelling type for Unitas Park in 2011 (Urban-Econ calculations based on Census data, 2011)

Tenure status

Figure 6-5 indicates that most of the households in Unitas prefer to own their homes as opposed to renting. Of the households that own their homes, 64,9% have not yet paid them off 64,9% while the remaining 22,6% have fully paid them off. There is a relatively minute number of households renting in the study area (8,9) as well as those who occupy homes without paying rent 2,8%.

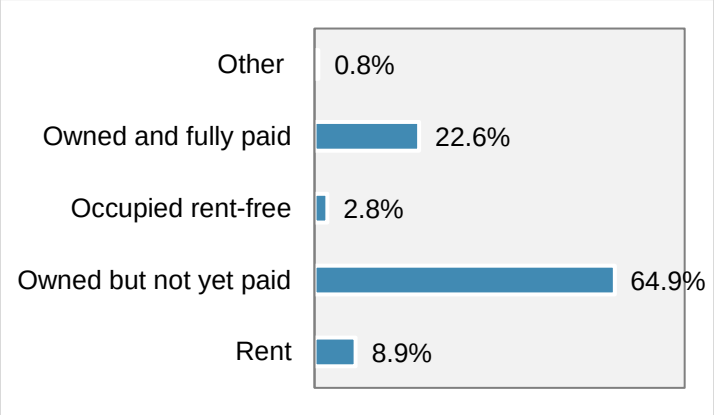


Figure 6-5: Tenure status in 2011
(Urban-Econ calculations based on Census data 2011)

Residential market stock

Figure 6-6 indicates that the housing stock in Unitas Park is predominantly freeholds (99,75%) with an insignificant supply of freeholds in estates (0,28%). The high prevalence of freehold units in the study area may be attributed to the benefits that accompany the ownership of a freehold property. Some of the benefits of owning a freehold property include independence; owners have the liberty to have full title ownership as well as freedom

to make improvements to their properties (such as renovations) without the need to get approval from a body corporate (Property24, 2017).

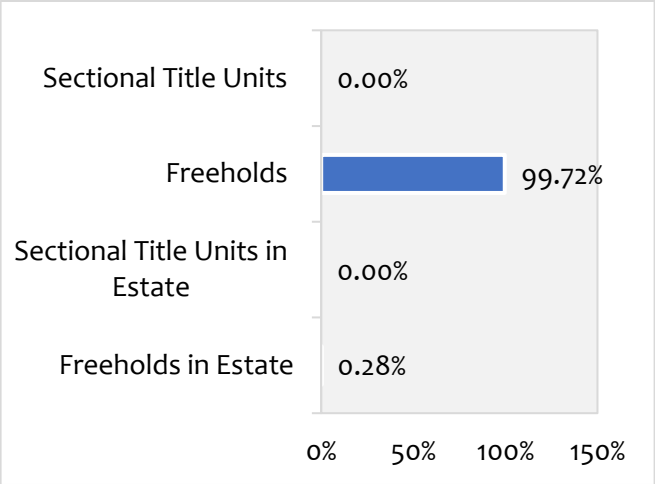
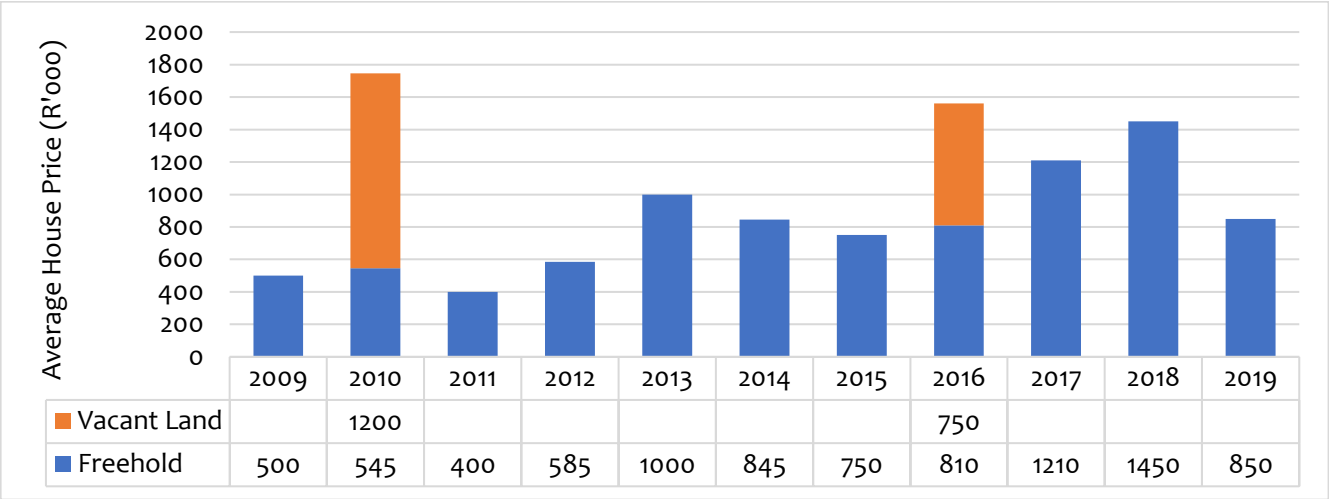


Figure 6-6: Residential market stock in Unitas Park
(Lightstone report, 2020)

Average house prices

Figure 6-7 below indicates the average house prices in Unitas Park for the available residential market stock. Average house prices indicate affordability, growth trends and the overall residential market in the study area. Evidently, freehold property dominates the housing market in the study area. Average house prices fluctuated within the ten-year period between 2009 to 2019. The only prices listed in the area are for freehold property

as well as vacant land, this shows the high prevalence of freehold property in Unitas Park. The average house price of freehold property in Unitas Park increased from R500 000 in 2009 to R850 000 in 2019.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Vacant Land		1200						750			
Freehold	500	545	400	585	1000	845	750	810	1210	1450	850

Figure 6-7: Median house prices (R' 000) 2009 – 2019 in Unitas Park (Lightstone report, 2020)

Property ownership distribution

Figure 6-8 below indicates the ownership, buying and selling trends in Unitas Park for the period January 2019 to December 2019. Stable property owners in the study area are predominantly pensioners 65 years and older while recent buyers are mature adults between the age of 50 and 64 years. The figure indicates that there has not been a record of pensioners who have bought property in the area between January 2019 to December 2019. On the other hand, mature adults, middle aged and young adults have been active in buying property. Conversely, recent property sellers have predominantly been pensioners (40%), mature adults (30%) and middle-aged individuals (30%), while young adults have not been active in selling property between January2019 to December 2019.

Figure 6-8: Property owner distribution in Unitas Park (Lightstone Report, 2020)

Figure 6-9 indicates the period of ownership for existing property owners and recent property sellers in the study area. Recent sellers and existing owners have had ownership of their properties for a significantly long period, i.e. 71% of recent sellers and 70% of existing property owners owned their property for 11 years and more.

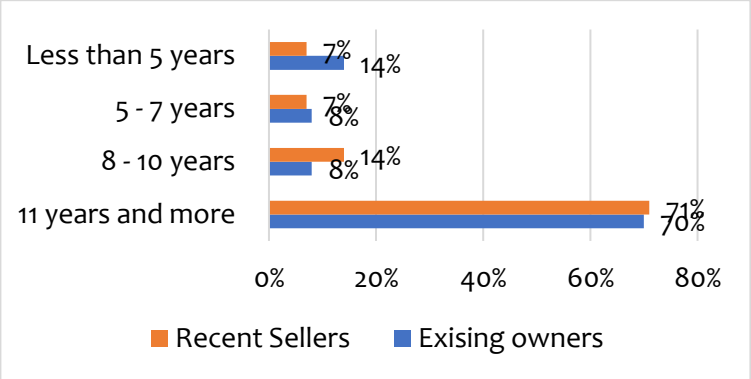


Figure 6-9: Period of ownership (Lightstone Report, 2020)

The property ownership distribution indicates that the residential market in the study area is primarily dominated by mature and older individuals. Although stable owners in the study area are older individuals, there is a relatively notable number of recent buyers who are young adults. Income levels as well as household compositions are some of the factors that may potentially influence the decision to purchase residential property. The proposed mixed high-density development may include single or bachelor units which may potentially attract demand from individuals who live on their own as well as those living in relatively large households.

7. IMPACT ANALYSIS

7.1 Introduction

This chapter presents the analysis of the socio-economic impacts that are expected to ensue as a result of the development of the proposed mixed high-density development and an evaluation of these impacts according to the predefined criteria. The assessment took a targeted approach towards the analysis of the potential impacts which are anticipated during the construction and the operational phase of the proposed mixed high-density development.

7.2 Preliminary Impact Assessment

7.2.1Identify potential impacts

The preliminary impacts of the proposed development are assessed and characterised as either positive or negative. The potential impacts that will potentially occur due to the proposed development are listed below:

- Stimulation of the local and regional economy
- Creation of temporal and sustainable employment opportunities
- Household income
- Demographic shift
- Impact on basic services
- Impact on the sense of place

7.3 Impact criteria and ratings

The various identified impacts are assessed based on the impact assessment criteria provided in Table 7.1 below:

Table 7.1: Impact Assessment Criteria

Severity
• Insignificant / non-harmful – **1** • Small / potentially harmful – **2** • Significant / slightly harmful – **3** • Great / harmful – **4** • Disastrous / extremely harmful / within a regulated sensitive area – **5**
Spatial scale
How big is the area that the aspect is impacting on? • Area specific (at impact site) – **1** • Whole site (entire surface right) – **2** • Local (within 5km) – **3** • Regional / neighbouring areas (5km to 50km) – **4** • National – **5**
Duration
• One day to one month (immediate): **1** • One month to one year (Short term): **2** • One year to 10 years (medium term): **3** • Life of the activity (long term): **4**

- Beyond life of the activity (permanent): **5**

Frequency of activity

How often is the specific activity done?

- Annually or less: **1**
- 6 months: **2**
- Monthly: **3**
- Weekly: **4**
- Daily: **5**

Frequency of impact

How often does the activity impact on the environment?

- Almost never / almost impossible / >20%: **1**
- Very seldom / highly unlikely / >40%: **2**
- Infrequent / unlikely / seldom / >60%: **3**
- Often / regularly / likely / possible / >80%: **4**
- Daily / highly likely / definitely / >100%: **5**

Legal issues

- No legislation: **1**
- Fully covered by legislation: **5**

Detection

How quickly/easily can the impacts/risks of the activity be detected on the environment, people, and property?

- Immediately: **1**
- Without much effort: **2**
- Need some effort: **3**
- Remote and difficult to observe: **4**
- Covered: **5**

Impact ratings

Each impact identified will be assessed in terms of scale (spatial scale), magnitude (severity) and duration (temporal scale). Consequence is then determined as follows:
Consequence = Severity + Spatial Scale + Duration

The Risk of the activity is then calculated based on frequency of the activity and impact, how easily it can be detected and whether the activity is governed by legislation. Thus: **Likelihood = Frequency of activity + frequency of impact + legal issues + detection**

The risk is then based on the consequence and likelihood.
Risk = Consequence x likelihood

Risk impact rating criteria:

- 1-55: Low (L) Risk
- 56-169: Medium (M) Risk
- 170-600: High (H) Risk

7.4 Impact Analysis

7.4.1 Construction phase

Demographic shift – influx of migrant workers

A demographic shift is anticipated to occur during the construction phase of the proposed development due to the influx of migrant workers who come from other areas looking for employment opportunities. The construction phase of the proposed development will attract those who are looking for job opportunities and may be willing to relocate to the area during the construction phase. The migrant workers may potentially remain during the operational phase of the development as they may anticipate permanent work opportunities including building management positions, security, cleaning and maintenance services. The influx of migrant workers into the area may potentially result to an increase of informal settlements or backyard houses and the overall increase in the population in the short and medium term.

Change in the sense of place

The activities that will take place during the construction phase of the proposed development such as the movement of construction vehicles, construction workers as well as the noise from the construction vehicles is anticipated to impact nearby residents. The proposed development is expected to affect the activities on the road and result in the obstruction of roads, driveways and walkways with the movement of construction vehicles and construction workers and will potentially impact the flow of traffic in the study area.

Stimulation of the local and regional economy

The proposed mixed high-density development is anticipated to have a positive impact on the local and regional economy. Business transactions that are anticipated to take place during the construction phase such as the purchase of building materials and equipment from local producers as well as outsourcing are anticipated to boost local businesses. It is anticipated that the proposed development will require the movement of goods, may attract labours from other areas who may potentially require accommodation and therefore, local and regional economic sectors such as the construction, transport and wholesale and retail trade sectors are anticipated to be positively impacted by the proposed development. The following are the broad activities that are anticipated to result in the simulation of the local and regional economy

- Growth in business activity
- Increased private investment
- Increase in household income- increased spending on goods and services which will result to the flow of money back into the economy through the multiplier effect.

Creation of temporary employment opportunities

The proposed development is anticipated to result in the creation of **direct**, **indirect** and employment opportunities. Direct employment opportunities are anticipated to occur through the employment of construction workers, and this is anticipated to be short term or last until the construction phase is complete. The development is anticipated to attract a pool of skilled, semi-skilled labour in the local area and is expected to result in the transfer of skills during the construction phase.

Additional activities during the construction phase such as transactions with building material suppliers will potentially create indirect job opportunities, as suppliers are expected to potentially hire additional factory workers as well as equipment and material producers due to the demand for building equipment.

Household income

The temporal employment opportunities created during the construction phase will provide households with income. The disposable income will enable households to have access to retail goods and services such as educational and medical services. The wage and salary levels are to be competitive and take consideration of the skills levels of the employed construction workers.

7.4.2 Operational phase

Demographic shift - immigration of middle-income households during operations

The proposed development is anticipated to attract middle-income households into the area during the operational phase of the proposed development. The demographic shift may result in an increased demand for the proposed mixed high-density units as the middle-income households who have the means to pay rent may choose to reside in the proposed mixed high-density units. The demographic shift is also anticipated to result in the growth of the local economy as the middle-income households are expected to spend their disposable income on goods and services.

Service delivery and infrastructure upgrades

Activities that are anticipated to take place include the upgrading of roads, water, electricity, sewer, and storm water systems. The service delivery upgrades will be to ensure that there is adequate access to services for the demographic shift that will occur as a result of the proposed development.

Change in the sense of place

The proposed development is a mixed high-density development, and this may potentially obstruct the view of the residence. The sense of place may also be impacted by potential noise, vagrants outside the premises as well as illegal parking.

Stimulation of the local and regional economies through direct and multiplier effects

Employment that will created from the proposed development will result in an increase in the demand for goods and services as households will have access to disposable income. The increase in consumption expenditure will contribute to the growth of the local and regional economies. The investment created from increased business activities is also anticipated to contribute to the stimulation of the local economy. The table below indicates the impact rating of the anticipated direct net regional economic gain in production and GDP during the operational phase of the proposed development.

Creation of sustainable employment opportunities-direct, indirect and induces employment opportunities

Direct employment creation during the operational phase of the development is anticipated to be sustainable and the duration is anticipated to be longer than the employment created during the construction phase. The following activities are anticipated to create direct employment opportunities during the operational phase

- Cleaning and maintenance of the buildings
- Safety and security
- Building management

Indirect employment creation will occur though the transactions between suppliers for services. Such services may be outsourced from external companies and may provide those companies to hire more employees to produce the supplies or offer the needed services. These services may include:

- Cleaning material suppliers
- Security services

Induced employment creation will be created through retail jobs that will be created as those who are employed during the operational phase of the development will spend their disposable income on goods and services. The increase in business sales may potentially create and an incentive for retail stores to employ more workers.

Access to household income

Workers who are employed in the development during the operational phase will have access to disposable income and this is anticipated to have a positive social and economic impact. Households will have the means to purchase goods and services such as food, clothing, medical services and educational services. Households are therefore anticipated to have an improved standard of living.

Potential impact description	Phase	Environmental Significance before and after mitigations							Impact rating	Significance rating	Proposed mitigation measures Management and mitigation measures
		Consequence			Likelihood						
		Severity	*Spatial*	*Duration*	*Frequency activity*	*Frequency impact*	*Legal issues*	*Detection*			
Demographic shift- influx of migrant workers	Construction phase	2	3	4	1	4	1	4	90	Before mitigations (M)	• Prioritise employment of construction workers coming from the nearby residential settlements • Ensure the transfer of skills. Highly skilled construction workers must collaborate with low to medium skilled workers in order to facilitate the skills sharing and transfer process. • Establish skills desks in Unitas Park to identify the labour force with the correct skills that could be employed immediately or could be trained for specific positions during construction
		1	3	4	1	4	1	4	80	After mitigations (M)	
Change in the sense of place	Construction phase	3	2	4	1	4	1	1	63	Before mitigations (M)	• Create strict controls on the roads leading to the facility and prevent people from parking on the side of the roads, driveways, and other public areas that may inconvenience other road users and cause traffic congestion. • Vehicles should be towed away if parked in the non-designated areas and such practices should be made abundantly clear among the construction workers and construction managers to avoid unnecessary conflicts. • There are however limited mitigative measures that can be taken to mitigate the potential noise impacts that may arise from the construction, such as the sound of the building machinery and equipment. • The construction of the development should take place during the day when most of the residents in the area are anticipated to be at school or work or occupied by other activities.
		2	**2**	**4**	**1**	**4**	**1**	**1**	56	After mitigations (M)	
Stimulation of the local and	Construction phase	3	4	4	5	5	5	4	209	Before mitigations (H)	• Utilise domestically produced building material and equipment

Potential impact description	Phase	Environmental Significance before and after mitigations							Impact rating	Significance rating	Proposed mitigation measures Management and mitigation measures
		Consequence			Likelihood						
		Severity	*Spatial*	*Duration*	*Frequency activity*	*Frequency impact*	*Legal issues*	*Detection*			
regional economy		4	4	4	5	5	5	4	228	After mitigation (H)	• Prioritise the procurement of goods and services from the local SMMEs and particularly SMMEs located in the study area.
Creation of temporary employment opportunities	Construction phase	3	4	4	4	4	5	3	172	Before mitigations (H)	• Prioritise employment of construction workers coming from the nearby residential settlements particularly those in the primary market area. • Establish skills desks in Unitas Park Extension 16 to identify the labour force with the correct skills that could be employed immediately or could be trained for specific positions during construction.
		4	4	4	4	4	5	3	192	After mitigations (H)	
Impact on household income	Construction phase	4	4	4	4	4	5	4	208	Before mitigations (H)	• The labourers employed during the construction and the operational phase must be given a contract that stipulates the required hours of work as well as the pay rate/wage or salary amount. • The contract of employment should stipulate the duration of employment (temporal or permanent) depending on the phase of the development. • The salary must be competitive or adhere to the minimum wage standards.
		4	4	4	4	4	5	4	208	After mitigations (H)	
Demographic shift - immigration of middle-income households during operational phase	Operational phase	3	3	4	1	3	1	4	80	Before mitigations (M)	None
		3	3	4	1	3	1	4	80	After mitigations (M)	

Potential impact description	Phase	Environmental Significance before and after mitigations							Impact rating	Significance rating	Proposed mitigation measures Management and mitigation measures
		Consequence			Likelihood						
		Severity	*Spatial*	*Duration*	*Frequency activity*	*Frequency impact*	*Legal issues*	*Detection*			
Service delivery and infrastructure upgrades	Operational phase	3	4	5	1	4	5	2	156	Before mitigations (M)	• Ensure that the bulk of services that will occur as a result of the project will be extended to the primary communities (Sebokeng, Falcon Ridge, Arcon Park and Unitas Park) as well as the secondary areas (Evaton and Bophelong) • Ensure that the road conditions are improved and necessary expansion of the road networks (additional lanes) are made to avoid worsening the road congestion in the area particularly during peak hours • Upgrade the stormwater infrastructure in the area to benefit existing residents as wells as those who will occupy the proposed development
		3	4	5	1	4	5	2	156	After mitigations (M)	
Change in the sense of place	Operational phase	3	3	5	5	4	1	2	132	Before mitigation (M)	• Ensure that the parking capacity on site is adequate to accommodate the number of people in the development • Ensure that the facility is designed in such a way as to limit any noise pollution outside its site, as well as noise pollution that can reach the commercial and other sections surrounding the site • Ensure that the facility and its surrounding developments have adequate security and that it is visible to any onlooker as a preventative measure • Ensure that no people are allowed to sleep on the roads leading to the facility as well as on site itself • The proposed development is anticipated to be high-density. The height of the development may obstruct some of the residents' exposure to the sun and certain views. There are however no mitigation measures that can be taken to avoid such an impact
		3	3	5	5	4	1	2	132	After mitigations (M)	

Potential impact description	Phase	Environmental Significance before and after mitigations							Impact rating	Significance rating	Proposed mitigation measures Management and mitigation measures
		Consequence			Likelihood						
		Severity	*Spatial*	*Duration*	*Frequency activity*	*Frequency impact*	*Legal issues*	*Detection*			
Stimulation of the local and regional economy through the multiplier effect	Operational phase	3	4	4	5	5	5	4	209	Before mitigations (H)	• Prioritise the procurement of goods and services from the local SMMEs and particularly SMMEs located in the study area
		4	4	4	5	5	5	4	228	After mitigations (H)	
Creation of sustainable employment opportunities	Operational phase	4	4	4	5	5	5	2	204	Before mitigation (H)	• Establish relationships with local businesses/SMMEs and purchase building material from local businesses to increase business activity and profits which will provide an incentive for businesses to hire more workers • Establish skills desks in Unitas Park Extension 16 to identify the labour force with the correct skills that could be employed immediately or could be trained for specific positions during operation. • Create employment opportunities for labours with different skills set and incorporate labour intensive components during the construction phase which will provide employment opportunities and the inclusion of low-skilled labour.
		4	4	4	5	5	5	2	204	After mitigations (M)	
Impact on household income	Operational phase	3	4	4	3	4	5	2	154	Before mitigation (M)	• The labourers employed during the operational phase must be given a contract that stipulates the required hours of work as well as the pay rate/wage or salary amount. • The contract of employment should stipulate the duration of employment (temporal or permanent) during the operational phase of the proposed development. • The salary must be competitive or adhere to the minimum wage standards.
		4	4	4	3	4	5	2	168	After mitigations (M)	

8. CONCLUSION

The proposed mixed high-density development is anticipated to yield more positive socio-economic impacts than negative. The proposed development aligns with national, provincial and local policies and strategies in the promotion of broader objectives and goals for spatial integration, inclusivity and the creation of employment opportunities and the stimulation of economic growth. Employment creation, the simulation of the local and regional economy as well as access to household income are key benefits that the proposed development is anticipated to yield. The utilisation of the site for a mixed high-density development is anticipated to yield positive economic and social benefits than its current use, as it is currently vacant. Overall, the anticipated positive impacts outweigh the anticipated negative impacts more so with mitigative measures put in place to enhance the positive impacts as well as to minimise the negative impacts. The following are some of the key mitigative measures recommended:

- Prioritise employment of construction workers from nearby areas and ensuring the transfer skills
- Create strict controls on the roads leading to the facility and prevent people from parking on the side of the roads, driveways, and other public areas that may inconvenience other road users and cause traffic congestion
- Vehicles should be towed away if parked in the non-designated areas and such practices should be made abundantly clear among the construction workers and construction managers to avoid unnecessary conflicts
- The construction of the development should take place during the day where most of the residents in the area are anticipated to be at school or work or occupied by other activities. No construction activities are anticipated to take place during the day
- Utilise domestically produced building material and equipment and prioritise the procurement of goods and services from the local SMMEs
- Prioritise local people for employment opportunities
- Provide contracts that stipulates the required hours of work as well as the pay rate/wage or salary amount for labour during construction and operational phase
- Employment contrasts should stipulate the duration of employment (temporal or permanent) depending on the phase of the development and the salary must be competitive or adhere to the minimum wage standards
- Ensure adequate parking on site to accommodate the number of people in the development.

Table 8.1: Summary of potential impact significance before and after mitigations

Impact	Status before mitigations	Significance after mitigations
Change in the sense of place	Construction phase: Moderate (63) Operational phase: Moderate (132)	Construction phase: Moderate (56) Operational phase: Moderate (132)
Residential shifts due to residential development	Construction phase: Moderate (90) Operational phase: Moderate (80)	Construction phase: Medium (80) Operational phase: Medium (80)
Stimulation of the local and regional economy	Construction phase: High (209) Operational phase: High (209)	Construction phase: High (228) Operational phase: High (228)
Creation of temporal and permanent employment opportunities	Construction phase: High (192) Operational phase: Moderate (204)	Construction phase: (228) Operational phase: (204)
Impact on household income	Construction phase: High (208) Operational phase: Moderate (154)	Construction phase: (208) Operational phase: Moderate (168)

Impact	Status before mitigations	Significance after mitigations
Service delivery and infrastructure upgrades	Operational phase: Moderate (156)	Operational phase: Moderate (156)

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APPENDIX D

Public Participation Process Documents

GCS

Water & Environmental Consultants

APPENDIX D1

Current Interested and Affected Parties (IAP) Database

GCS
Water & Environmental Consultants

Title	Last name	First name	Organisation	Position
Landowners and lawful occupiers (Directly Affected)				
Mr	Daniel	Molokomme	Department of Human Settlements (DHS) - Gauteng Provincial Government	Department Representative
Authorities				
			Department of Environment, Forestry and Fisheries (DEFF)	
Ms	Masina	Litsoane	Department of Environment, Forestry and Fisheries (DEFF)	
	Administration		Department of Environment, Forestry and Fisheries (DEFF)	Administration and Support
			Department of Human Settlements, Water and Sanitation	
Mr	Khathutshelo	Mudau	Department of Human Settlements, Water and Sanitation	Environmental Officer - Sedibeng Region
			Gauteng Department of Agriculture and Rural Development	
Mr	Dan	Motaung	Gauteng Department of Agriculture and Rural Development	Case Officer
Ms	Boniswa	Belot	Gauteng Department of Agriculture and Rural Development	Deputy Director: Strategic Administration Support
Ms	Malesela	Sehona	Gauteng Department of Agriculture and Rural Development	Administration and Support
			Department of Roads and Transport	
			Department of Roads and Transport	Environmental Officer
			Sedibeng District Municipality	
Mr	Stanley	Khanyile	Sedibeng District Municipality	Municipal Manager
	Maisaka	Mtshali	Sedibeng District Municipality	MM - Personal Assistant
	Administration		Sedibeng District Municipality	
Ms	Mapuleng	Mateane	Sedibeng District Municipality - Office of the Executive Mayor	Personal Assistant
Mr	Sipho	Nhlengethwa	Sedibeng District Municipality - Office of the Executive Mayor	Assistant Mananger: Ntirhisano Service Delivery Programmes
	Archie	Mokonane	Sedibeng District Municipality - Office of the Executive Mayor	Director
	Motshedisi	Motsoari	Sedibeng District Municipality - Transport Infrastructure, Development and Environment	Office Manager
Ms	Betty	Peterson	Sedibeng District Municipality - Municipal Manager	Personal Assistant
	Refilwe	Mhlwatika	Sedibeng District Municipality - Municipal Manager	Director - Legal
	Marriam	Mosiane	Sedibeng District Municipality - Spatial Development and Economic Development	Office Manager
	Khulu	Mbongo	Sedibeng District Municipality - Spatial Development and Economic Development	Director: Local Economic Development
	Bassey	Ramagaga	Sedibeng District Municipality - Spatial Development and Economic Development	Manager: IDP (Intergrated Development Planning)
	Sello	Pitso	Sedibeng District Municipality - Spatial Development and Economic Development	Manager: Housing
	Kate	Plank	Sedibeng District Municipality - Office of the Chief Whip of Council	Community Liaison
			Emfuleni Local Municipality	
Ms	Elize	Aucamp	Emfuleni Local Municipality	Ward Councillor
Ms	Mmatshepo	Mathumbo	Emfuleni Local Municipality	Executive Secretary to the Speaker
Mr	Lucky	Leseane	Emfuleni Local Municipality	Municipal Manager
	Amanda	van Onselen	Emfuleni Local Municipality	MM - Personal Assistant
Mr	Lekgotla	Motapane	Emfuleni Local Municipality	Town Planning Manager
	Xoli	Madiba	Emfuleni Local Municipality	Manager: Health, Social Development and Environment
			Emfuleni Local Municipality	Assistant Manager:Environment
	Moratuwa	Mthimkhulu	Emfuleni Local Municipality	
	Hennie	Pelser	Emfuleni Local Municipality	
	Anton	Mojapelo	Emfuleni Local Municipality	
	Administration		Emfuleni Local Municipality	
			Emfuleni Local Municipality - Social Development	
Cllr	Nomvula	Thulo	Emfuleni Local Municipality - Mayorial Committee	MMC: Environmental Management and Planning
Cllr	Dimakatso Maria	Malisa	Emfuleni Local Municipality - Mayorial Committee	MMC: Health and Social Development
Cllr	Khethiwe	Ntombela	Emfuleni Local Municipality - Mayorial Committee	MMC: Infrastructure Planning, Development and Asset Management (IPAM)
Cllr	Mokete Edwin	Kele	Emfuleni Local Municipality - Mayorial Committee	MMC: Human Settlement
Cllr	Pius	Maseko	Emfuleni Local Municipality - Mayorial Committee	MMC: Agriculture, Local Economic Development, Development Planning and Tourism
Cllr	Thembile Samson	Nquba	Emfuleni Local Municipality - Mayorial Committee	MMC: Basic Services
			South African Heritage Resources Agency (SAHRA)	
Ms	Khumalo	Nokukhanya	South African Heritage Resources Agency (SAHRA)	
Ms	Natasha	Higgitt	South African Heritage Resources Agency (SAHRA)	
	Leomile	Mofutsanyana	South African Heritage Resources Agency (SAHRA)	
Business Forum				
Mr	Paul	Mosedi	Sedibeng Business Forum	
NGOs/ CBOs/ Parastatals				
Libraries (Public Places for review of documents)				
			Zone 7 Library	
			Vereeniging Public Library	
			Vereeniging Public Library	Senior Librarian
			Vereeniging Public Library	Principal Librarian
			Vanderbijlpark Public Library	
			Unit 13 Community Library	
			Sebokeng Public Library	
Media				

APPENDIX D2

Background Information Document (BID)

GCS

Water & Environmental Consultants

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Background Information Document

Unitas Park, Gauteng

January 2021

Phumaf Engineering Solutions

GCS Project Number: 19.0921

Client Reference: Unitas Park

PHUMAF
ENGINEERING SOLUTIONS THAT TOUCH PEOPLE'S LIVES

ENVIRONMENTAL ASSESSMENT PRACTITIONER: GCS (PTY) LTD

GCS Water and Environment (Pty) Ltd (GCS) is a fully integrated water, environmental, and earth science consulting services company based in the Republic of South Africa. GCS provides a professional consulting service in the fields of environmental, water and earth sciences. GCS has a team of highly trained staff with considerable experience in the fields of environmental and water science.

GCS WILL ACT AS THE INDEPENDENT ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP), AS WELL AS THE PUBLIC PARTICIPATION PRACTITIONER FOR THIS ENVIRONMENTAL AUTHORISATION PROCESSES AND PPP.

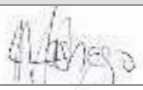
Background Information Document:
Unitas Park, Gauteng

Version – 01

January 2021

Phumaf Engineering Solutions

DOCUMENT ISSUE STATUS

Document Issue	V01		
GCS Reference Number	19.0921		
Title	Background Information Document: Unitas Park, Gauteng		
	Name	**Signature**	**Date**
Prepared by:	Lehlogonolo Mashego		December 2020
Reviewed by:	Gerda Bothma		January 2021
Approved by:	Gerda Bothma		January 2021

INTRODUCTION

The purpose of this Background Information Document (BID) is to provide all Interested and Affected Parties (I&APs) with information in respect of the Application for Environmental Authorisation.

In addition to the aforesaid, the BID aims to:

- Introduce and explain the Scoping and Environmental Impact Assessment (S&EIA) Process, as well as other related parallel environmental processes;
- Introduce and explain the Public Participation Process (PPP), which is prescribed by the *National Environmental Management Act*, 1998 (Act No. 107 of 1998) (NEMA);
- Invite all I&APs to comment on:
  - The ecological, physical, socio- economic aspects of the project as well as any other issues of concern;
  - The proposed public participation and environmental assessment process, and
  - Any other suggestions which might be of relevance.

ABBREVIATIONS	
BID	Background Information Document
CRR	Comments and Response Report
DEIAR	Draft Environmental Impact Assessment Report
DHWS	Department Human Settlements, Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMP	Environmental Management Plan
FEIAR	Final Environmental Impact Assessment Report
GCS	GCS Water and Environmental Consultants (Pty) Ltd
GDARD	Gauteng Department of Agriculture and Rural Development
GRLRP	Gauteng Rapid Land Release Programme
I&AP	Interested and Affected Party
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NWA	National Water Act, 1998 (Act 36 of 1998)
Phumaf	Phumaf Holdings (Pty) Ltd
PPP	Public Participation Process
S&EIA	Scoping and Environmental Impact Assessment

PUBLIC PARTICIPATION – CONTACT DETAILS

Contact Person(s): Lehlogonolo Mashego
011 803 5726
011 803 5232

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Postal Address: PO Box 2597
Rivonia
Johannesburg
2128

WHAT IS AN S&EIA and EMP AND WHAT DO THEY CONTAIN?

The *National Environmental Management Act*, 1998 (Act 107 of 1998) (NEMA) prescribes the processes to be followed when compiling the Scoping and Environmental Impact Assessment (S&EIA) and the Environmental Management Programme (EMP), in respect of the NEMA listed activities, which forms the legal basis of this authorisation.

The process aims to ensure that all relevant factors are considered when evaluating the potential environmental impacts of a project, as well as developing appropriate environmental management measures to mitigate these impacts. The purpose of the S&EIA is to assess the current environment in which a proposed activity will take place and assess all potential impacts in terms of its extent, duration, intensity and significance relating to the specific activity. The EMP describes the goals and objectives for environmental management to minimise or eliminate the potential environmental impacts; the action plans to bring effect to those goals and objectives; the procedures to be implemented to ensure integration of environmental management into the daily operations; as well as a plan to raise awareness of employees and the surrounding community with regards to environmental management.

PROJECT BACKGROUND

The Department of Human Settlements (DHS) aims at fast tracking the release of serviced stands form State owned land to qualifying beneficiaries through the Gauteng Rapid Land Release Programme (GRLRP). Phumaf Holdings (Pty) Ltd (Phumaf) was appointed as the responsible Managing Engineers to undertake all preliminary planning, planning, design and construction management to enable the release of the identified stands. GCS Water and Environmental Consultants (Pty) Ltd (GCS) has been sub-contracted by Phumaf to undertake the environmental authorisation (EA) processes and associated Public Participation Processes (PPP) required for the stands in order for compliance to the National Environmental Management Act (NEMA) (Act 107 of 1998, as amended) and/or Supporting Environmental Management Acts (SEMA's). This background information document (BID) provides the background details for the proposed development, associated exercises undertaken in order to comply with the required authorisation process, and acts as a baseline document for all interested and affected parties (I&APs).

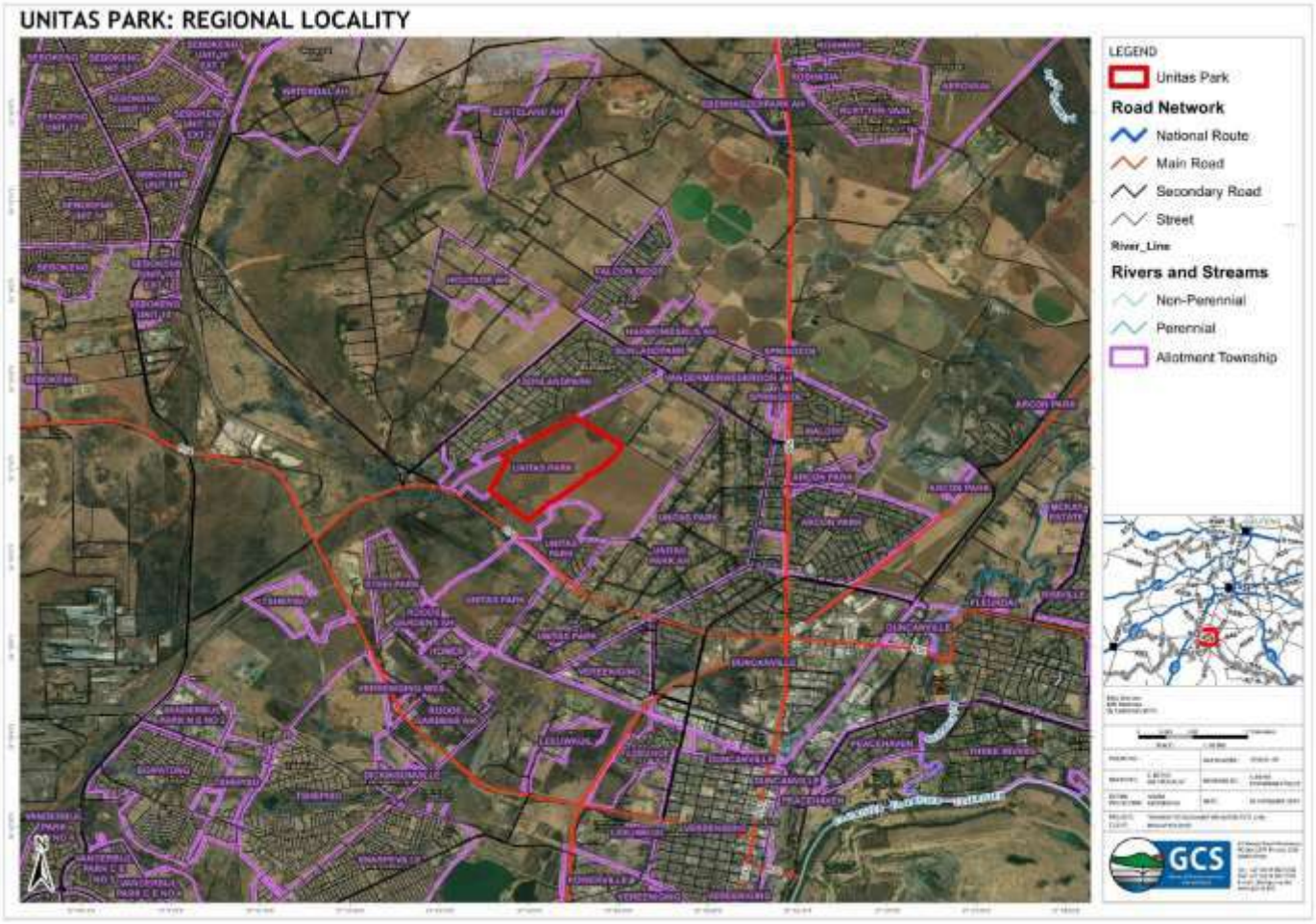

Figure 1: Site Locality Map and Regional Boundaries

PROJECT DESCRIPTION

The site is planned to have a township layout, with 2680 erven. This was approved; however, not proclaimed or registered due to constraints with the waste-water treatment capacity, and electricity upgrades required. The release strategy is for a proposed 7 250 units comprising of mixed high density and to achieve the proposed yield, the existing layout will have to be withdrawn and a new application submitted.

The area is located within Unitas Park, Vereeniging within the Sedibeng District Municipality and Emfuleni Local Municipality, 6 km north-west of the Vereeniging central business district (CBD), sandwiched between roads R54 and R42. The R82 is runs north-south approximately 2.3km to the east of the site. The N1 is about 11km to the west of the site and R54 runs through the site. Sebokeng lies to the north west of the site, with Vereeniging to the south east. The closest towns include Homer (3.1 km from the proposed site), Roods Gardens (3.3 km from the proposed site), Steelpark (4.9 km from the proposed site), Vereeniging (8.8 km from the proposed site) and Houtkop (9.6 km from the proposed site). Access to the site is via Skippie Botha and Langraad Roads and the predominant adjacent land use is residential and agricultural.

The area is currently zoned as Farmland on a dolomitic zone in terms of Geophysics. The site is approximately 149 hectares in extent and is owned by the Gauteng Provincial Government. The proposed site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of a wetland or some surface water on the site, as well as to the south east of the site. A drainage line appears to run from the site towards Houtkop Road to the south west, where the surface water drains under the road and continues to flow into a National Freshwater Ecosystem Protection Area (NFEPA). The buffer of the NFEPA includes a portion of the south west of the site.

Figure 2: Unitas Park Locality Map at 1:7 500

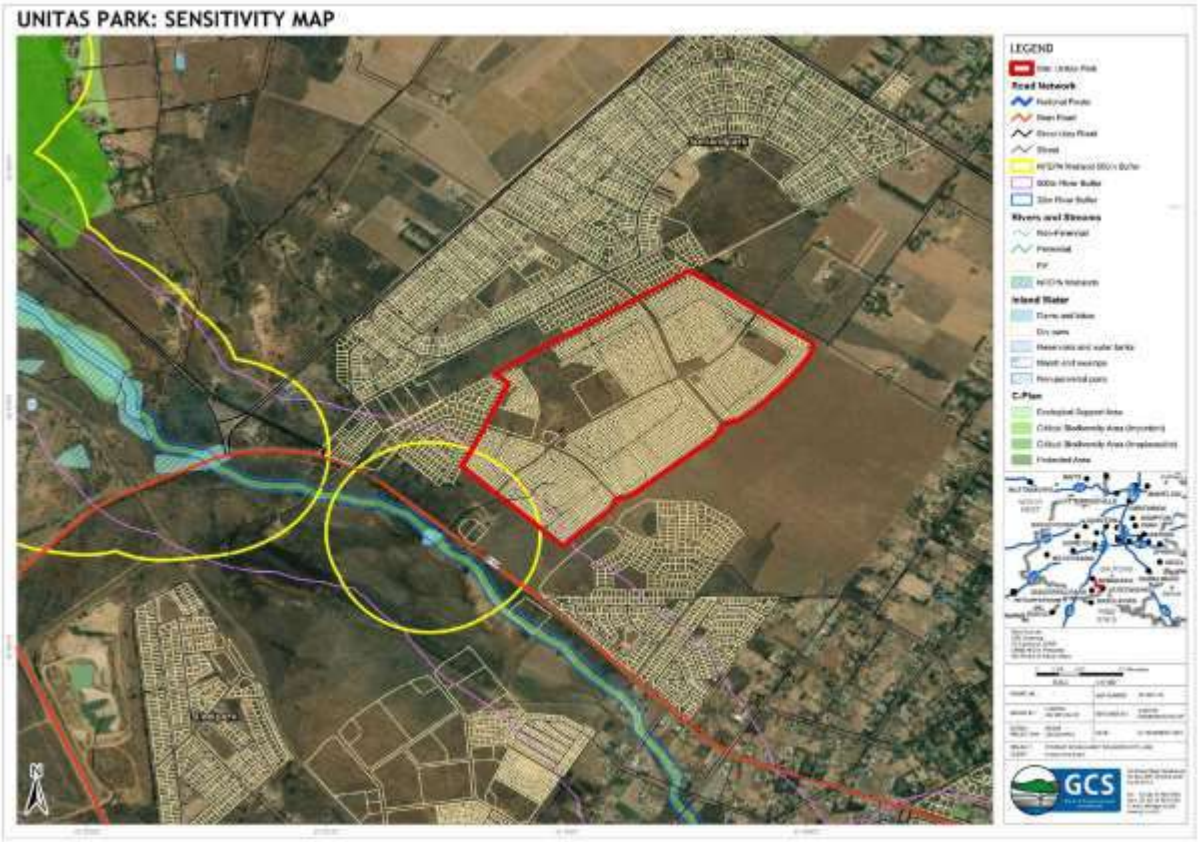

Figure 3: Unitas Park Sensitivity Map

LOCALITY

Province:	Gauteng
District:	Sedibeng District Municipality
Local Municipality:	Emfuleni Local Municipalities
Extent:	149 hectares
Zoning:	Farmland
Ownership:	Gauteng Provincial Government Deed No. T942/2015
Current Use:	Vacant
Nearest Towns:	Homer, Roods Gardens, Steelpark, Vereeniging and Houtkop
Release Strategy:	Mixed High Density
Farm Portions affected:	225 of Farm Houtkop 594IQ.

PROPOSED SPECIALIST ASSESSMENTS

The following specialist studies are proposed:

- Aquatic ecology and wetland assessment;
- Ecological assessment;
- Soils, land use, land capability assessment;
- Wetland and aquatics;
- Heritage assessment;
- Traffic assessment; and
- Socio-economic assessment.

REGULATORY CONTEXT:

THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) (NEMA)

Section 24(1) of NEMA requires that the potential consequences or impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Where Environmental Impact Assessment has been identified as the instrument to be utilised, an application for EA needs to be submitted. The identified activities are listed under Government Notice (GN) R327, R325 and R324 of the 2014 NEMA Regulations respectively (as amended).

The listed activities (Table 1.1) triggered require an application for an EA in the form of an EIA process.

NATIONAL WATER ACT, 1998 (ACT 36 OF 1998) (NWA)

A Water Use License Application may need to be compiled and submitted to the Department of Human Settlement, Water and Sanitation (DHWS) to ensure the legality of the proposed project's water uses.

The Water Use License Application (if required) will be conducted for the project in parallel with the EIA and EMP process for any activity in terms of Section 21 of the NWA.

Table 1.1: Identified Listed Activities under NEMA

NR	Activity
	Listing Notice 1 (GN R327)
12	*The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs —* *a) within a watercourse;* *b) in front of a development setback; or* *c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.*
25	*The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.*
27	*The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for —* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*
28	*Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:* *(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*
	Listing Notice 2 (GN R325)
15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*
25	*The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.*
	Listing Notice 3 (GN R324)
4	*The development of a road wider than 4 meters with a reserve less than 13.5 meters in* *c) Gauteng within* *(i) A protected area identified in terms of NEMPAA, excluding conservancies;* *(ii) National Protected Area Expansion Strategy Focus Areas;* *(iii) Gauteng Protected Area Expansion Priority Areas;* *(vii) Sites identified as high potential agricultural land in terms of Gauteng Agricultural Potential Atlas;* *(xii) Sites zoned for conservation use or public open space or equivalent zoning.*
12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan, in* *c) Gauteng within* *(iii) On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.*
14	*The development of—* *(ii) infrastructure or structures with a physical footprint of10 square metres or more;* *where such development occurs—* *a) within a watercourse;* *b) in front of a development setback; or* *c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse.* *c) Gauteng* *(i) A protected area identified in terms of NEMPAA, excluding conservancies;* *(ii) National Protected Area Expansion Strategy Focus Areas;* *(iii) Gauteng Protected Area Expansion Priority Areas;* *(x) Sites zoned for conservation use or public open space or equivalent zoning.*
15	*The transformation of land bigger than 1000 square metres in size to residential, commercial, retail, industrial or institutional used where such land was zoned open space, conservation or had an equivalent zoning, on or after 02 August 2010.* *b) Gauteng* *(i) All areas.*

PUBLIC PARTICIPATION PROCESS

Public involvement is an essential part of any environmental assessment / authorisation process. You have been identified as an I&AP who may want to receive information regarding the above-mentioned project. You will be given the opportunity to provide your input into the EA process and to receive information. All comments will be recorded and presented to the project team and regulatory authorities. You will receive feedback on how your comments have been taken into account and the outcome of the assessment.

I&APs include any person who will be directly or indirectly involved and/or affected by the project. To be recognized as an I&AP one must register with GCS to be added to the stakeholder database for the project. You may communicate via fax, email or telephone to obtain further information or comment on the proposed project. All registered I&APs will be kept informed of the decision taken by the GDARD.

Proposed steps in the process are as follows:

Step 1: Notify I&APs and identify issues	• Notify I&APs of the project proposal; • Identify any issues/concerns of I&APs; • Provide I&APs with a BID on the project, including a locality map and a Registration and Comment Sheet; and • I&APS are required to register their interest in the project to receive further project information.
Step 2: I&AP review of Draft Scoping Report (DSR)	• Issues and concerns raised by I&APs are contained in a CRR; • The DSR is released for a **30-day** commenting period; and • All registered I&APs on the project database are notified in writing of the opportunity to comment.
To assist I&APs with their understanding of the project, a public meeting or consultation in a similar manner, to which all I&APs are invited or will be involved, will be held during the review period. Copies of the report will be made available on request from GCS.	
Step 3: Final Scoping Report (FSR)	• Comments received from I&APs during the review process are considered in the compilation of the FSR; and • The FSR is submitted to the Competent Authority.
Step 4: Draft EIR and EMP for I&AP review	• Compilation and release of a Draft EIR for a **30-day** review period.
Step 5: Final EIR and Draft EMPR	• The Final EIR, including the CRR and EMP will be compiled for submission to the Competent Authority for decision making.
Step 6: Environmental Authorisation and Appeal Period	• All registered I&APs will be notified in writing of the decision by the Competent Authority regarding the authorisation, being positive or negative for the project. All I&APs will also be notified of the appeal period, as well as the manner of appeal.
Public Notification	A major part of the PPP is to notify members of the public of the proposed activities, particularly those who may be directly or indirectly affected by the proposed project. This will be achieved via the following means: • The placement of an advertisement in a regional newspaper; • Notices in English will be placed at the site; • Distribution of BIDs to landowners and occupiers of land adjacent to the proposed prospecting area and to I&APs on request; and • Local authorities will be notified in writing and automatically registered as I&APs.
How to comment	• Should you wish to register as an I&AP in order to be kept informed, please complete the registration form on the overleaf and submit to GCS via fax, post or email. • Any further enquiries can be directed to GCS telephonically, or via fax or email. • It is important that you provide your contact details so that we can respond to your comments or questions.
Kindly note that should you require any other party to be contacted, please provide their contact details as well.	

Phumaf Holdings (Pty) Ltd
Unitas Park, Gauteng
Background Information Document

I&AP Comment and Registration Form
GCS Ref No: 19.0921

Name:		Surname:	
Organisation / interest:			
Postal / Residential address			
	Area:		Code:
Contact details	Tel:	( )	
	Fax:	( )	
	Mobile:	( )	
	Email:		

Please mark with an **X** to indicate whether you would like to participate in the process:

Yes, I would like to participate in this process and receive periodic updates	
No, I am not interested in participating and do not wish to receive further information	

Preferred method of communication	Email		Fax		Post	
Date commented	(DD / MM / YYYY)					

Please indicate any issues, comments and concerns with regards to the proposed project

Please indicate in which aspects you would require more information

Please indicate the contact details of any other I&APs whom you think should be contacted

Name:		Surname:	
Tel:	( )	Fax:	( )
Mobile:	( )		
Email:			

In order to be registered as an I&AP for this project, fax, mail, or e-mail the completed registration form to Lehlogonolo Mashego at:
Tel: (011) 803 5726
Fax: (011) 803 5232
Email: lehlo@gcs-sa.biz
Post: PO Box 2597, Rivonia, 2128

NOTES:

APPENDIX D3

Pre-Application Correspondance

GCS

Water & Environmental Consultants

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Meeting Minutes

Subject	Pre-application Meeting for Gauteng Rapid Land Release Programme (GRLRP) – Unitas Park – Extension 16 and Evaton West – Project F, G, H and I, Gauteng Province
Date	19 August 2020
Time	10h00
Attendance	Dan Motaung (DM) (Gauteng Department of Agriculture and Rural Development) Boitshoko Buthelezi (BB) (Phumaf Holdings) Ngoni Gandiwa (NG) (Phumaf Holdings Sikelela Mnguni (SM) (Phumaf Holdings) Gerda Bothma (GB) – GCS Water & Environmental Consultants Lehlogonolo Mashego (LM) – GCS Water & Environmental Consultants
Apologies	None

1. Introduction and Welcome

- GB welcomed all present and introduced the meeting as the Pre-application Meeting.
- A disclaimer was expressed of the session being recorded and that the meeting outcomes will further be shared (see Appendix 1).
- All attendees were requested to introduce themselves for the purpose of all parties being acquainted with the stakeholders involved and present.

2. Attendance Register and Apologies

- No apologies were received.

3. Discussion

- *Unitas Park – Extension 16*
    - Dan Motaung (DM) indicated that it is critical to include a Traffic Impact Assessment (TIA) and Geotechnical Assessment (GA) in addition to the proposed assessments. These assessments are also to be submitted to the department. It was since confirmed in the meeting that the assessments have been covered for the respective sites under the Engineering Assessments conducted and this will further be incorporated into the environmental application accordingly.
    - A great issue faced within Gauteng Province are the issues associated with waste (solid and liquid) and this is to be accounted for in the proposed developments. Maintenance and the available capacity needs to evidently allow for connections and

efficient connections into the municipal grid and to be able to handle the increase capacity.

  - Ngoni Gandiwa (NG) indicated that the current proposal especially regarding this site is to make provision for a package plant to deal with the sewage issue and the expected flow will be large. Any associated impacts relevant to the Environmental Impact Assessment (EIA) are still to be verified at this stage.

- *Evaton West – Project F*
  - Include the applicable TIA and GA – DM
  - DM indicated that considering that there is an alleged drainage line traversing the site (natural drainage line) this will require a Storm Water Management Plan (SWMP). This needs to be submitted and drafted by a qualified Engineer or professional. The impacts associated with lack of storm water are vast in lower income communities, this is to be curbed and accounted for accordingly.
- *Evaton West – Project G*
  - Include the applicable TIA and GA - DM
  - DM noted that the Critical Biodiversity Areas (CBA) data is not to be omitted without further verifying with a qualifying Specialist. The site itself is evidently degraded and transformed and would not necessarily warrant any environmental protection. To this nature a Land-use application/enquiry detailing the site observations and sensitivities must be submitted to have the department confirm and accept the approach.
- *Evaton West – Project H*
  - Include the applicable TIA and GA - DM
  - DM noted again that the CBA data is not to be omitted without further verifying with a qualifying Specialist. The site itself is evidently degraded and transformed and would not necessarily warrant any environmental protection. To this nature a Land-use application/enquiry detailing the site observations and sensitivities must be submitted to have the department confirm and accept the approach.
- *Evaton West – Project I*
  - Include the applicable TIA and GA – DM
  - DM indicated that considering that there is an alleged drainage line traversing the site (natural drainage line) this will require a SWMP. DM indicated that the SWMP submitted to the municipality and to the department serve different purposes and this needs to be taken into consideration when submitting the respective reports.
- *Public Participation*
  - The intent of carrying out the public participation process (PPP) is in line with Chapter 6 of the National Environmental Management Act, 1998 (NEMA) (Act No. 107 of 1998) as amended and the Covid-19 response guidelines as issues on 05 June 2020. We have

since moved to Level 2 and as such, await on the updated guidelines to inform any changes to the way the PPP will be conducted.

- The proposed PPP will include virtual activities as far as possible.
- The proximity of the Evaton West sites will potentially work in the collectives' favour if a combined PPP is conducted and a separate process initiated for the Unitas Park site.
- Should a combined approach be followed then all interested and affected parties (I&APs) are to be included and ensure that the message gets through to all I&APs. This needs to be managed carefully whilst ensuring that it is efficiently carried out in accordance with the NEMA regulations. - DM
- Suggestion with regards to project announcement is not to start to early as the community's response, cannot be pre-empted should this be done. – DM

4. General

- Where there are wetlands and areas of sensitivity on site, the necessary buffer zones are to be applied. These need to be included in the Specialist Assessments – DM.
- Low-cost housing generally does not account for spacing and greening or functional open areas. This is a recommendation was provided by DM and it was since confirmed in the meeting that this is an added component proposed to be included in support of the developments. – DM

5. Way Forward and Closure

Action	Role	Date
Internal project team to regroup and pave the response from the meeting way	**GCS + Phumaf**	**20 August 2020**
Meeting minutes to be distributed accordingly	**GCS**	**24 August 2020**
Submit PPP plan for approval	**GCS**	**28 August 2020**
Combination approach of PPP must be submitted to department for approval	**GCS**	**28 August 2020**
Submit a Land-use Application/Enquiry	**GCS**	**28 August 2020**

Meeting was closed off at 11:10, the meeting outcomes will be shared accordingly, so comments and input may be shared for three (3) days from the date of receipt.

Appendix 1 – Meeting Recording

Link - https://web.microsoftstream.com/video/854ec04d-80a8-4e17-94a8-4dc21707298d

From:	**Lehlo Mashego** <Lehlo@gcs-sa.biz>
To:	**MOTAUNG, DAN (GDARD)** <Dan.Motaung@gauteng.gov.za>
CC:	**Gerda Bothma** <gerdab@gcs-sa.biz>
Subject:	RE: Pre-Application Meeting Minutes
Date:	01.09.2020 12:01:26 (+0200)

Good day Dan

Noted with thanks.

Kind regards
Lehlogonolo Mashego

From: MOTAUNG, DAN (GDARD) <Dan.Motaung@gauteng.gov.za>
Sent: Monday, 31 August 2020 11:14 AM
To: Lehlo Mashego <lehlo@gcs-sa.biz>
Cc: Gerda Bothma <gerdab@gcs-sa.biz>
Subject: RE: Pre-Application Meeting Minutes

Good morning,

I hereby confirm that the contents of the minutes are a true reflection of the meeting held on 19 August 2020.

Regards

Dan

From: Lehlo Mashego <lehlo@gcs-sa.biz>
Sent: Monday, 31 August 2020 09:56
To: MOTAUNG, DAN (GDARD) <Dan.Motaung@gauteng.gov.za>
Cc: Gerda Bothma <gerdab@gcs-sa.biz>
Subject: Pre-Application Meeting Minutes

Good morning Dan

Following the pre-application meeting held on Wednesday, 19 August 2020, please see attached are the meeting outcomes for your comment and input.

Kindly have the comments sent in by Thursday midday and feel free to contact us should you need any additional information.

Kind regards
Lehlogonolo Mashego

Lehlo Mashego
Environmental Liaison Officer

Tel +27 (0) 11 803 5726
Fax +27 (0) 11 803 5745
Cell
Web www.gcs-sa.biz
Address 63 Wessel Road, Rivonia,

Established in 1987

Johannesburg,
South Africa

Consider the environment before printing this email.

APPENDIX E

Draft Environmental Management Plan Report (EMPr)

GCS
Water & Environmental Consultants

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Draft Environmental Management Plan

Unitas Park – Extension 16

Version - Draft for Authority and Public Comment

January 2021

Phumaf Holdings (Pty) Ltd

GCS Project Number: 19.0921

Client Reference: 034RFP/7001/2019

GDARD Reference: 002/20-21/E0042

Draft Environmental Management Plan
Unitas Park – Extension 16

Version – Draft for Authority and Public Review

January 2021

DOCUMENT ISSUE STATUS

Report Issue	Draft for Authority and Public Review		
GCS Reference Number	19.0921		
Client Reference	034RFP/7001/2019		
GDARD Reference	002/20-21/E0042		
Title	Draft Environmental Management Plan (EMP) for Unitas Park Extension 16, Gauteng Province		
	Name	**Signature**	**Date**
Author	Lehlogonolo Mashego		January 2021
Document Reviewer	Gerda Bothma		January 2021

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1 OVERVIEW

1.1 Project Background

The Gauteng Rapid Land Release Programme (GRLRP) aims at fast tracking the release of serviced stands form State owned land to qualifying beneficiaries. The proposed site is located within Unitas Park, Vereeniging within the Sedibeng District Municipality and Emfuleni Local Municipality, 6 km north-west of the Vereeniging central business district (CBD), sandwiched between roads R54 and R42 (see **Figure 2-3** and **Figure 2-4).**

GCS Water and Environmental Consultants (Pty) Ltd (GCS) has developed this Environmental Management Plan (EMP) report in terms of the National Environmental Management Act (NEMA) (Act 107 of 1998, as amended) were the application is for an EA. These regulations help guide management actions against the identified potential impacts through the construction, operation and decommissioning phases. Additionally, the EMP sets actions that enhance the project and its implementation through the recommended mitigation measures and as such this report is presented.

1.2 Purpose of the EMPr

This EMP has been developed in line with requirements under the NEMA Environmental Impact Assessment (EIA) Regulations to guide environmental management action throughout the project lifespan and ensure that any adverse environmental impacts that result from the activities are adequately managed and mitigated for. Section 19 of the NEMA EIA Regulations of 2017, as amended (GN R326 in GG 40772, April 2017), requires that the Applicant submit an Environmental Management Programme (EMPr) to the Competent Authority. This EMPr will form part of the Environmental Authorisation for Unitas Park – Extension 16, once approved.

Furthermore, the EMPr is an important environmental management tool, developed in line with best practices under NEMA and other environmental legislation, and informed by the EAP's professional experience as well as any relevant specialist information. The EMPr provides management guidance for activities undertaken at the development site. If correctly followed, the EMPr ensures that any adverse environmental impacts which could result from the development are adequately managed and mitigated for.

The EMP outlines all environmental management and monitoring actions, set to a timeline and with specific assigned responsibilities. This EMP is legally binding and any person who contravenes the provisions herein is liable for imprisonment or a fine. This document should be viewed as "live" and thus, should be updated as and when necessary during the rehabilitation project. The objectives of the EMP are as follows:

- Ensure compliance with the relevant legislation;
- Verify environmental performance through information on impacts as they occur;
- Respond to changes in project implementation or unforeseen events; and

- Provide feedback on for continual improvement in environmental performance.

It is understood the all-contract documentation related to the construction, operation and decommissioning (if required) of the proposed development will include the conditions of this EMPr. It is important to note that the contract obligations must include the recording of any complaints on the project in the environmental register. Further, it is incumbent on the ECO to keep an accurate audit trail showing compliance with the EMPr during construction phase.

1.3 Content of the EMPr

According to Appendix 4 of the NEMA EIA Regulations of 2014, as amended (GN 326 in GG 40772, April 2017), the EMPr for a project must include certain information. **Table 1.1** below describes how this report meets those requirements.

Table 1.1: Contents of this Environmental Management Programme (EMPr)

REQUIREMENT	SECTION IN THIS REPORT
Details of— (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.4
A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 2.3
A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Section 2.2
A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post closure; and (v) Where relevant, operation activities;	Section 4
A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated above will be achieved, and must, where applicable, include actions to— (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	Section 4

(ii) Comply with any prescribed environmental management standards or practices; (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	
The method of monitoring the implementation of the impact management actions;	Section 3
The frequency of monitoring the implementation of the impact management actions;	Section 3
An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 3
The time periods within which the impact management actions must be implemented;	Section 4
The mechanism for monitoring compliance with the impact management actions;	Section 3
A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 3
An environmental awareness plan describing the manner in which— (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 4
Any specific information that may be required by the competent authority.	NA

1.4 Environmental Assessment Practitioner (EAP)

GCS have been appointed by Phumaf Holdings (Pty) Ltd (Phumaf) as the independent environmental assessment practitioners (EAPs), to oversee the development of this EMP.

The details of the applicant are provided in **Table 1.2.**

Table 1.2: Name and address of applicant.

ITEM	DETAILS
Company Name	Department of Human Settlement (DHS) – Provincial
Company Representative	Daniel Molokomme
Contact Persons	Daniel Molokomme
Telephone No.	016 440 7628
Facsimile No.	016 950 5050
E-mail Address	Daniel.Molokomme@gauteng.gov.za
Postal Address	Private Bag X79, Marshalltown, 2001

GCS Water and Environment (Pty) Ltd (GCS) have been appointed as the independent Environmental Assessment Practitioners (EAP) to undertake the environmental processes required to obtain approval for the proposed listed activities, as requested by the relevant competent authorities. The contact details of the EAP are provided in **Table 1.3** and the EAP's CV is attached as Appendix A**.**

Table 1.3: Name and address of Environmental Assessment Practitioner (EAP).

ITEM	DETAILS
Company Name	GCS Water and Environment (Pty) Ltd
Company Representative	Gerda Bothma
Telephone No.	+27 (0)11 803 5726
Facsimile No.	+27 (0)11 803 5745
E-mail Address	gerdab@gcs-sa.biz
Postal Address	PO Box 2597, Rivonia, 2128

Gerda Bothma has over 20 years' experience within the environmental and waste management field and strives to deliver custom environmental services to clients. Ms Bothma began her career in the environmental field within the government sector, managing environmental aspects and impacts as well as reviewing environmental assessments with the view of authorizing or declining authorization of the developments.

After six years within the government sector she joined a consulting engineering firm where she was ultimately responsible for the Management of the Environmental Sub-Division. Ms Bothma has experience in project and client management, financial management and the compilation and costing of project proposals and tenders. She has been involved in several engineering projects as the Environmental Assessment Practitioner as well as the Environmental Control Officer during construction, working closely with the Occupational Health and Safety Officer. Ms Bothma has also been involved in projects where waste licensing as well as water use licensing processes formed an integral part of the services offered. Environmental auditing and compliance monitoring of waste disposal sites also forms part of her experience gained. She also has experience in dealing with projects which involve NEC3 Contracts.

1.5 Assumptions and Limitations

This EMPr has been drafted with the acknowledgment of the following assumptions and limitations:

- Information used to guide the development of this EMPr was gained during the site visit, through the Department of Environmental Affairs' (DEA) Online Screening Tool, through specialist input and using the EAP's professional experience in township development. Additionally, three (3) specialist studies were included as part of the assessment;
- The mitigation measures recommended in this EMP document are based on the risks/impacts identified through the scoping assessment, professional knowledge and specialist input. These impacts were identified according to the provided project description and the known receiving environment. Should the scope of the project change, the risks will have to be reassessed and mitigation measures updated accordingly.

1.6 Legal Requirements

The EMP should take cognizance of the relevant South African legislation as well as best practice guidelines. **Table 1-4** below lists the most relevant environmental legislation and guidelines applicable to this project and the EMP.

Table 1-4: Applicable legislation and best practice guidelines to be considered in this EMP.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
The Constitution of the Republic of South Africa (Act 108 of 1996)	The Constitution is the supreme act to which all other acts must speak to and sets out the rights for every citizen of South Africa and aims to address past social injustices. With respect to the environment, Section 24 of the constitution states that: "Everyone has the right: a) To an environment that is not harmful to their health or well-being; b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".	The Applicant must ensure that environmental impacts are avoided, mitigated or managed as far as possible throughout the life cycle of the project.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
National Environmental Management Act (Act 107 of 1998) (NEMA)	Framework law giving effect to the constitutional environmental right. Provides the framework for regulatory tools in respect of environmental impacts. Section 24 of NEMA regulates environmental authorisations. Section 28(1) states that "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".	Residential developments outside an urban area where the total land to be developed is larger than 1 ha requires Environmental Authorisation through a Basic Assessment process. The Applicant must ensure that environmental impacts are avoided, mitigated or managed as far as possible throughout the life cycle of the project.
National Environmental Management: Waste Act (Act 59 of 2008) (NEM:WA)	Regulates inter alia the duty of care, management, transport and disposal of waste. Section 16(1) of the NEM:WA provides that: "A holder of waste must, within the holder's power, take all reasonable measures to – a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated; b) reduce, re-use, recycle and recover waste; c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts; e) prevent any employee or any person under his or her supervision from contravening this Act; and f) prevent the waste from being used for an unauthorised purpose." The NEM:WA also provides for a licensing regime specific to waste management activities.	While no Waste Management Licence will be required for this development, the Applicant must ensure that waste is appropriately managed throughout the life cycle of the project.
National Environmental Management: Air Quality Act (Act 39 of 2004) (NEM:AQA)	Regulates activities which may have a detrimental effect on ambient air quality including certain processes and dust generating activities.	An Air Emissions Licence will not be required, however, duty of care should be employed during construction to minimise air pollution as far as possible.
National Environmental	Regulates the protection of biodiversity and the management of invasive species. Section 73	Should a threatened or protected species be

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
Management: Biodiversity Act (Act 10 of 2004) (NEM:BA)	speaks to duty of care with respect to listed invasive species and states that "A person who is the owner of land on which a listed invasive species occurs must notify any relevant competent authority, in writing, of the listed invasive species occurring on that land, take steps to control and eradicate the listed invasive species and to prevent it from spreading and take all the required steps to prevent or minimise harm to biodiversity."	discovered on the site, a permit will be required to remove or relocate the specimen. It is also the duty of the Applicant to remove invasive species found on site.
Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA)	Regulates the eradication of weeds and invader plants, including those occurring on development sites.	It is the duty of the Applicant to remove invasive species found on site.
National Water Act (Act 36 of 1998) (NWA)	Regulates the protection of the water resources and the use of water. Section 19(1) states that "An owner of land, a person in control of land or a person who occupies or uses the land on which – a) any activity or process is or was performed or undertaken; or b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring." Section 21 outlines various water uses for which authorization is required.	A Water Use Licence will be required for this development and will be undertaken simultaneously.
The National Heritage Resources Act (Act 25 of 1999) (NHRA)	Section 34(1) of NHRA states that "No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority."	A heritage study undertaken on the site confirmed that no heritage features or sites of significance were identified. However, should a heritage artefact be found during development, the chance find procedure should be adhered to.
Spatial Planning and Land Use Management Act (Act 16 of 2013) (SPLUMA)	The aim of SPLUMA is to provide a uniform system of spatial planning and land use management throughout the country. SPLUMA places emphases on the fundamental role municipal planning and municipalities have on effective spatial planning and development. Based on the above use is primarily governed by the applicable land use or zoning scheme and land may not be used in contravention of such a scheme. Despite any issued environmental authorisation, activities can only be executed on land with the appropriate zoning permitting such activities.	The land on which the settlement will be developed must be appropriately rezoned by the Applicant with the assistance of a town planner.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
Carbon Tax Act (Act 15 of 2019)	Regulates and guides the imposition of taxes on businesses or organisations in relation to their carbon emissions.	The Applicant must adhere to the reporting stipulations within the Act.
Occupational Health and Safety Act (Act 85 of 1993) (OHSA) and Regulations for Hazardous Chemical Substances (GN R1179, 1995)	Makes provision to protect the health and safety of employees at work or others affected by activities undertaken by businesses or industries.	The Applicant must adhere to the stipulations within the Act throughout the lifecycle of the activity.
Hazardous Substance Act (Act 15 of 1973)	Regulates substances which may cause injury, ill-health or death of human beings through their toxic, corrosive, irritant, strongly sensitizing or flammable nature.	The Applicant must adhere to the stipulations within the Act throughout the lifecycle of the activity.
Emfuleni Local Municipality Notice: Water and Sanitation By-Laws, 2004	Regulates/manages waste water in the Emfuleni Local Municipality.	The Applicant must adhere to the stipulations within the by-laws throughout the lifecycle of the activity.
Emfuleni Local Municipality Solid Waste Management By-Laws, 2017	Regulates collection and removal of refuse for residents and businesses within the municipal area.	The business must adhere to the stipulations within the by-laws throughout the lifecycle of the activity. Waste removal services will be provided by the municipality.
Emfuleni Local Municipality Air Quality Management By-Laws, 2017	Regulates air pollution and provides a management framework to ensure that air pollution is avoided or managed within the municipality's jurisdiction.	The Applicant must adhere to the stipulations within the by-laws throughout the lifecycle of the activity.

2 PROJECT DESCRIPTION

2.1 Site Description

Unitas Park – Extension 16 is located on Portion 222 of the farm Houtkop 549 IQ within Unitas Park, Vereeniging within the Sedibeng District Municipality and Emfuleni Local Municipality. The site was originally planned to have a township layout, with 2680 residential erven, two primary and one high school, three social/commercial facility erven and three open space erven. This layout was approved; however, not proclaimed or registered as this "standard layout" did not accommodate different residential densities and it did not comply with the latest environmental and geotechnical requirements. The new strategy for this site is a proposed 7 250 units comprising of mixed high density and to achieve the proposed yield, the existing layout will have to be withdrawn and a new application submitted.

The area is currently zoned as Farmland on a dolomitic zone in terms of Geophysics. The total extent is approximately 149 hectares and is owned by the Gauteng Provincial Government. The proposed site is currently vacant, with immediate adjacent land portions also being vacant. There is evidence of water courses on the site, as well as to the south east of the site. A drainage line appears to run from the site towards Houtkop Road to the south west, where the surface water drains under the road and continues to flow into a National Freshwater Ecosystem Protection Area (NFEPA). The buffer of the NFEPA includes a portion of the south west of the site.

The proposed project entails the phased establishment of a mixed use residential development inclusive of the following land uses: low, medium and high density residential; student village; mixed use; innovation hub; social/educational; public open space and sports facility.

2.2 Site Sensitivity

2.2.1 Climate

The red line in Figure 2-1 below indicates the mean daily maximum temperature, ranging between 18C in winter and 29C in summer, while the blue line indicates the mean daily minimum temperature, which ranger between 2C in winter and 15C in summer months. The maximum temperatures in summer can reach approximately 35C, while in winter, the number of days that frost occurs can reach up to 8 days in July. The mean annual precipitation ranges from a minimum of 1mm per month in winter to a maximum of 107mm per month in summer (Meteoblue, 2020).

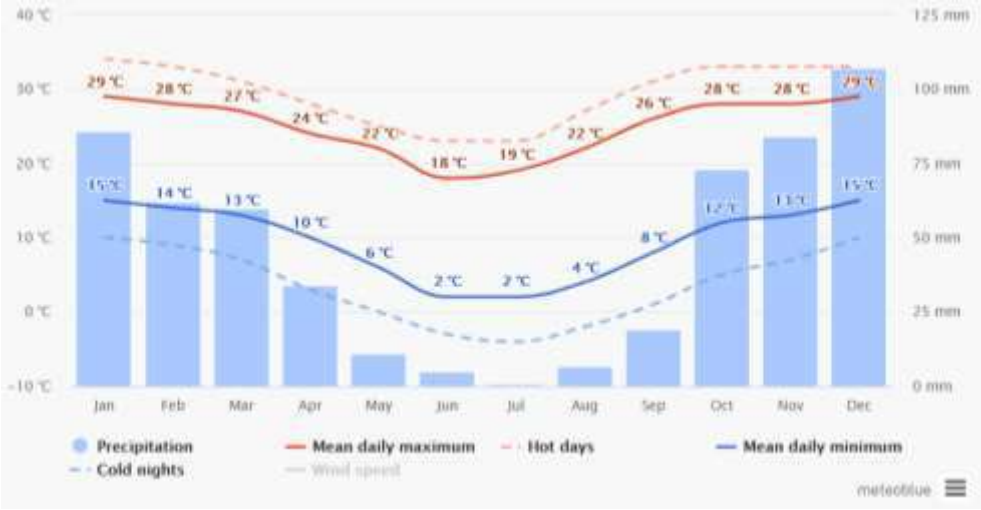

Figure 2-1: Mean monthly temperatures and precipitation in the Vanderbijlpark area (Meteoblue, 2020)

2.2.2 Topography, Drainage and Watercourses

From a southerly to northerly direction, the topography across the study area is relatively undulating with a steady rise from the south to the north. A similar topographic profile is evident from the west to the east of the proposed development area. There is a steady undulating decrease of the topographic slope west to east.

The proposed development area falls within the C22F Quaternary Catchment and the Upper Vaal Water Management Area (WMA). The ephemeral drainage line which falls within the study area and which is approximately 426 m south of the proposed development sites drains south east towards the Vaal Rivier.

The hydrological component of the wetland system has been seriously modified through the canalization and stream channel modification or the system. Unchannelled valley bottom wetlands are generally characterised by diffuse surface flow in their natural states. As such, it was determined that canalization and stream channel modifications have had serious impacts on the hydrology of the system.

2.2.3 Geology and Soils

According to the Environmental Protection Atlas (ENPAT) geology data for the Gauteng Province, the site is underlain by a Quartzite Geology. The associated patterns with the geology in this area are rare upland duplex and margalitic soils and widespread dystrophic and/or mesotrophic red soils. The ENPAT data also indicates that the soil form that overlays this geology is the Hutton Formation.

The Hutton soil formation is characterised by an orthic A-horizon over a red apedal B-horizon. This soil form is generally reddish coloured with a weak structure in which water stagnation does not generally take place.

Six different soil forms (Carolina, Cullinan, Dresden, Glencoe, Lichtenburg and Mispah) were identified within the proposed development site. Both the Cullinan and Carolina soil forms are newly described soil forms of the new Natural and Anthropogenic Soil Classification System of South Africa (Soil Classification Group, 2018). The natural soil forms identified on site include soil of the Carolina, Dresden, Glencoe, Lichtenburg and Mispah forms while the Cullinan form is an anthropogenic soil form.

Approximately 95.6ha of the 154ha study site consists of yellow-brown and red sandy-clayloam soil profiles of the Carolina, Glencoe and Lichtenburg forms with soil depth of 1m or deeper than 1m. These soil profiles are located in the northern, eastern, south-eastern and centre of the study area. A small portion (1ha) of shallow Dresden soil profiles are located in the south of the study area. More than 95% of the areas of Carolina, Dresden, Glencoe and Lichtenburg soil forms have been used for maize cultivation the past growing season (2019 – 2020).

The western section of the proposed development area consist of shallow Mispah profiles with soil depth between 0.1 and 0.35m where evidence of a derelict old farmhouse was found. Two areas of previous soil excavations are present in the western section of the site (Cullinan form). The Cullinan form soil form has been described as large, exposed excavations without backfilling (Soil Classification Working Group, 2018).

2.2.4 Land Cover and Land Use of the Region

The area is zoned for farming/agricultural. Evidence was found of a derelict farmstead surrounded by what may be the remains of a garden around the house. The current land use of the site largely consists of rainfed production of grains (maize was planted for the 2019-2020 growing season) as well natural veld that may be used for livestock production (will be confirmed when information is received from farmer who leases the property). Within the south-western section of the study site, there are evidence of two areas of previous soil excavation in where gravel and fractured rock was removed without any backfill or active rehabilitation of the area.

Land outside the proposed development site consist of a mixture of land uses, including residential areas and a school to the north-west of the site as well as rainfed crop production and farmsteads towards the north-east, east and south-east of the study site. The R54 (Houtkop Road) is located south of the study site.

2.2.5 Flora and Fauna

According to Mucina and Rutherford (2006) the proposed development area falls within the Soweto Highveld Grassland vegetation unit. This vegetation unit has been classified as ‘endangered’ with almost half already having been impacted or transformed due to cultivation, urban sprawl, mining and building of road infrastructure (Mucina and Rutherford, 2006). Despite the ongoing impacts to this vegetation unit, only 0.2% is protected which is far below the conservation target of 24%.

The open and degraded grassland were determined to have low to very low naturalness due to the extensive commercial agriculture taking place within the study area. During the infield floral assessment, no species of conservation concern were observed. The study area falls within the Soweto Highveld Grassland which is considered to be endangered. However, very small and scattered areas of open grassland was identified.

Although the area has the potential to provide habitat for a diverse range of fauna species in a natural state, the degraded nature resulted in very few fauna species being observed. One (1) mammal species, namely the *Lepus saxtilis* (Scrub Hare) (LC) was observed. Additionally, large flocks of *Streptopelia decipiens* (African Dove) (LC) were observed.

2.2.6 Socio-Economic

According to the Sedibeng Growth and Development Strategy 2 (Sedibeng District Municipality, 2012), the Unitas Park population is of low-Living Standards Measurement with a low access to services. This places the community as vulnerable to impact. The community also has a high unemployment rate. These factors must be considered when proposing development within Unitas Park. The community is not positioned to address impacts to their human health, living conditions or environment. Therefore, it is important that the developer communicate with neighbouring community members in order to minimize negative impacts of the development. This will be focused within the construction phase of the project.

2.2.7 Traffic

Background

The site is well-connected on a regional scale. To the south is Houtkop Road (R54), to the south-west is the R28 and to the east is the R59 (Old Johannesburg Road). The proposed PWV 20 runs to the west of the site and the proposed K55 abuts the site on its eastern boundary. On a more local level, the extension of Houtkop Road, Skippie Botha Road, and Langrand Road provides connectivity to the north, east, and west.

A strong movement of people occurs between Vanderbijlpark, Vereeniging, and Meyerton towards Johannesburg along the P156 freeway. A strong movement also occurs between Sebokeng and Johannesburg, especially during the morning and afternoon peak hours, as commuter access employment opportunities in Johannesburg and surrounding areas. A strengthening of movement in the future can be expected between Vereeniging and Sebokeng, as urban development and densification occur along this corridor. Movement along the corridor between Vereeniging, Sebokeng, and Johannesburg is supported by the existing commuter railway line.

Rail Network

Emfuleni is served by a rail network that connects Emfuleni to neighbouring areas in Gauteng and the Free State. This rail network consists of three (3) lines.

- The first rail line stretches along with the P156 (R59) freeway and links Sasolburg to Vereeniging, Meyerton, and Germiston. This rail line is primarily a freight line but does contain commuter railway stations along sections of the line.
- The second railway line stretches from Sasolburg, via Vereeniging towards Sebokeng, Orange Farm, and Johannesburg. This railway line also functions as a freight railway line, although it also fulfills a significant commuter railway line function.
- The third railway line stretches from Sebokeng towards Westonaria. This railway line is exclusively used for rail freight purposes.

Road Network

Emfuleni comprises of an extensive bus network that serves the municipal area. A prominent bus route is the bus route linking Vereeniging to Sebokeng along with the K53 (Moshoeshoe Road) and the K45 (Golden Highway). This bus route links Evaton and Sebokeng to the Vereeniging CBD and the industrial areas located within Vereeniging. Equally so, the area comprises of an extensive mini-bus taxi network. This network largely uses the same routes as of the bus routes and serves the same areas within the municipal area. The only significant exception is that the minibus route links Vanderbijlpark CBD to Sebokeng via Mittal Steel; a route that the bus network does not serve.

The proposed development will generate an estimated 566 trips during the weekday AM and weekday PM peak periods, respectively. Whilst this has been identified, it is to be noted that the site is currently underdeveloped and existing capacity constraints, as such the development needs to meet this along with the increased traffic impacts. As a precautionary measure the analysis performed, found that the impact of the proposed developments can be mitigated by means of several road and intersection improvements

2.2.8 Heritage sites and paleontological importance

A Heritage study was undertaken by HCAC (2020) and a paleontological study by Marion Bamford (2020) to determine the character of the site in terms of cultural resources. T Due to the area being ranked of high significant by SAHRIS (Figure 2-2), a paleontological study was undertaken. The non-intrusive field survey identified some scatted Stone Age artefacts, a stone cairn of unknown purpose and a partially demolished homestead. The paleontological study concluded that, as the site lies on soils that overlay deposits of siltstones, mudstones, shales and possible coal seams of the Vryheid Formation, there is a possibility of fossils being preserved. However, these rocks are only potentially present more than 50m below the surface. It is therefore unlikely that fossils will be unearthed.

Due to the site being used for the cultivation of maize, a large portion of the site was inaccessible. Although artefacts were identified in the areas that could be accessed, they are rated as having low heritage significance. It is recommended that the area is monitored during the construction phase.

Figure 2-2: SAHRIS palaeosensitivity map for the proposed development in Unitas Park Ext 16 shown within the yellow rectangle.

(Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero)

Figure 2.3: Unitas Park – Extension 16 Erf 2680 Locality Map

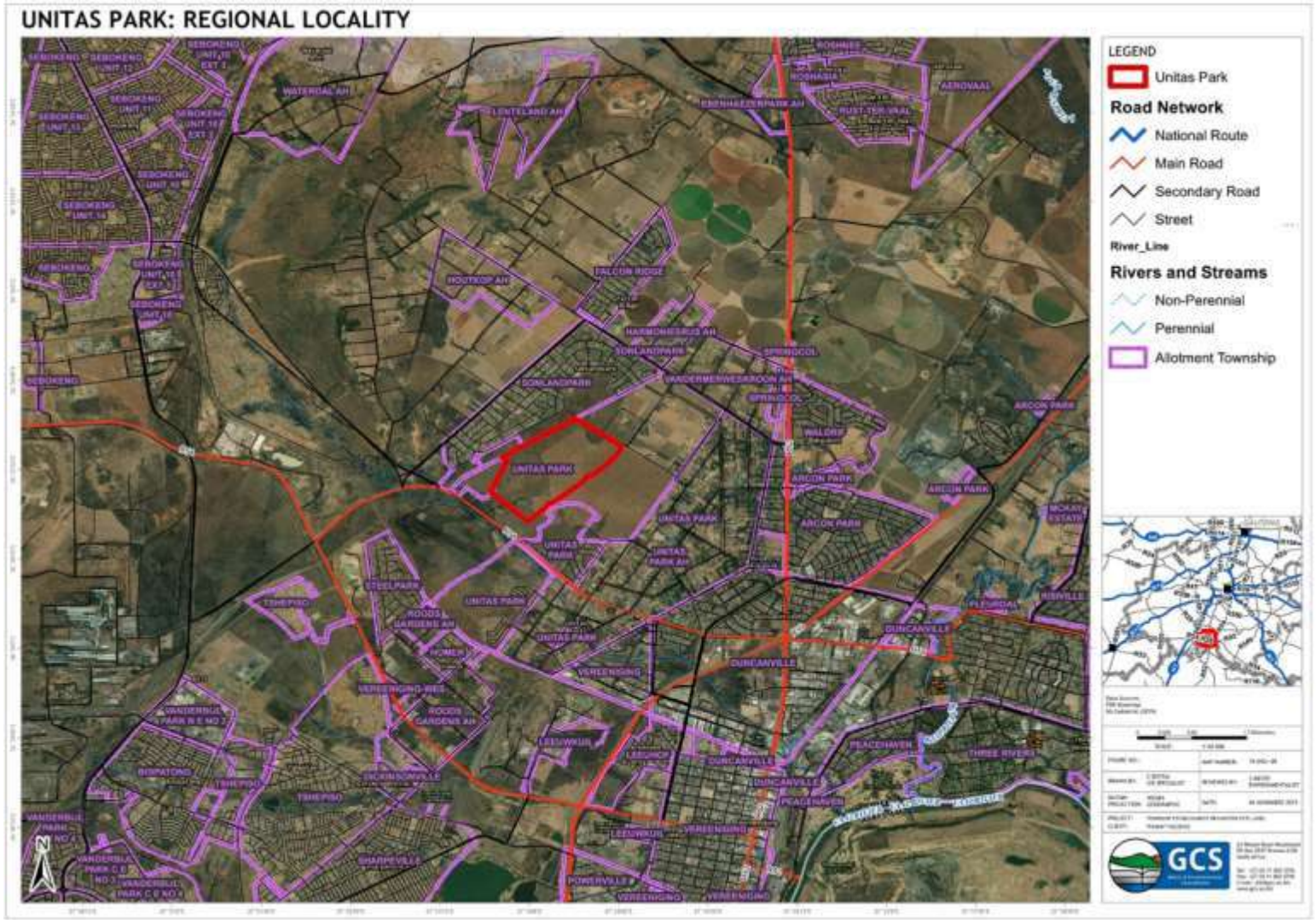

Figure 2.4: Unitas Park – Extension 16 Erf 2680 Regional Locality

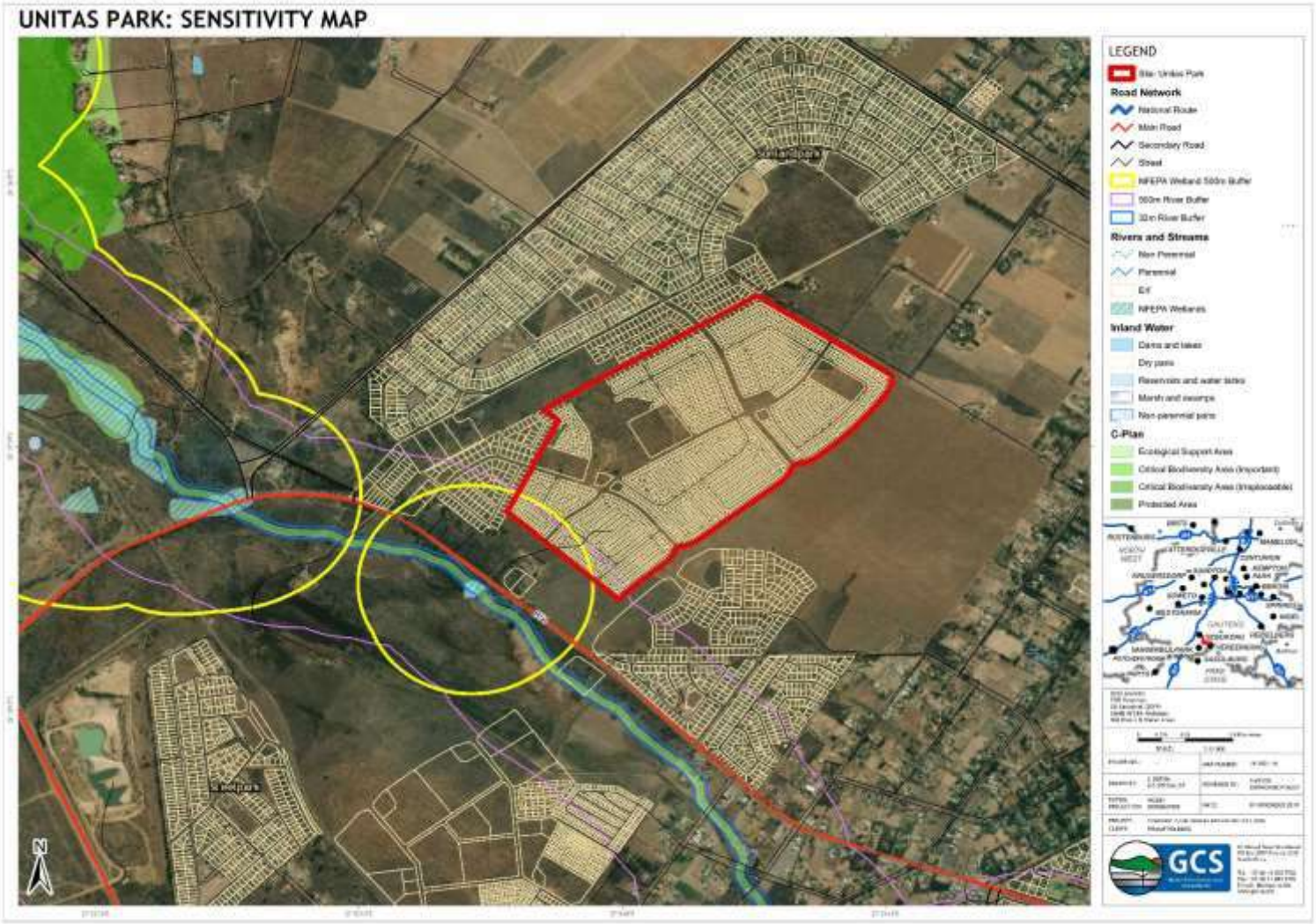

Figure 2-5: Unitas Park – Extension 16 Erf 2680 Sensitivity Map

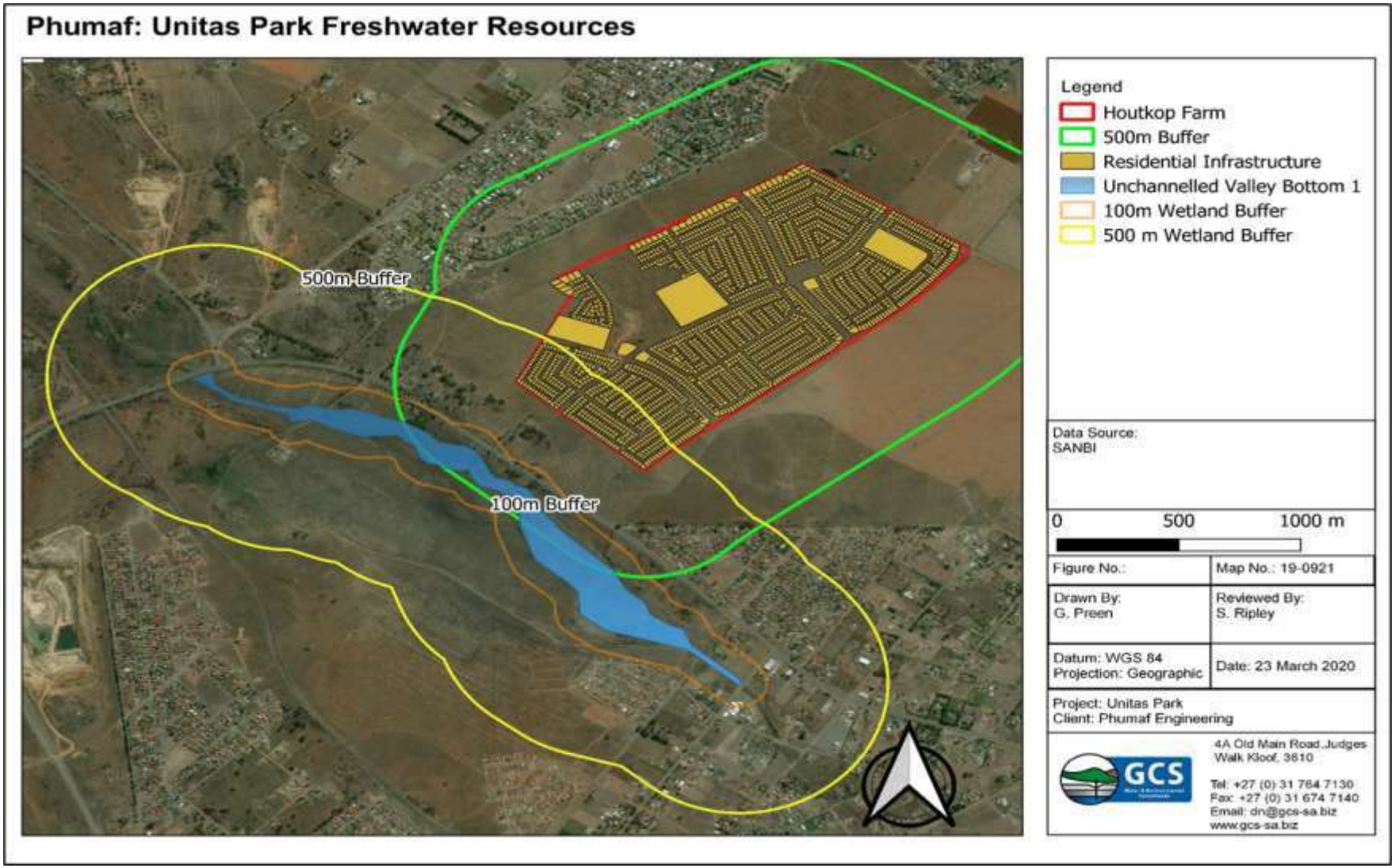

Figure 2-6: Unitas Park – Extension 16 Erf 2680 Sensitivity Map.

2.3 Activity Description

The proposed development of Unitas Park – Extension 16 from agricultural to mixed use residential/township development will include the following g the aspects during the pre-planning phase:

- Site design and layout;
- Identification of service infrastructure already present in the area;
- Construction planning; and
- Relevant permitting.

Construction phase activities will include:

- Vegetation clearance;
- Excavation;
- Service infrastructure installation;
- Paving and concreting;
- Building; and
- Rehabilitation.

During the operational phase, activities will include:

- Occupation of residential structures;
- Use of service infrastructure;
- Stormwater Management; and
- Use of roads.

Decommissioning of this project is highly unlikely due to its permanent nature, however, should decommissioning be deemed necessary, activities would include:

- Demolition of residential;
- Decommissioning of service infrastructure;
- Removal of building rubble; and
- Rehabilitation.

Throughout the project lifecycle, the construction, operating and decommissioning teams must be prepared for unplanned emergencies or incidents threatening human health or the environment.

3 ROLES AND RESPONSIBILITIES

3.1 Project Manager and Engineer's Representative

Phumaf has been appointed by DHS – Provincial to undertake the design and implementation of the project. Phumaf will thus be responsible for appointing a Contractor to undertake the construction necessary to achieve the objectives of the GRLRP based on the project design for Unitas Park – Extension 16. The Contractor will manage the site, but this must be monitored by a representative from Phumaf (Engineer) in order to oversee and manage the environment (and associated) aspects of the development. It is to be noted that Phumaf is ultimately responsible for the implementation of the EMP.

The representative will be responsible for overseeing all environmental aspects on site, including sub-contractors or service providers. The representative should undertake weekly site inspections to ensure that the EMPr is being effectively implemented on site. The representative's responsibilities include the following:

- Managing and facilitating communication and training to all staff on the content of this EMPr;
- Ensuring that a copy of this EMPr is always available on site;
- Conducting and reporting on weekly site inspections (by way of a checklist) to document the implementation of this EMPr;
- Identifying and assessing previously unforeseen, actual or potential impacts on the environment;
- Facilitating any monitoring required;
- Advising the Site Manager regarding the removal of person(s) and/or equipment not complying with the provisions of this EMPr;
- Making recommendations to the Site Manager with respect to the issuing of fines for contraventions of the EMPr; and
- Continually reviewing the EMPr and recommending additions and/or changes to this document as necessary.

3.1.1 Method Statements

It is recommended that the Engineer's Representative develop site specific method statements, in consultation with the appointed Contractor, which will assist in managing aspects of the development, in line with the requirements of the EMPr. A generic method statement has been included as Error! Reference source not found.. Method Statements should include at least a description of the activity to be undertaken, a detailed description of the process to be followed (including methods and materials), an indication of which areas the work will be undertaken in and an indication of the timeframes and end dates of the activity.

All Method Statements must be in place at least five (5) working days prior to the relevant activity beginning. At minimum, the following method statements must be in place:

- Site plan, including "no-go areas", sensitive sites and TOPS;
- Waste Management Plan;
- Erosion Management Plan;
- Biodiversity Management Plan;
- Hazardous Substance/ Hydrocarbon Management Plan; and
- Traffic Management Plan.

3.1.2 Environmental Register

An Environmental Register must be kept on site throughout all phases of the project in order to record environmental incidents, deviations from the EMPr by employees and complaints. The register must include the date of the incident and the measures taken to rectify it. The Register must be available for any party who wishes to investigate its contents. The Register may be kept by the Engineer's/ Applicant's representative or a suitable individual within the Contractor's team.

3.2 Environmental Control Officer

Phumaf will appoint an Environmental Control Officer (ECO) to assess (on a monthly basis during construction and e very five (5) years during the operational phase) the implementation of the EMPr on site. The Engineer may decide to assign this role to one person for all phases or to assign a different ECO for each phase respectively. The ECO's responsibilities include the following:

- Managing and facilitating communication between the Applicant, Applicant/Engineer's representative, contractors and Interested and Affected Parties (I&APs) with regard to this EMPr;

- Conducting monthly site inspections and audits during construction phase to assess the implementation of this EMPr on site;
- Conducting inspections and audits every 5 (five) years during operational phase to assess the implementation of this EMPr on site;
- Submitting audit reports to the Applicant and Competent Authority for review;
- Assisting the Contractor in finding solutions with respect to matters pertaining to the implementation of this EMPr;
- Advising the Applicant/Engineer's representative regarding the removal of person(s) and/or equipment not complying with the provisions of this EMPr;
- Making recommendations to the Applicant/Engineer's representative with respect to work stoppages or the issuing of fines for contraventions of the EMPr; and
- Continually reviewing the applicability of the EMPr and recommending additions and/or changes to this document.

4 ENVIRONMENTAL MANAGEMENT PLAN ACTIONS

4.1 Key Environmental Impacts

Based on the investigation of the receiving environment acquired from previous experience, a desktop assessment, site visit, DEA Online Screening Tool, Specialist input, as well as the understanding of activities to be carried out for the construction and operation phases of the project, the potential environmental impacts during the various phases of the development will be identified and addressed in detail during the EIA phase. Potential impacts that have been identified at this stage are presented in Table **3-1**.

Table 3.1: Preliminary impacts identified.

ENVIRONMENTAL ASPECTS	POTENTIAL ENVIRONMENTAL IMPACT	SPECIALIST STUDY TO INVESTIGATE IMPACT
Vegetation/Flora	• Clearing or damage to vegetation • Disruption of ecological connectivity; • Loss of biodiversity; • Spreading of weeds and alien vegetation; and • Introduction of alien invasive plants.	Ecological Impact Assessment and Environmental Management Plan
Wildlife/Fauna	• Loss and degradation of faunal habitat and diversity; • Introduction of alien invasive plants.	Ecological Impact Assessment and Environmental Management Plan
Wetlands	• Loss of ecological services/processes	Ecological Impact Assessment and Environmental Management Plan
Soils and Geology	• Loss of soil resource, land use and land capability • Loss of soil productivity • Contamination of soil resources	Soils, Land Capability and Agricultural Potential Assessment
Land-Use	• Permanent change in the land use from agricultural to residential • Altering of geological strata • Alteration of natural topography	Soils, Land Capability and Agricultural Potential Assessment
Surface Water	• Change in drainage patterns • Contamination of surface water resources • Potential contamination of surface water resources	Design Stormwater Management Plan Implement Environmental Awareness and Response Plan
Groundwater	• Potential contamination of groundwater resources; • Poor quality seepage	Environmental Management Plan Implement Environmental Awareness and Response Plan
Air Quality	• Fugitive dust releases	Environmental Management Plan
Heritage	• Possible damage to heritage artefacts • Disturbance of heritage resources.	Environmental Management Plan and Environmental Awareness and Response Plan

ENVIRONMENTAL ASPECTS	POTENTIAL ENVIRONMENTAL IMPACT	SPECIALIST STUDY TO INVESTIGATE IMPACT
Waste	• Waste generation; • Increase in greenhouse gas emissions as a result of construction activities (gases emitted by construction vehicles); and • Release of hazardous substances, including hydrocarbons, into the environment.	Environmental Management Plan and Environmental Awareness and Response Plan
Visual	• Negative Impacts on aesthetics • Change of Visual Character • Landscape visual change	Environmental Management Plan
Health and Safety	• Disturbance to road users; • Disturbance to surrounding property owners, users and businesses (noise and dust impacts); and • Health and safety of construction team, road users and surrounding property owners, users and businesses.	Environmental Management Plan
Socio-economic	• Employment opportunities through temporary job creation (positive) • Nuisance factors of traffic, dust, noise • Increase in crime	Environmental Management Plan Stakeholder Communication Strategy and Grievance Mechanism

The following key impacts have been identified as per the pre-empted project phases:

4.1.1 Planning and Design Phase

- Avoidable environmental harm resulting from unsuitable site designs or layout;
- Avoidable social impacts resulting from unsuitable site designs or layout;
- Illegal activities resulting from a lack of appropriate permitting;
- Social disturbance resulting from improper construction planning.

4.1.2 Construction Phase

- Loss of or disturbance to vegetation and habitat;
- Loss of topsoil;
- Erosion of surrounding soil;
- Loss of threatened or protected species (TOPS), both floral and faunal;
- Introduction of alien invasive species (AIS);
- Soil and groundwater contamination from hydrocarbon/ hazardous substance spills;

- Surface water contamination from hydrocarbon/ hazardous substance spills;
- Impact on vehicular traffic;
- Increase in emissions of greenhouse gases by construction machinery/vehicles;
- Dust generation- disturbance to surrounding land owners/users;
- Noise generation- disturbance to surrounding land owners/users;
- Waste generation;
- Archaeological impacts if heritage sites are found on the project site; and
- Health and safety impacts of construction workers and surrounding land owners/users.

4.1.3 Operational Phase

- Erosion of surrounding soil;
- Soil and groundwater contamination from vehicle oil spills;
- Surface water contamination from sewage leaks;
- Surface water contamination from vehicle oil spills;
- Soil and groundwater contamination from sewage leaks;
- Impact on vehicular traffic;
- Waste generation;
- Edge effects of development on surrounding open spaces; and
- Invasion of alien invasive species.

4.1.4 Decommissioning Phase

- Loss of residential space;
- Soil and groundwater contamination from hydrocarbon/ hazardous substance spills;
- Surface water contamination from hydrocarbon/ hazardous substance spills;
- Impact on vehicular traffic;
- Increase in emissions of greenhouse gases by decommissioning machinery/vehicles;
- Dust generation- disturbance to surrounding land owners/users;
- Noise generation- disturbance to surrounding land owners/users;
- Waste generation; and

- Health and safety impacts of decommission team workers and surrounding land owners/users.

4.1.5 Cumulative and Latent Impacts

- Loss of Soweto Highveld Grassland vegetation and habitat;
- Reduced landscape connectivity;
- Loss of open spaces in Gauteng; and
- Reduction in housing demand (positive).

These impacts are unavoidable; however, they will be mitigated as far as possible through implementation of mitigation/ management measures recommended for the above phases.

4.2 Environmental Opportunities

The environmental opportunities provided by this project can be maximized through implantation of the NEMA Sustainable Development Principles. Sustainable development can be achieved by addressing the current housing needs while still minimizing environmental harm, so that future generations may also benefit from environmental resources. The NEMA Principles require the following:

- Avoid, minimise or remedy ecosystem disturbance and biodiversity loss as far as possible;
- Avoid, minimise or remedy pollution and environmental degradation as far as possible;
- Avoid, minimise or remedy landscape disturbance and loss of cultural heritage as far as possible;
- Avoid, minimise, re-use or recycle waste where possible, otherwise dispose of waste in a responsible manner;
- Responsibly and equitably use/ exploit non-renewable natural resources in a manner which takes into account the consequences of the depletion of the resource;
- Apply a risk-averse and cautious approach which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Anticipate and prevent, or minimise and remedy, negative impacts on the environment and environmental rights be anticipated and prevented.

In order to achieve sustainable development goals, use of alternatives that are technologically and environmentally superior to “standard” technologies should be investigated and promoted throughout the project lifecycle.

4.3 Management Actions

The following management actions of this EMP (**Table 4-2**) have been developed in order to avoid the potential impacts listed above as far as possible. Where impacts cannot be avoided, measures are provided to reduce the significance of these impacts.

It is important that the Engineer assess the following commitments in detail. In signing the final version of the EMP, the Engineer acknowledges their responsibility to uphold the specific management actions detailed below. It should be noted that although responsibility has been allocated to the Contractor team in most instances, the Engineer is responsible for ensuring that the EMP and its conditions are implemented and adhered to.

Table 4-2: EMP Management Actions.

ASPECT	IMPACT	MANAGEMENT ACTIONS
PLANNING AND DESIGN PHASE		
Site design and layout	Avoidable environmental harm resulting from unsuitable site designs or layout	1. Site design/layout should minimise transformed spaces and ensure that the footprint is as small as possible 2. Site design must include indigenous garden patches in order to maintain some connectivity for insects, birds and reptiles 3. Gardens must contain insect-, bird- and reptile-friendly indigenous grass, bush and tree species 4. Floral TOPS must be identified prior to construction and accommodated by the site design or removed (to be placed in a nursery or other suitable habitat) 5. Large plant species (trees, bushes) must be left on site if and where possible 6. Stormwater designs must be appropriately designed so as to minimise erosion 7. A waste management plan must be compiled prior to the commencement of the construction phase;
	Avoidable social impacts resulting from unsuitable site designs or layout	8. Site design/layout should include open spaces to avoid over-crowding 9. The site should be designed so as to minimise disturbance to residents in the area, as far as possible
Construction planning	Social disturbance resulting from improper construction planning	10. The construction site must be clearly marked and should not exceed the boundaries of the construction site plan 11. The unnecessary removal of vegetation outside of the construction site plan is not permitted 12. All threatened or protected species (TOPS) in the vicinity of the construction activity should be identified prior to construction beginning 13. An IAPS management plan must be compiled by a suitable specialist prior to the commencement of construction activities. This must be implemented throughout

ASPECT	IMPACT	MANAGEMENT ACTIONS
		the construction and operational phase. This must be monitored by the Environmental Control Officer (ECO) 14. All construction machinery, vehicles and personnel movement must be limited to the existing informal tracks around the site 15. No fires are permitted on site 16. Construction must be planned so as to minimise disturbance to the current residents of the area 17. At least two weeks prior to construction, residents should be warned of possible disturbances 18. The Engineer/Contractor must maintain open communication with the surrounding residents regarding the progress and timeframes of the project 19. The Contractor must record and repair any damage to neighbouring properties caused by construction activities
Relevant permitting	Illegal activities resulting from a lack of appropriate permitting	20. The EA and WUL must be in place prior to construction beginning 21. A permit in terms of NEM:BA must be in place should any TOPS need to be relocated or damaged (including trimmed) 22. A permit in terms of NHRA must be in place should any heritage artefacts need to be relocated
CONSTRUCTION PHASE		
Environmental awareness	Lack of awareness may result in environmental harm and/or non-compliance to the EMPr/EA	23. Comprehensive induction of all employees on site, including an environmental section which outlines as a minimum the following: o Explanation of the importance of complying with the EMPr o Discussion of the potential environmental impacts of development activities o Employees' roles and responsibilities, including emergency preparedness

ASPECT	IMPACT	MANAGEMENT ACTIONS
		○ Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities ○ Importance of biodiversity 24. Daily safety talks should include environmental topics (at least one environmental topic per week) to increase general and site-specific environmental awareness
Monitoring of compliance and EMP implementation	Lack of monitoring may result in environmental harm and/or non-compliance to the EMPr/EA	25. The construction site should be informally monitored on a continual basis by the Engineer/Applicant's representative to ensure compliance to the EMPr and thus reduce environmental harm 26. The Engineer/Applicant's representative should conduct weekly inspections of the site and implementation of the EMPr 27. Implementation of the EMPr and conditions of the EA must be formally monitored (audited) on a monthly basis by an appropriately qualified and experienced ECO
Vegetation clearance	Loss of or disturbance to vegetation and habitat	28. The clearance footprint should be kept as small as possible 29. The site must be clearly demarcated, and employees made aware to stay within its boundaries 30. Areas that are not intended for clearance must be appropriately marked and cordoned off as "no-go areas" 31. Construction machinery and vehicles to stay within site and on demarcated roads as far as practically possible 32. Floral TOPS and large plant species (trees or bushes) are to be left in situ where possible 33. Floral species to be left on site must be appropriately marked and cordoned off to prevent damage 34. No fires are permitted on site

ASPECT	IMPACT	MANAGEMENT ACTIONS
		35. The open grassland identified and demarcated within this report must be avoided as far as practicable 36. These individuals should be barricaded and the construction team must be trained in their importance to ensure they are not damaged; 37. TOPS may not be relocated or damaged (including trimmed) without a permit 38. Other large trees and bushes should be similarly protected 39. Employees may not litter in the grassland areas or use them as ablution facilities 40. Edge effect control needs to be implemented within construction areas, with specific consideration to compaction and erosion control
	Loss of topsoil	41. Topsoil must be cleared and stored separately from subsoil and other excavated materials (e.g. rock) 42. Topsoil stockpiles should be no higher than 2 m tall 43. Topsoil should be stockpiled for the least amount of time before being reused on site for rehabilitation or moved to other sites for use 44. Topsoil stockpiles should be barricaded so as to prevent loss of topsoil through erosion
	Erosion of surrounding soil	45. The clearance footprint should be kept as small as possible 46. Any areas on site or on the edge of the site susceptible to erosion must be monitored and protected where necessary, through the use of silt fences or rock packing 47. Stockpiles may not exceed 5 m in height and must be covered using an impermeable material
	Loss of threatened or protected species (TOPS), both floral and faunal	48. Floral TOPS and large plant species (trees or bushes) are to be left in situ where possible 49. Floral species to be left on site must be appropriately marked and cordoned off to prevent damage

ASPECT	IMPACT	MANAGEMENT ACTIONS
		50. Plant species left on site may not be used as fence posts or to hang bags, store waste or as latrines by employees 51. Permits must be in place if any plant TOPS will be removed, trimmed or relocated 52. Any TOPS which will be temporarily removed from site and planted back during rehabilitation must be protected in a suitable nursery 53. No hunting, poaching, fishing, or any other harm to animals by employees is permitted on or around site 54. Any snakes (or other animals) found on site may not be killed or harmed in any way, but may be removed safely by a professional snake handler or rehabilitation expert 55. No poisons are to be utilised on site
	Introduction/ proliferation of AIS	56. Any plant AIS noted on site must be removed 57. Disturbed soils must be monitored for colonisation of plant AIS 58. Plant AIS must be removed from disturbed soils before seeding and disposed of with general waste 59. Animal AIS may not be dealt with using poison, but should be controlled through prevention measures (such as keeping waste areas clean) or biocontrol measures
	Soil and groundwater contamination resulting from hydrocarbon leaks from clearing machinery/equipment	60. Restrict movement of construction employees, vehicles and machinery outside of construction areas 61. Restrict vehicles to travel only on designated roadways 62. Construction machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 63. Servicing of machinery/equipment may only take place within a designated area which must be appropriately bunded and have an oil separation system in place 64. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used

ASPECT	IMPACT	MANAGEMENT ACTIONS
		65. Park construction vehicles in areas lined with concrete or fitted oil traps 66. Stationary construction vehicles and machinery must have drip trays placed underneath 67. Ensure vehicles are in good condition and not leaking fuel or oil when entering the construction area 68. Regular vehicle and equipment inspections 69. Use of bunds during refuelling 70. Maintenance to be done off site 71. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 72. Drip trays must be in good condition (i.e. no holes and not bent or flattened) 73. All employees are to be trained in proper spill management techniques and drilled quarterly 74. Fully stocked spill kits must be available in all working areas on site and inspected weekly to ensure they have all the required elements 75. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 76. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 77. Significant spills must be reported to GDARD
	Soil and groundwater contamination from hazardous substance spills	78. All hazardous substances (including hydrocarbons) must be stored in labelled and sealed containers, within a labelled, protected and bunded area 79. Employees must be trained on appropriate hazardous substance management techniques

ASPECT	IMPACT	MANAGEMENT ACTIONS
		80. Appropriate PPE (e.g. gloves, safety goggles) should be used when handling hazardous substances; and 81. Hazardous substances must be transported by an appropriately licenced contractor and disposed of in an appropriately licensed facility. 82. All hazardous substances utilised or stored on site must be accompanied by a Material Safety Data Sheet (MSDS) and employees must be trained in using these documents appropriately 83. Hazardous substance spills are to be dealt with in the same manner as hydrocarbon spills 84. Hazardous substances must be stored in appropriately sealed and labelled containers and/or bunded areas 85. Hazardous waste must be stored in appropriately sealed and labelled waste containers and/or bunded areas 86. A record of all spills must be kept on site
	Surface water contamination from hydrocarbon/ hazardous substance spills	87. The construction site must be clearly marked and should not exceed the boundaries of the construction site plan. 88. The wetland system must be demarcated as a no-go zone 89. A 45 m buffer must be established and maintained during the construction phase of the proposed development. This must be monitored by the ECO 90. Keep impact footprint as small as possible 91. Construct cut-off berms downslope of working areas, demarcate footprint areas to be excavated to avoid unnecessary digging 92. Exposed areas must be ripped and vegetated to increase surface roughness 93. Create energy dissipation at discharge areas to prevent scouring

ASPECT	IMPACT	MANAGEMENT ACTIONS
		94. Temporary and permanent erosion control methods may include silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching 95. Compacted areas must be ripped (perpendicularly) to a depth of 300 mm 96. A seed mix must be applied to rehabilitated and bare areas 97. Any gullies or dongas must also be backfilled 98. Soil management plans should be in place which will include the use of correct stockpiling methods 99. Berms should be placed around soil stockpiles to secure them 100. Stockpiles must not exceed 5 m in height.
	Impact on vehicular traffic from movement of clearing machinery	101. All operators and drivers must possess the appropriate driver's licenses 102. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 103. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 104. Heavy machinery/vehicles should not be parked within the road or on the road verge
	Increase in emissions of greenhouse gases by construction machinery/vehicles	105. Construction machinery and vehicles should be kept to a minimal as far as practically possible 106. Use of car-pooling or public transport by employees must be encouraged 107. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Dust generation	108. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised daily to reduce airborne dust 109. Dust screens should be erected around working areas if and where practically possible

ASPECT	IMPACT	MANAGEMENT ACTIONS
		110. Employees must be provided with appropriate dust masks
	Noise generation	111. Notices must be erected prior to construction, forewarning surrounding land owners/users of construction activities 112. Construction must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 113. Excessive noise from employees must be discouraged where possible 114. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	115. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents 116. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 117. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 118. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams 119. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site. The waste bins must be wind and scavenger proof 120. Waste bins should be periodically inspected to ensure they are not overflowing 121. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 122. Tips should be periodically serviced to ensure they do not overflow 123. Tips must be serviced by a licensed service provider

ASPECT	IMPACT	MANAGEMENT ACTIONS
		124. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 125. Volumes of waste removed must be monitored and reduced where possible 126. No waste may be buried or burned on site or anywhere else 127. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages
	Destruction or partial destruction of non-renewable heritage resources	128. While unlikely, should any chance-finds of graves or other archaeological artefacts occur, all work in the area is to be ceased immediately and the Chance Find Procedure as laid out in the Archaeological Impact Assessment report must be implemented: o If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager o It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area

ASPECT	IMPACT	MANAGEMENT ACTIONS
		○ The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA. 129. If fossils are seen on the surface or during clearance/excavations: ○ When excavations begin the site must be given a cursory inspection by the Applicant/Engineer's representative or designated person. Any fossiliferous material (stromatolites, microbially induced sedimentary structures) should be put aside in a suitably protected place (see Archaeological Impact Assessment report for examples) ○ Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment ○ If there is any possible fossil material found then the qualified palaeontologist sub-contracted for this project should visit the site to inspect the selected material and check the dumps where feasible ○ Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits

ASPECT	IMPACT	MANAGEMENT ACTIONS
		○ If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils
	Health and safety of construction workers	130. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 131. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 132. Daily health and safety training must be undertaken to ensure employees remain vigilant 133. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 134. An Emergency Response Plan must be available on site at all times 135. Unsafe work areas should be identified and marked as such 136. MSDSs for any hazardous substances are to be readily available on site 137. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area 138. A fully stocked first aid kit must be available on site at all times 139. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times
Excavation and service structure installation	Loss of topsoil	140. Topsoil must be cleared and stored separately from subsoil and other excavated materials (e.g. rock) 141. Topsoil stockpiles should be no higher than 2 m tall

ASPECT	IMPACT	MANAGEMENT ACTIONS
		142. Topsoil should be stockpiled for the least amount of time before being reused on site for rehabilitation or moved to other sites for use 143. Topsoil stockpiles should be barricaded so as to prevent loss of topsoil through erosion
	Erosion of surrounding soil	144. The site footprint should be kept as small as possible 145. Any areas on site or on the edge of the site susceptible to erosion must be monitored and protected where necessary, through the use of silt fences or rock packing
	Loss of TOPS, both floral and faunal	146. Floral TOPS and large plant species (trees or bushes) are to be left in situ where possible 147. Floral species to be left on site must be appropriately marked and cordoned off to prevent damage 148. Plant species left on site may not be used as fence posts or to hang bags, store waste or as latrines by employees 149. Permits must be in place if any plant TOPS will be removed, trimmed or relocated 150. Any TOPS which will be temporarily removed from site and planted back during rehabilitation must be protected in a suitable nursery 151. No hunting, poaching, fishing, or any other harm to animals by employees is permitted on or around site 152. Any snakes (or other animals) found on site may not be killed or harmed in any way, but may be removed safely by a professional snake handler or rehabilitation expert 153. No poisons are to be utilised on site
	Soil and groundwater contamination resulting from hydrocarbon leaks from excavators	154. Construction machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 155. Servicing of machinery/equipment may only take place within a designated area which must be appropriately bunded and have an oil separation system in place

ASPECT	IMPACT	MANAGEMENT ACTIONS
		156. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used 157. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 158. Drip trays must be in good condition (i.e. no holes and not bent or flattened) 159. All employees are to be trained in proper spill management techniques and drilled quarterly 160. Fully stocked spill kits must be available in all working areas on site and inspected weekly to ensure they have all the required elements 161. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 162. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 163. Significant spills must be reported to GDARD 164. A record of all spills must be kept on site
	Soil and groundwater contamination from hazardous substance spills	165. All hazardous substances (including hydrocarbons) must be stored in labelled and sealed containers, within a labelled, protected and bunded area 166. Employees must be trained on appropriate hazardous substance management techniques 167. All hazardous substances utilised or stored on site must be accompanied by an MSDS and employees must be trained in using these documents appropriately 168. Hazardous substance spills are to be dealt with in the same manner as hydrocarbon spills 169. A record of all spills must be kept on site

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Impact on vehicular traffic from movement of excavators	170. All operators and drivers must possess the appropriate driver's license 171. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 172. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 173. Heavy machinery/vehicles should not be parked within the road or on the road verge
	Increase in emissions of greenhouse gases by construction machinery/vehicles	174. Construction machinery and vehicles should be kept to a minimal as far as practically possible 175. Use of car-pooling or public transport by employees must be encouraged 176. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Dust generation	177. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised daily to reduce airborne dust 178. Dust screens should be erected around working areas if and where practically possible 179. Employees must be provided with appropriate dust masks
	Noise generation	180. Notices must be erected prior to construction, forewarning surrounding land owners/users of construction activities 181. Construction must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 182. Excessive noise from employees must be discouraged where possible 183. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	184. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents

ASPECT	IMPACT	MANAGEMENT ACTIONS
		185. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 186. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 187. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams 188. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site 189. Waste bins should be periodically inspected to ensure they are not overflowing 190. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 191. Tips should be periodically serviced to ensure they do not overflow 192. Tips must be serviced by a licensed service provider 193. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 194. Volumes of waste removed must be monitored and reduced where possible 195. No waste may be buried or burned on site or anywhere else 196. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Destruction or partial destruction of non-renewable heritage resources	197. While unlikely, should any chance-finds of graves or other archaeological artefacts occur, all work in the area is to be ceased immediately and the Chance Find Procedure as laid out in the Archaeological Impact Assessment report must be implemented: ○ If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager ○ It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area ○ The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA. 198. If fossils are seen on the surface or during clearance/excavations: ○ When excavations begin the site must be given a cursory inspection by the Applicant/Engineer's representative or designated person. Any fossiliferous material (stromatolites, microbially induced sedimentary structures) should be put aside in a suitably protected place (see Archaeological Impact Assessment report for examples)

ASPECT	IMPACT	MANAGEMENT ACTIONS
		○ Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment ○ If there is any possible fossil material found then the qualified palaeontologist sub-contracted for this project should visit the site to inspect the selected material and check the dumps where feasible ○ Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits 199. If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils
	Health and safety	200. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 201. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 202. Daily health and safety training must be undertaken to ensure employees remain vigilant 203. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 204. An Emergency Response Plan must be available on site at all times

ASPECT	IMPACT	MANAGEMENT ACTIONS
		205. Unsafe work areas should be identified and marked as such 206. Deep excavations must be cordoned off and marked as such 207. Material Safety Data Sheets (MSDS) for any hazardous substances are to be readily available on site 208. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area if required 209. A fully stocked first aid kit must be available on site at all times 210. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times
Paving, concreting and infrastructure development/building	Erosion of surrounding soil	211. The site footprint should be kept as small as possible 212. Any areas on site or on the edge of the site susceptible to erosion must be monitored and protected where necessary, through the use of silt fences or rock packing 213. Concreted/paved areas must include suitable drainage and stormwater management systems to avoid erosion of the surrounding land, as per the stormwater management design
	Loss of TOPS, both floral and faunal	214. Floral TOPS and large plant species (trees or bushes) are to be left in situ where possible 215. Floral species to be left on site must be appropriately marked and cordoned off to prevent damage 216. Plant species left on site may not be used as fence posts or to hang bags, store waste or as latrines by employees 217. Permits must be in place if any plant TOPS will be removed, trimmed or relocated 218. Any TOPS which will be temporarily removed from site and planted back during rehabilitation must be protected in a suitable nursery

ASPECT	IMPACT	MANAGEMENT ACTIONS
		219. No hunting, poaching, fishing, or any other harm to animals by employees is permitted on or around site 220. Any snakes (or other animals) found on site may not be killed or harmed in any way, but may be removed safely by a professional snake handler or rehabilitation expert 221. No poisons are to be utilised on site
	Introduction/ proliferation of AIS	222. Any plant AIS noted on site must be removed 223. Disturbed soils must be monitored for colonisation of plant AIS 224. Plant AIS must be removed from disturbed soils before seeding and disposed of with general waste 225. Animal AIS may not be dealt with using poison, but should be controlled through prevention measures (such as keeping waste areas clean) or biocontrol measures
	Soil and groundwater contamination resulting from hydrocarbon leaks from concrete trucks and other construction machinery/ vehicles	226. Construction machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 227. Servicing of machinery/equipment may only take place within a designated area which must be appropriately bunded and have an oil separation system in place 228. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used 229. Concrete trucks must be sourced from a reputable contractor who ensures that trucks are well-maintained to ensure that no preventable leakages occur 230. A drip tray is to be placed under any potentially leaking elements of concrete trucks while they unload concrete 231. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 232. Drip trays must be in good condition (i.e. no holes and not bent or flattened)

ASPECT	IMPACT	MANAGEMENT ACTIONS
		233. All employees are to be trained in proper spill management techniques and drilled quarterly 234. Fully stocked spill kits must be available in strategic positions on site and inspected weekly to ensure they have all the required elements 235. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 236. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 237. Significant spills must be reported to GDARD 238. A record of all spills must be kept on site
	Soil and groundwater contamination from concrete/cement spills	239. If concrete is being delivered, it must be deposited on an area that is going to be laid with concrete (i.e. not on other areas where bare soil will remain) 240. If concrete is mixed on site, this must take place on an area that is going to be laid with concrete (i.e. not on other areas where bare soil will remain) 241. Concrete and cement must be adequately contained and prevented from spilling onto bare soil areas or into the road
	Soil and groundwater contamination from other hazardous substance spills	242. All hazardous substances (including hydrocarbons) must be stored in labelled and sealed containers, within a labelled, protected and bunded area 243. Employees must be trained on appropriate hazardous substance management techniques 244. All hazardous substances utilised or stored on site must be accompanied by an MSDS and employees must be trained in using these documents appropriately 245. Hazardous substance spills are to be dealt with in the same manner as hydrocarbon spills

ASPECT	IMPACT	MANAGEMENT ACTIONS
		246. A record of all spills must be kept on site
	Surface water contamination from construction machinery/vehicle and concrete/cement spills	247. Adhere to the wetland and watercourse buffers 248. The proposed infrastructure should be relocated outside of the proposed buffers described in this assessment 249. Keep impact footprint as small as possible 250. Implement SWMP 251. Construct cut-off berms downslope of working areas, demarcate footprint areas to be cleared to avoid unnecessary clearing 252. Exposed areas must be ripped and vegetated to increase surface roughness 253. Temporary and permanent erosion control methods may include, gabion walls, mattresses and bars, silt fences, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed areas, erosion mats, and mulching
	Surface water contamination from other hazardous substance spills	254. No cleaning of vehicles, machines and equipment on site 255. All hazardous substances to be stored separately in appropriately bunded and demarcated facilities 256. No servicing of machines, vehicles and equipment on site 257. Storage of potential contaminants in bunded areas 258. All contractors must have spill kits available and be trained in the correct use thereof
	Surface water contamination through inadequate waste management (including ablutions)	259. Ablution facilities may not be placed within 50 m or the 1:50 year floodline. Whichever is furthest will apply. 260. Implement a waste management plan 261. Implement the SWMP

ASPECT	IMPACT	MANAGEMENT ACTIONS
		262. Appropriate sanitary facilities must be provided and all waste to be removed to an appropriate waste facility
	Impact on vehicular traffic from concrete truck movement	263. All operators and drivers must possess the appropriate driver's license 264. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 265. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 266. Heavy machinery/vehicles should not be parked within the road or on the road verge
	Increase in emissions of greenhouse gases by construction machinery/vehicles	267. Construction machinery and vehicles should be kept to a minimal as far as practically possible 268. Use of car-pooling or public transport by employees must be encouraged 269. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Cement dust generation	270. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised daily to reduce airborne cement dust 271. Dust screens should be erected around areas where raw cement (i.e. not wet concrete) is being utilised, where possible 272. Employees must be provided with appropriate dust masks to reduce inhalation of cement particles
	Noise generation	273. Notices must be erected prior to construction, forewarning surrounding land owners/users of construction activities 274. Construction must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 275. Excessive noise from employees must be discouraged where possible

ASPECT	IMPACT	MANAGEMENT ACTIONS
		276. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	277. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents 278. Waste cement must be removed as building rubble, by a licensed contractor/service provider and disposed of at the nearest appropriately licensed facility 279. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 280. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 281. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams 282. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site 283. Waste bins should be periodically inspected to ensure they are not overflowing 284. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 285. Tips should be periodically serviced to ensure they do not overflow 286. Tips must be serviced by a licensed service provider 287. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 288. Volumes of waste removed must be monitored and reduced where possible 289. No waste may be buried or burned on site or anywhere else

ASPECT	IMPACT	MANAGEMENT ACTIONS
		290. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages
	Health and safety	291. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 292. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 293. Daily health and safety training must be undertaken to ensure employees remain vigilant 294. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 295. Unsafe work areas should be identified and marked as such 296. An Emergency Response Plan must be available on site at all times 297. Material Safety Data Sheets (MSDS) for any hazardous substances are to be readily available on site 298. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area if required 299. A fully stocked first aid kit must be available on site at all times 300. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times
Rehabilitation	Loss of topsoil	301. Topsoil which was stockpiled during vegetation stripping should be placed in areas where vegetation will be grown

ASPECT	IMPACT	MANAGEMENT ACTIONS
		302. Newly topsoiled areas should be revegetated as soon as possible, using indigenous (and endemic, if possible) plant species 303. Topsoil should be placed last, after subsoil layers have been replaced 304. In areas with a high risk of erosion, topsoil should be protected with additional measures such as biodegradable soil blankets until vegetation has re-established
	Erosion of surrounding soil	305. The rehabilitated areas should blend into the surrounding vegetation so as to discourage erosion 306. The stormwater management plan must be properly implemented on site 307. There should be no harsh transition zones between the developed areas and the rehabilitated or surrounding areas, to prevent increased surface water runoff speed and resultant erosion
	Loss of TOPS, both floral and faunal	308. Floral species left on site must be appropriately marked and cordoned off to prevent damage during topsoiling and revegetation activities 309. Plant species left on site may not be used as fence posts or to hang bags, store waste or as latrines by employees 310. Any TOPS which were temporarily removed from site protected in a suitable nursery must be placed back on site in suitable areas and must be monitored for at least three months or until successfully re-established on site 311. No hunting, poaching, fishing, or any other harm to animals by employees is permitted on or around site 312. Any snakes (or other animals) found on site may not be killed or harmed in any way, but may be removed safely by a professional snake handler or rehabilitation expert 313. No poisons are to be utilised on site
	Introduction/ proliferation of AIS	314. Any plant AIS noted on site must be removed 315. Rehabilitated areas must be monitored for colonisation of plant AIS

ASPECT	IMPACT	MANAGEMENT ACTIONS
		316. Plant AIS must be removed before seeding and disposed of with general waste 317. Animal AIS may not be dealt with using poison, but should be controlled through prevention measures (such as keeping waste areas clean) or biocontrol measures
	Soil and groundwater contamination from hydrocarbon spills from rehabilitation machinery/ vehicles	318. Rehabilitation machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 319. Servicing of machinery/equipment may only take place within a designated area which must be appropriately bunded and have an oil separation system in place 320. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used 321. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 322. Drip trays must be in good condition (i.e. no holes and not bent or flattened) 323. All employees are to be trained in proper spill management techniques and drilled quarterly 324. Fully stocked spill kits must be available in all working areas on site and inspected weekly to ensure they have all the required elements 325. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 326. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 327. Significant spills must be reported to GDARD 328. A record of all spills must be kept on site

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Soil and groundwater contamination from hazardous substance spills	329. All hazardous substances (including hydrocarbons) must be stored in labelled and sealed containers, within a labelled, protected and bunded area 330. Employees must be trained on appropriate hazardous substance management techniques 331. All hazardous substances utilised or stored on site must be accompanied by an MSDS and employees must be trained in using these documents appropriately 332. Hazardous substance spills are to be dealt with in the same manner as hydrocarbon spills 333. A record of all spills must be kept on site
	Impact on vehicular traffic from rehabilitation machinery/ vehicle movement	334. All operators and drivers must possess the appropriate driver's license 335. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 336. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 337. Heavy machinery/vehicles should not be parked within the road or on the road verge
	Increase in emissions of greenhouse gases by rehabilitation machinery/vehicles	338. Rehabilitation machinery and vehicles should be kept to a minimal as far as practically possible 339. Use of car-pooling or public transport by employees must be encouraged 340. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Dust generation	341. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised daily to reduce airborne dust 342. Dust screens should be erected around working areas if and where practically possible 343. Employees must be provided with appropriate dust masks

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Noise generation	344. Notices must be erected prior to construction, forewarning surrounding land owners/users of construction activities 345. Construction must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 346. Excessive noise from employees must be discouraged where possible 347. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	348. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents 349. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 350. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 351. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams 352. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site 353. Waste bins should be periodically inspected to ensure they are not overflowing 354. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 355. Tips should be periodically serviced to ensure they do not overflow 356. Tips must be serviced by a licensed service provider 357. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a

ASPECT	IMPACT	MANAGEMENT ACTIONS
		licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 358. Volumes of waste removed must be monitored and reduced where possible 359. No waste may be buried or burned on site or anywhere else 360. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages
	Health and safety impacts of rehabilitation team and surrounding land owners/users	361. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 362. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 363. Daily health and safety training must be undertaken to ensure employees remain vigilant 364. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 365. An Emergency Response Plan must be available on site at all times 366. Unsafe work areas should be identified and marked as such 367. Deep excavations must be cordoned off and marked as such 368. Material Safety Data Sheets (MSDS) for any hazardous substances are to be readily available on site 369. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area if required

ASPECT	IMPACT	MANAGEMENT ACTIONS
		370. A fully stocked first aid kit must be available on site at all times 371. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times
Emergencies/Incidents	Emergencies/Incidents could impact health and safety and/or the receiving environment.	372. All incidents and emergencies should be dealt with in line with the Emergency Response Plan for the site. 373. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times. 374. Environmental incidents must be reported timeously to the relevant regulator's Regional office; GDARD.
OPERATIONAL PHASE		
Environmental Awareness	Lack of awareness may result in environmental harm and/or non-compliance to the EMPr/EA	375. Comprehensive induction of all employees on site, including an environmental section which outlines as a minimum the following: o Explanation of the importance of complying with the EMPr o Discussion of the potential environmental impacts of development activities o Employees' roles and responsibilities, including emergency preparedness o Explanation of the mitigation measures that must be implemented when particular work groups carry out their respective activities o Importance of biodiversity 376. Daily safety talks should include environmental topics (at least one environmental topic per week) to increase general and site-specific environmental awareness
Monitoring of Compliance	Lack of monitoring may result in environmental harm and/or non-compliance to the EMPr/EA	377. The operation should be informally monitored on a continual basis by the Applicant's representative or Site Manager to ensure compliance to the EMPr 378. Implementation of the EMPr and conditions of the EA must be formally monitored (audited) every five (5) years by an appropriately qualified and experienced ECO

ASPECT	IMPACT	MANAGEMENT ACTIONS
Occupation of residential structures and use of service infrastructure	Erosion of surrounding soil	379. Areas susceptible to erosion (such as near smooth, hard surfaces) must be monitored 380. Where necessary, erosion protection measures or stormwater management measures must be adapted to reduce erosion around the site 381. Implementation of SWM plan to manage increasing impervious areas within the project site
	Soil and groundwater contamination from sewage leaks	382. Sewage leaks must be immediately reported and repaired so as to prevent long-term environmental harm 383. The sewage purification works must be efficiently operated by adequately trained personnel at all times and must, as far as is reasonably practicable, not be overloaded 384. The person or authority in charge of the purification works must satisfy himself that the quality of the final effluent will at all times be in accordance with the directives as set out in this guide 385. Regular control tests of representative final effluent samples must be made at least quarterly and records must be kept of such tests 386. The effluent reporting to the treatment plant originated from a potable source before biological contamination via bath, shower, basin and cleaning operations. The Effluent has no industrial or chemical contamination 387. No toxic substances are to be forwarded to the plant 388. No storm water will be forwarded to the plant 389. Oils and fats are to be treated at the source with fat traps before entering the plant 390. Normal kitchen and bathroom detergents should not be problematic in terms of plant operation

ASPECT	IMPACT	MANAGEMENT ACTIONS
		391. For typical domestic sewage treated in aerobic/anoxic reactor with de-nitrification (MLE process low alkalinity with pH instability) is normally not a problem. In the absence of alkalinity information, it is assumed that there will be adequate alkalinity in order to maintain a pH of 6.8 to 7.2 in the reactor 392. The plant must cope with daily variation in the flow rate from a maximum during the day to nearly zero during the night 393. The process design to include a 10% safety factor
	Waste generation	394. Waste must be appropriately managed by the municipality including timeous removal and disposal in appropriate waste disposal sites 395. Residents must be encouraged not to litter
	Edge effects of development on surrounding open spaces	396. Surrounding natural spaces must be protected as far as possible by measures such as: o Prevention of illegal dumping o Provision of designated pathways
	Invasion/ proliferation of alien invasive species	397. Plant AIS must be removed before seeding to prevent uncontrolled spread into surrounding natural areas 398. Animal AIS may not be controlled with poison but should be prevented from proliferating through appropriate waste management techniques or controlled using biocontrol methods
Use of roads	Soil and groundwater contamination from vehicle oil spills	399. All vehicle repairs and services must take place on sealed surfaces
	Impact on vehicular traffic	400. Roads must be appropriately marked and signposted to avoid confusion 401. Roads should be appropriately developed to help reduce congestion as far as possible 402. Consider surfacing road 403. Use dust-minimising (surface wetting) procedures on access road

ASPECT	IMPACT	MANAGEMENT ACTIONS
		404. Restrict construction activity to the footprint area only 405. Control vehicle speeds, by providing speed limits (40hm/h in general areas and 20km/h in working areas) and placing temporary speed humps 406. Any instances of road mortalities (roadkill) must be recorded and reported to the ECO
	Waste generation	407. Roadside waste bins must be provided and emptied regularly 408. Residents must be encouraged not to litter
Stormwater Management	Soil and groundwater contamination from improper management of effluent	409. The Stormwater Management Plan must be correctly implemented on site and must be adapted where necessary to site conditions 410. Stormwater must be channelled into a properly constructed drainage system 411. Drains must be regularly inspected for a build up of debris (e.g. litter or leaves) and appropriately cleared 412. No fuels must be allowed to discharge directly into stormwater pipes, drains, sewage manholes/pipes
Emergencies/Incidents	Incidents/Emergencies could impact health and safety or the environment	413. All incidents and emergencies should be dealt with in line with the Emergency Response Plan for the site 414. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times 415. Environmental incidents must be reported to GDARD
DECOMMISSIONING PHASE		
Demolition of residential space and decommissioning of service infrastructure	Loss of housing	416. Alternative options must be in place to provide safe housing for displaced residents
	Soil and groundwater contamination resulting from hydrocarbon leaks from demolition machinery/equipment	417. Demolition machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 418. No servicing of machinery/equipment take place on site

ASPECT	IMPACT	MANAGEMENT ACTIONS
		419. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used 420. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 421. Drip trays must be in good condition (i.e. no holes and not bent or flattened) 422. All employees are to be trained in proper spill management techniques and drilled quarterly 423. Fully stocked spill kits must be available in strategic positions on site and inspected weekly to ensure they have all the required elements 424. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 425. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 426. Significant spills must be reported to GDARD
	Impact on vehicular traffic from movement of demolition machinery	427. All operators and drivers must possess the appropriate driver's license 428. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 429. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 430. Heavy machinery/vehicles should not be parked within the road or on the road verge

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Increase in emissions of greenhouse gases by rehabilitation machinery/vehicles	431. Demolition machinery and vehicles should be kept to a minimal as far as practically possible 432. Use of car-pooling or public transport by employees must be encouraged 433. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Dust generation	434. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised to reduce airborne dust 435. Dust screens should be erected around working areas if and where practically possible 436. Employees must be provided with appropriate dust masks
	Noise generation	437. Notices must be erected prior to demolition, forewarning residents of activities 438. Demolition must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 439. Excessive noise from employees must be discouraged where possible 440. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	441. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents 442. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 443. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 444. The reuse/recycling of building rubble must be explored and undertaken where possible

ASPECT	IMPACT	MANAGEMENT ACTIONS
		445. Non-reusable or recyclable building rubble must be removed by a licensed contractor/service provider and disposed of at the nearest appropriately licensed facility 446. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams 447. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site 448. Waste bins should be periodically inspected to ensure they are not overflowing 449. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 450. Tips should be periodically serviced to ensure they do not overflow 451. Tips must be serviced by a licensed service provider 452. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 453. Volumes of waste removed must be monitored and reduced where possible 454. No waste may be buried or burned on site or anywhere else 455. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Health and safety of construction workers	456. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 457. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 458. Daily health and safety training must be undertaken to ensure employees remain vigilant 459. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 460. An Emergency Response Plan must be available on site at all times 461. Unsafe work areas should be identified and marked as such 462. MSDSs for any hazardous substances are to be readily available on site 463. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area 464. A fully stocked first aid kit must be available on site at all times 465. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times
Rehabilitation	Loss of topsoil	466. Newly topsoiled areas should be revegetated as soon as possible, using indigenous (and endemic, if possible) plant species 467. Topsoil should be placed last, after subsoil layers have been replaced 468. In areas with a high risk of erosion, topsoil should be protected with additional measures such as biodegradable soil blankets until vegetation has re-established
	Erosion of surrounding soil	469. The rehabilitated areas should blend into the surrounding vegetation so as to discourage erosion

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Loss of TOPS, both floral and faunal	470. Floral species on site must be appropriately marked and cordoned off to prevent damage during topsoiling and revegetation activities 471. Plant species on site may not be used as fence posts or to hang bags, store waste or as latrines by employees 472. No hunting, poaching, fishing, or any other harm to animals by employees is permitted on or around site 473. Any snakes (or other animals) found on site may not be killed or harmed in any way, but may be removed safely by a professional snake handler or rehabilitation expert 474. No poisons are to be utilised on site
	Introduction/ proliferation of AIS	475. Any plant AIS noted on site must be removed 476. Rehabilitated areas must be monitored for colonisation of plant AIS 477. Plant AIS must be removed before seeding and disposed of with general waste 478. Animal AIS may not be dealt with using poison, but should be controlled through prevention measures (such as keeping waste areas clean) or biocontrol measures
	Soil and groundwater contamination from hydrocarbon spills from rehabilitation machinery/ vehicles	479. Rehabilitation machinery and equipment must be inspected weekly by the operator and maintained/serviced regularly to ensure that no preventable leakages occur 480. Servicing of machinery/equipment may only take place within a designated area which must be appropriately bunded and have an oil separation system in place 481. In case of emergency repairs, machinery/equipment must be placed on an impermeable surface and drip trays are to be used 482. A drip tray is to be placed under any potentially leaking elements of any machinery/equipment that is not in use or being stored on site 483. Drip trays must be in good condition (i.e. no holes and not bent or flattened) 484. All employees are to be trained in proper spill management techniques and drilled quarterly

ASPECT	IMPACT	MANAGEMENT ACTIONS
		485. Fully stocked spill kits must be available in all working areas on site and inspected weekly to ensure they have all the required elements 486. Should hydrocarbons spill on to the ground, the spill should immediately be contained and managed. Contaminated soil must be excavated to the depth of the spill 487. Any contaminated material (including excavated soil) must be disposed of in an appropriately labelled and sealed container, then transported by a licensed service provider to a licensed hazardous waste disposal facility 488. Significant spills must be reported to GDARD 489. A record of all spills must be kept on site
	Soil and groundwater contamination from hazardous substance spills	490. All hazardous substances (including hydrocarbons) must be stored in labelled and sealed containers, within a labelled, protected and bunded area 491. Employees must be trained on appropriate hazardous substance management techniques 492. All hazardous substances utilised or stored on site must be accompanied by an MSDS and employees must be trained in using these documents appropriately 493. Hazardous substance spills are to be dealt with in the same manner as hydrocarbon spills 494. A record of all spills must be kept on site
	Impact on vehicular traffic from rehabilitation machinery/ vehicle movement	495. All operators and drivers must possess the appropriate driver's license 496. Appropriate signage must be placed on the roads around the site to ensure that road users are made aware of construction activities 497. When large machinery is moving near the roads or entering the traffic stream, an appropriately visible flag person must be stationed next to the road to warn traffic of heavy moving vehicles 498. Heavy machinery/vehicles should not be parked within the road or on the road verge

ASPECT	IMPACT	MANAGEMENT ACTIONS
	Increase in emissions of greenhouse gases by rehabilitation machinery/vehicles	499. Rehabilitation machinery and vehicles should be kept to a minimal as far as practically possible 500. Use of car-pooling or public transport by employees must be encouraged 501. Volumes of petrol and diesel usage should be recorded in order to report on emission data
	Dust generation	502. Dust suppression/surface wetting mechanisms (such as use of a water bowser) must be utilised daily to reduce airborne dust 503. Dust screens should be erected around working areas if and where practically possible 504. Employees must be provided with appropriate dust masks
	Noise generation	505. Notices must be erected prior to construction, forewarning surrounding land owners/users of construction activities 506. Construction must only take place during working hours (i.e. 07h00 to 17h00 on weekdays and 07h00 to 13h00 on Saturdays) 507. Excessive noise from employees must be discouraged where possible 508. Employees must be provided with ear plugs for use when they are in close proximity to noisy machinery
	Waste generation	509. A Waste Management Plan must be developed and implemented on site, and all employees must be trained on its contents 510. Employees must be trained in good housekeeping practices and site must be regularly inspected for state of housekeeping 511. Reduction, reuse, and recycling of waste should be prioritised in that order, before disposal 512. Waste must be separated into general recyclable, general non-recyclable, hazardous and building waste streams

ASPECT	IMPACT	MANAGEMENT ACTIONS
		513. An appropriate number of separated, labelled and sealed waste bins must be provided in all working areas of site 514. Waste bins should be periodically inspected to ensure they are not overflowing 515. When waste bins are full, waste should be disposed of in appropriately separated, labelled tips 516. Tips should be periodically serviced to ensure they do not overflow 517. Tips must be serviced by a licensed service provider 518. Waste must be disposed of in a licenced and appropriate waste disposal sites (i.e. hazardous waste must go a licenced hazardous waste site, recycling must go to a licenced recycling depot and non-recyclable general waste must go to municipal landfill site) 519. Volumes of waste removed must be monitored and reduced where possible 520. No waste may be buried or burned on site or anywhere else 521. An appropriate number of chemical toilets must be provided for employees (at least one (1) per ten (10) employees), must be the only sites used for ablutions by employees, must be secured with rope or otherwise tied down and must be emptied regularly (at least twice a week) by a licensed service provider to prevent bad odours or spillages
	Health and safety impacts of rehabilitation team and surrounding land owners/users	522. All relevant Health and Safety legislation should be strictly adhered to, including but not limited to OSHA 523. Employees, contractors and visitors must undergo induction training on general site safety as well as the Emergency Response Plan 524. Daily health and safety training must be undertaken to ensure employees remain vigilant

ASPECT	IMPACT	MANAGEMENT ACTIONS
		525. Employees must be provided with the necessary Personal Protective Equipment (PPE)- hard hat, safety boots, overalls, safety goggles, dust masks, ear plugs and gloves 526. An Emergency Response Plan must be available on site at all times 527. Unsafe work areas should be identified and marked as such 528. Deep excavations must be cordoned off and marked as such 529. Material Safety Data Sheets (MSDS) for any hazardous substances are to be readily available on site 530. Hazardous substances are to be appropriately contained within functional, labelled containers and stored in a bunded area if required 531. A fully stocked first aid kit must be available on site at all times 532. A list of emergency contacts, including details of a nearby snake handler, must be kept on site at all times

5 CONCLUSION

This EMP contains practical mitigation measures for all activities that will occur as part of the GRLRP for Unitas Park – Extension 16. Should the mitigation measures provided within this EMP be implemented effectively, GCS is of the opinion that no significant environmental or social impacts will be generated. In signing this EMP, Phumaf accepts responsibility to ensure the measures outlined above are implemented.

APPENDIX A
EAP CV

APPENDIX B
Generic Method Statement